

Conference abstracts

COMMUNICABLE DISEASE CONTROL CONFERENCE 2015

AN ERA OF CHANGE: GLOBAL THREATS AND HARNESSING NEW TECHNOLOGIES
1–2 JUNE 2015, BRISBANE

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These abstracts are provided unedited**Day 1: Controlling global infectious threats****Plenary 1: Global threats from infectious diseases****Chair: Professor Jeremy McAnulty****Novel epidemiological approaches to surveillance of emerging infectious disease threats in the Asia–Pacific region**

Speaker: Professor Archie Clements, Director and Professor, Research School of Population Health, ANU College of Medicine, Biology and Environment, The Australian National University, Canberra

The Asia–Pacific region is the global epicentre of emerging infectious diseases, and novel approaches to surveillance are required to effectively mitigate the growing and high potential burden of these diseases. With climate change, predictions of increasing frequency and severity of cyclones in the Pacific might increase flooding risk, exacerbating the disease burden from emerging disease such as leptospirosis and typhoid. Similarly, dengue emergence in the region is linked to environmental change, including climate change and rapid, unplanned urbanisation. Earth observation technologies, which use satellite and earth surface monitoring data provide information on the natural and built environment, including climate and weather (temperature, precipitation, humidity, cloud cover, etc.), land cover and land use, vegetation, soil and elevation, underpin one novel approach; data from clinical surveillance systems, and entomological surveillance, can be integrated with earth observation data to augment existing surveillance approaches, whereby associations between environmental factors, measured using earth observation, and disease patterns can be used to predict the spatial and/or temporal distribution of disease. This approach has greatest potential for vectorborne and zoonotic infectious diseases that are sensitive to environmental factors. Digital surveillance using internet search engine queries and social media is another non-traditional approach with some promise. Digital surveillance and earth observation have the potential to be integrated within early warning systems that can trigger timely resource mobilization in the face of an emerging epidemic. In the field, systems that support operational decision-making, such as spatial decision support systems, can provide accessible, low-tech methods to enable more effective targeted intervention to combat disease outbreaks, including surveillance-response. Each of these approaches will be illustrated and critically evaluated using examples from recently conducted studies in the region.

Immunisation strategies to reduce vaccine preventable diseases: using the New Zealand example

Speaker: Associate Professor Nikki Turner, Department of General Practice and Primary Health Care, Director, CONECTUS and The Immunisation Advisory Centre, University of Auckland, New Zealand

NZ traditionally had poor immunisation coverage in their national immunisation programme. However over the past 15 years there has been dramatic improvement in both coverage and timeliness of delivery of the childhood schedule. The main reasons behind this improvement have been the ability to collect and utilise data via the NZ National Immunisation Register, the creation of national targets, feedback loops on progress and provider buy in.

NZ now has a much more integrated approach to surveillance with the ability to connect the main surveillance data bases monitoring immunisation coverage and disease surveillance, utilising encrypted data from the unique national individual identifier. Data can be used much more effectively for monitoring the programme and answering translational questions.

However gaps still remain, particularly in the areas of maternal vaccination, older children and adult vaccination. There is still significant morbidity from pertussis and influenza in young infants and some localised measles outbreaks particularly in older children and young adults. Immunisation programmes need to take a whole of life approach, having the right tools, utilising linked data sets and reporting mechanisms can support a more effective approach across the whole population.

Clinical research in the midst of an Ebola outbreak

Speaker: Professor Peter Horby, Associate Professor, Group Leader Epidemic Research Group Oxford (ERGO), Group Head / Principal Investigator and Fellow, Nuffield Department of Medicine, University of Oxford, UK

The size and scale of the on-going Ebola Virus Disease (EVD) outbreak is unprecedented, and has been declared a Public Health Emergency of International Concern. The pathogenesis of EVD is incompletely understood but high levels of viral replication and the detection of virus in multiple body tissues is typical of severe disease. Coagulopathy, disruption of endothelial function, and increased inflammatory responses are also associated with severe EVD. The association between high levels of viraemia and EVD severity suggests that therapies that target viral replication may benefit patients.

Whilst several experimental therapeutic interventions have shown promise in the laboratory and in animal studies, none have been tested for efficacy and safety in humans with EVD. In August 2014 a World Health Organization expert panel concluded unanimously that 'investigators have a moral duty to evaluate these interventions in the best possible clinical studies that can be conducted under the circumstances of the epidemic.'

I will describe the therapeutics options that are being considered for EVD, the efforts that have been made to evaluate experimental therapeutics for EVD, and some of the challenges faced.

Emerging Infectious Diseases and International Health Chair: Vitali Sintchenko

Endgame strategies for lymphatic filariasis elimination in American Samoa

Presenter: Colleen Lau, The University of Queensland, Queensland

Authors: C Lau, R Soares Magalhaes, S Hundessa, S Sheridan, M Schmaedick, S Fuimaono, J Tufa and P Graves

Background: After seven rounds of mass drug administration (MDA) in American Samoa, lymphatic filariasis (LF) antigen prevalence dropped from 16.5% (1999) to 2.3% (2007). In 2011, prevalence in 6–7 year old children was <1%, the WHO threshold used to cease MDA. Our study aims to inform the risk of resurgence by identifying any residual infection clusters and/or high-risk populations.

Methods: A serum bank collected from 807 adults in 2010 was tested for LF antigen (Og4C3) and antibody (Bm14). Demographic data and spatial analysis were used to identify high-risk populations and residual infection clusters. In 2014, a follow up study was conducted to verify the findings.

Results: In 2010, Og4C3 prevalence was 0.8–3.2%, with two possible hot spots (estimated diameters of 1.2–1.5 km). Prevalence was higher (3.5–14.3%) in recent (<5 years) migrants compared to longer-term residents. In 2014, ICT prevalences at the two hot spots (N=125) were 4.4% and 12.5%, confirming the presence of residual clusters. Recent migrants (N=674) were tested at a workplace and clinic, and found to have ICT prevalence of 1.2% and 2.9%.

Conclusion: LF transmission appears to be still occurring in American Samoa. Further investigation is required to determine if current guidelines for certifying interruption of transmission are valid.

An outbreak of healthcare-associated cutaneous melioidosis in temperate Western Australia

Presenter: Carolien Giele, Communicable Disease Control Directorate, Department of Health, Western Australia

Authors: C Giele, T Inglis, A Merritt, B Clark, L Manning, A Peterson, P Armstrong and G Dowse

Background: Melioidosis is a serious disease caused by the environmental saprophyte *Burkholderia pseudomallei*. The organism is endemic in northern Australia and southeast Asia, and appears to be variably distributed elsewhere in the tropics.

Methods: Outbreak investigation.

Results: Six cutaneous melioidosis infections were notified among residents of a community south of Perth between January 2012 and December 2013. The index case preceded by 21 months a cluster of five cases reported over a 4-month period. All cases had attended the same medical clinic for wound dressings, the

latter five clearly prior to developing infection. A single *B. pseudomallei* MLST type was isolated from all six cases and was identical to that subsequently isolated from a bottle of saline irrigation fluid used to clean wounds of the last five cases.

Conclusion: This is the first reported healthcare-associated outbreak of cutaneous melioidosis in a temperate region. A contaminated bottle of saline was the likely source for at least five cases of infection, but the primary source of *B. pseudomallei*, the mode of contamination of the bottle, and how the organism persisted for an extended period at the clinic remain uncertain. This incident highlights the importance of maintaining infection control standards in primary healthcare settings.

Dengue infection acquired in Western Australia: evidence of importation of infected mosquitoes?

Presenter: Andrew Jardine, Department of Health, Western Australia

Authors: M Lindsay, D Smith, J Nicholson, P Neville, A Jardine, S Harrington, A Whittle, H Lyttle, A Levy and P Armstrong

A male with laboratory-confirmed dengue infection was notified to the Department of Health Western Australia (WA) in October 2013. He had a dengue-like illness and primary DENV-1 infection was confirmed by serology and PCR. He had never travelled outside the State and the most likely location of infection was Wickham or Point Sampson in the Pilbara region.

Retrospective testing of sera from other patients with suspected arbovirus illness did not identify any further cases of local infection. Intensive adult and larval mosquito surveillance undertaken immediately after notification and after the start of the wet season in January 2014 did not detect dengue virus or any vector species in the local region.

This is the first locally acquired case of dengue in WA for more than 70 years. While the source of infection in this case is unknown, it is most likely due to transient introduction of an infected mosquito by air or sea, which subsequently transmitted dengue to the patient but failed to establish a local breeding population.

This case highlights the high public health importance of vigilance in identifying possible local dengue cases, and in maintaining efforts to ensure dengue vectors do not become established in WA.

Tuberculosis in the Pacific Islands region, 2000 to 2013

Presenter: K Viney, Australian National University, Australian Capital Territory

Authors: D Hoy, A Roth, PM Kelly, D Harley and A Sleight

Background: Tuberculosis (TB) poses a significant public health challenge in the 22 countries and territories of the Pacific Islands region.

Methods: We ascertained TB cases reported annually by Pacific Island national TB programmes to the World Health Organization, Western Pacific Region Office and calculated various standard measures for TB occurrence (i.e. case notifications, incidence, prevalence, mortality), comparing the year 2013 to the year 2000.

Results: In 2013, 24,145 TB cases were notified, most (94% or 22,657) were from Papua New Guinea (PNG). Kiribati reported the highest TB case notification rate (398 per 100,000 population). Notification rates per 100,000 population were also high in PNG, Marshall Islands and Tuvalu (309, 283 and 182, respectively). Between 2000 and 2013, TB case notification rates increased by 58%, from 146 to 231 per 100,000 population. Incidence has remained high but stable from 2000 to 2013; prevalence and mortality have fallen by 20% and 47%, respectively.

Conclusion: Although TB incidence is stable across the region, many countries have high rates and the Pacific regional burden is increasing. To halt and reverse this trend, TB control efforts and health systems must be strengthened.

What do we know about enterovirus-D68 in Australia?

Presenter: Avram Levy, PathWest Laboratory Medicine WA and School of Pathology and Laboratory Medicine, University of Western Australia

Authors: A Levy, J Roberts, J Lang, S Tempone, A Kesson, A Daly, B Thorley and D Speers

Enterovirus D-68 (EV-D68) has emerged as a common cause of respiratory illness worldwide including acute and severe disease. Recent outbreaks have involved numerous cases of respiratory disease, followed by acute flaccid paralysis (AFP) or other neurological disease in a small proportion of cases. Western Australia (WA) has experienced two peaks of EV-D68 activity during July–October (winter–spring) in 2011 and 2013 with sporadic cases recorded from 2008–2015. The majority of cases involved hospitalised patients with upper respiratory infections, particularly lower airway disease or asthma/wheeze. EV-D68 was also identified in cerebrospinal fluid from one patient. Phylogenetic analysis suggests circulation of some strains within WA as well as sporadic detections of other strains, one of which appears closely related to the Californian AFP cases. It is likely that EV-D68 circulation has not been limited to WA, but has been occurring throughout Australia with detection in faeces from two patients through nationwide AFP and enterovirus surveillance in 2010. EV-D68 should be recognised as an emerging respiratory pathogen capable of causing large outbreaks, with severe neurological disease following infection on rare occasion. Ongoing surveillance including the use of EV-D68-specific assays should be considered by large public health laboratories.

Simulation training: preparing staff for managing a person with Ebola virus disease

Presenter: Wendy Morotti, Communicable Diseases Unit, Queensland

Authors: W Morotti, D El Saadi, J Gerard, B McCall, H Carroll and S Bennett

The current Ebola virus outbreak in West Africa and subsequent potential for cases to present in other countries has required Queensland health care services to evaluate their ability to manage a person presenting with Ebola virus disease (EVD). The level of personal protective equipment required to manage a person with EVD is much higher than that used for other more commonly managed infectious conditions in Queensland, posing new challenges for staff and hospital management in meeting patient's health care needs.

To assist staff to become more confident in the safe management of an EVD case, simulated clinical training in the care of an EVD case was developed and offered through one day workshops. Medium fidelity simulation training involves the use of manikins or actors trained to demonstrate a condition. The training covered a range of scenarios including general patient care, undertaking invasive techniques and managing contaminated environments.

This presentation will describe how the health staff performed in the simulated clinical training scenarios and discuss common challenges they faced. In particular it will highlight areas of care that pose a particular risk to staff or the patient when being undertaken in full PPE and discuss how these risks might be mitigated.

Vaccine Preventable Diseases 1

Chair: Stephen Lambert

Community Acquired Pneumonia Immunisation Trial in Adults (CAPiTA)

Presenter: Marieke Bolkenbaas, University Medical Center Utrecht, the Netherlands

Authors: M Bonten, S Huijts, M Bolkenbaas, C Webber, S Gault, W Gruber, S Patterson and D Grobbee, for the CAPiTA study team

Background: Conjugate vaccines have shown to prevent pneumococcal disease in children, but efficacy in elderly has not been established yet.

Methods: The CAPiTA study was a randomised, double-blind clinical trial in 84,496 immunocompetent community-dwelling participants of 65 years and older in the Netherlands. The primary objective of the study

was to determine the efficacy of a 13-valent pneumococcal conjugate vaccine (13vPnC) in preventing a first episode of vaccine-type (VT) pneumococcal community-acquired pneumonia (CAP). Secondary objectives were to determine the efficacy in preventing a first episode of non-bacteremic/noninvasive (NB/NI) VT pneumococcal CAP and a first episode of VT-IPD. Participants were randomised 1:1 to receive either 13vPnC or placebo. Surveillance for CAP and IPD cases was conducted at hospitals in areas of enrolment. A serotype-specific urinary antigen detection assay and/or cultures of pneumococci from blood or other sterile sites were used to identify vaccine-type CAP and IPD episodes.

Results: Per protocol analysis showed a vaccine efficacy for a first episode VT-CAP of 45.56% (95.2% 21.82%–62.49%, $P=0.0006$); for a first episode of NB/NI VT-CAP 45.00% (95.2% 14.21%–65.31%, $P=0.0067$), and for a first episode of VT-IPD 75.00% (95.2% 41.43%–90.78%, $P=0.0005$).

Conclusions: 13vPnC was effective in preventing vaccine-type pneumococcal CAP and IPD in adults >65 years of age.

Impact and effectiveness of 13vPCV among Australian children

Presenter: Sanjay Jayasinghe, National Centre for Immunization Research and Surveillance, Sydney, Australia, Discipline of Paediatrics and Child Health, Sydney Medical School, University of Sydney

Authors: C Chiu, H Quinn, R Menzies and P McIntyre

Background: In 2011 13-valent pneumococcal conjugate vaccine (13vPCV) replaced 7vPCV in the publicly-funded immunisation program for Australian children, with the '3+0' schedule (3 primary doses without booster) maintained. The 13vPCV was licensed based on immune correlates of protection. We assessed the coverage, impact and effectiveness (VE) against IPD three years into the 13vPCV program.

Methods: We assessed the serotype-specific IPD incidence rate ratios (IRRs) post (2011/12–2013/14) versus pre (2008/09–10/11) 13vPCV introduction in children aged <5 years using national laboratory-based notification data, and vaccine uptake from the Australian Childhood Immunization Register. We employed conditional logistic regression analysis to determine VE based on odds ratios for 13vPCV vaccination in cases versus age-matched controls.

Results: For children aged <5 years, the 3-year average annual incidence rate (per 100,000) of 13v-non-7v IPD declined from 10.7 (n=143, 2008/09–10/11) to 3.8 (n=54, 2011/12–2013/14). The greatest impact was against serotype 19A (IRR: 0.23, 95%CI 0.15–0.33). In 2013, 90% of children were fully vaccinated by 12 months of age. VE of ≥ 1 dose of 13vPCV against 13-non-7v IPD was 95.6% (77.8–99.1%).

Conclusion: A substantial reduction occurred in IPD due to 13v-non-7v serotypes in Australian children since 13vPCV ('3+0' schedule) introduction. Overall, 13vPCV VE is consistent with predictions based on immune correlates.

Birth outcomes among Australian women who receive an influenza vaccine in pregnancy, 2012–2014

Presenter: Lisa McHugh, MAE scholar, Queensland Children's Medical Research Institute and Communicable Diseases Unit, Queensland Health and Australian National University, ACT

Authors: L McHugh, RM Andrews, K Viney, SB Lambert and KA O'Grady

Background: Although recommended for all pregnant women, there is a shortage of Australian data on the safety and effectiveness of influenza vaccination in pregnancy. We aimed to determine whether there are any differences in relation to birth weight and gestation at birth of infant between groups based on pregnancy vaccination status.

Methods: A cohort study of women aged >17 years recruited between February 2012 and December 2014 at less than 8 weeks postpartum. The primary exposure of interest was self-reported influenza vaccination in pregnancy. The primary outcomes of interest were infant birth weight in grams and gestation (weeks) at birth of infant.

Results: There were 7175 women enrolled. Mean maternal age at infant birth was 31.7 years (range 17–51 years). The mean birth weight of infants born to vaccinated mothers was 3325 grams (95% CI 3301, 3350) compared to 3336 (95% CI 3317, 3356) in unvaccinated mothers, $P=0.50$; the mean gestation at birth was 38.7 weeks (95% CI 38.6, 38.7) compared to 38.7(95% CI 38.6, 38.8) $P=0.43$ respectively.

Conclusion: We found no association between influenza vaccination during pregnancy and either birth weight or gestational age. These data will be an important contribution to evaluating the impact of influenza vaccine in pregnancy.

Post-exposure passive immunisation for preventing rubella and congenital rubella syndrome

Presenter: Megan Young, Griffith University, Queensland

Authors: MK Young, AW Cripps, GR Nimmo and ML van Driel

Background: Primary studies examining the effectiveness of polyclonal immunoglobulins for post-exposure prophylaxis of rubella have small sample sizes and varying results.

Methods: We conducted a systematic review as per standard Cochrane methodological procedures.

Results: Twelve studies (430 participants) were included; seven RCTs and five controlled clinical trials (CCTs). The result of meta-analysis (11 studies) of gammaglobulin versus control (saline or no treatment) for preventing rubella cases favoured the intervention group (RR 0.61, 95%CI 0.45–0.83) but studies were heterogeneous. Heterogeneity was explained by subgrouping studies according to the estimated volume of gammaglobulin administered by weight and then removing studies where the intervention was given >5 days after exposure (“0.027–0.037 ml/lb” RR 1.60 (95%CI 0.57–4.52); “0.1–0.15 ml/lb” RR 0.53 (95%CI 0.29–0.99); “0.2–0.5 ml/lb” RR 0.20 (95%CI 0.04–1.00)). One study examined the incidence of congenital rubella syndrome among pregnant participants (<9/40 weeks) who were randomised to one of two gammaglobulin groups (‘high’ or ‘low’ rubella titre). No cases were identified.

Conclusion: Compared to no treatment, polyclonal immunoglobulins are of benefit for preventing rubella if given in sufficient dose up to five days after exposure. There is insufficient evidence to make direct conclusions about the effectiveness of polyclonal immunoglobulins for preventing congenital rubella syndrome.

The 2012/3 measles serosurvey: at odds with Australia’s elimination status?

Presenter: Heather F Gidding, University of New South Wales and National Centre for Immunisation Research and Surveillance, New South Wales

Authors: HF Gidding, HE Quinn, L Hueston, DE Dwyer and PB McIntyre

Background: Australia’s measles elimination status was verified in 2014, but notifications have increased since 2011.

Aim: Estimate population immunity to measles using the 2012/3 national serosurvey and R (the effective reproduction number), and compare with previous serosurveys.

Methods: A similar national sample to previous serosurveys was tested (residual sera and plasma from 1–49 year olds obtained from public and private laboratories) using the Enzygnost anti-measles IgG enzyme immunoassay. R was calculated from weighted estimates of the proportion seronegative by age using established methods.

Results: The weighted proportion seronegative increased progressively from 3.7% (95%CI: 3.3–4.2%) in 1999 to 10.3% (9.11–1.4%) in 2012/3. Similarly, the proportion equivocal increased from a low of 1.7% (95%CI: 1.4–1.9%) in 2002 to 8.9% (95%CI: 7.8–10.0%) in 2012/3. These changes were most pronounced in 10–34 year olds and suggest waning vaccine induced immunity. R increased from 0.57 in 1999 to above the epidemic threshold of 1 in 2012/3 ($R=1.7$)

Conclusion: The 2012/3 serosurvey results are consistent with the age distribution of notified measles cases, but at odds with other indicators (e.g. number and importation status of notifications) which support the conclusion that measles elimination is being maintained. Steps to further investigate these serologic findings are being considered.

Using SMS technology to actively monitor the safety of vaccines in general practice

Presenter: Alan Leeb, Illawarra Medical Centre

Authors: A Leeb, AK Regan, I Peters, G Leeb, L Tracey and PV Effler

Introduction: Ongoing monitoring of adverse events following immunisation (AEFI) is essential for detecting safety signals and maintaining public confidence. SmartVax is a general practice initiative using software to send short message service (SMS) texts to query vaccines about AEFI.

Methods: All persons immunised at a WA general practice during 2012–2014 were sent an SMS 3 days post-vaccination asking if they experienced any reaction(s). Patients who replied “Yes” were invited to complete an online survey to assess nature, severity and duration of the reaction.

Results: 8,868 vaccination encounters received SMS follow-up and an SMS response was received for 75%. The overall reaction rate was 7% (9% in persons under 16 years and 5% in others); most were local reactions. Differences by vaccine brand were identified. The change to combined MMR-V did not increase reported reactions.

Conclusions: This prototypic system provides a timely, efficient way to monitor vaccine safety. While the data presented are from a sole large group site, a network of practices has been established and currently 19 sites across five jurisdictions are participating. A network of GP sites uploading de-identified data to an aggregated database could serve as an early warning system for unanticipated safety signals.

Sexually Transmissible and Bloodborne Infections Chair: Linda Selvey

Human papillomavirus control: registry data support an impact of incomplete vaccine courses

Presenter: Julia Brotherton, National HPV Vaccination Program Register, VCS, Victoria

Authors: J Brotherton, M Malloy, D Gertig, A Budd, K Drennan and M Saville

Background: Optimised two-dose HPV vaccine schedules are now endorsed for young adolescents by WHO. Limited data are available about effectiveness of <3 doses using a standard dose schedule.

Methods: Deterministic data linkage was undertaken between the Victorian Cervical Cytology Registry and National HPV Vaccination Program Register to determine vaccination status and incidence of cervical pathology among vaccine eligible women screened in Victoria between April 2007 and December 2011. Proportional hazards regression was used to estimate hazard ratios (HR) adjusted for age, socioeconomic status and area of residence. Women were stratified into those vaccinated before or after first screen.

Results: Any number of doses (1, 2 or 3) were associated with lower rates of high grade and low grade cytology diagnoses *as long as doses were given prior to screening commencement* (one dose HR high grade 0.44 (95%CI 0.32 to 0.59), one dose low grade 0.48 (95%CI 0.40 to 0.58); two doses HR high grade 0.63 (95%CI 0.50 to 0.80), HR low grade 0.52 (95%CI 0.44 to 0.61); three doses HR high grade 0.53 (95%CI 0.47 to 0.60), HR low grade 0.73 (95%CI 0.68 to 0.78)).

Conclusion: Our data suggest vaccine effectiveness of less than three doses against cervical intraepithelial neoplasia.

Trends in testing for chlamydial infection in the ACT, 2003 to 2012

Presenter: Lucas Mills, Australian National University and ACT Health Protection Service

Authors: L Mills, R Hundy and E Fearnley

Keywords Sexually transmissible infections, chlamydia, surveillance

Background: Around Australia, notifications for chlamydial infection have increased rapidly over recent years. Notification data is susceptible to changes in testing in the community. This study sought to describe testing trends to assist the interpretation of disease notifications.

Methods: We used pathology testing data provided by two major pathology providers in the ACT (accounting for 77% of laboratory notifications) from 2003 to 2012. Pathology results were analysed by sex, age, clinical setting and year of test, using Stata13.

Results: The overall proportion of positive tests was higher in males than females (5.7% compared with 3.1%) with no statistically significant change in positivity over this period. The number of tests performed annually increased from 10,997 in 2003 to 20,139 in 2012, with increased testing in both a general practice and sexual health setting. Approximately two-thirds of all tests were performed on women, although the proportion of tests performed on men has increased over time from 27.7% to 38.1%.

Conclusions: Analysis of ACT data suggests the increase in chlamydia notifications is associated with increased testing. This study has demonstrated that it is feasible to utilise pathology testing data to interpret trends in notification data.

Peer-led STI testing and early HIV diagnosis among MSM in Western Australia

Presenter: Byron Minas, Department of Health Western Australia

Authors: BC Minas, CM Giele, SC Laing, L Bastian, AW Burry, KJ Sales and DB Mak

Background: We describe trends in newly acquired HIV notifications among men who have sex with men (MSM) in Western Australia (WA) since commencement of the M Clinic, a peer-led STI testing service for MSM established by the WA AIDS Council in 2010.

Methods: Numbers and proportions of MSM HIV cases with newly acquired infection were compared for the 2004–2006, 2007–2009 and 2011–2013 time periods. Data from 2010 were excluded as the M Clinic opened that year.

Results: Between the 2004–2006 and 2007–2009 periods, the number of MSM with newly acquired HIV increased by 50% (23 to 33 cases) and the number of newly acquired cases as a proportion of new HIV diagnoses among MSM increased from 27% to 35% (30% increase) ($P = \text{NS}$). In the 2011–2013 period, the number of newly acquired HIV cases among MSM more than doubled compared to 2007–2009, and comprised 53% ($n=70$) of new HIV diagnoses among MSM ($P < .05$).

Conclusions: The proportion of MSM HIV notifications that were newly acquired increased between 2004 and 2013 in WA, with the greatest increase seen after the M Clinic's commencement. Peer-led approaches to HIV testing can contribute to early diagnosis among MSM.

Mapping progress towards Australia's National Hepatitis B Strategy targets, 2013

Presenter: Jennifer MacLachlan, The Doherty Institute, Victoria

Authors: J MacLachlan, N Allard and B Cowie

Background: The National Hepatitis B Strategy includes specific targets to achieve in order to improve the response to chronic hepatitis B (CHB). We assessed progress towards these targets in the areas of diagnosis, monitoring, treatment and vaccination, for Australia's 61 Medicare Locals.

Methods: Data for the period 2012–13 were analysed, including the Australian Childhood Immunisation Register, Pharmaceutical Benefits Schedule prescribing data, National Notifiable Diseases Surveillance System notifications, and previously derived estimates of hepatitis B prevalence.

Results: National immunisation uptake at one year in 2012–13 was 91.5%, with no Medicare Locals reaching the Strategy's target of 95%. Several areas with uptake <90% have been previously identified as having high CHB prevalence. Progress towards the target of 80% of people with CHB being diagnosed is static, being 57% nationally in 2013 and the number of notifications remaining stable.

No Medicare Local achieved the 15% treatment target in 2013, and only twelve MLs achieved uptake above the national average of 5.3%, all in Sydney and Melbourne.

Conclusions: This analysis demonstrates that Australia's response to CHB is falling short of the targets identified in the National Strategy, and that identifying high and low performing areas can highlight effective strategies and areas of greatest need.

Molecular detection of *Neisseria gonorrhoeae* antimicrobial resistance: moving towards individualised treatment strategies

Presenter: Ella Trembizki, QCMRI, The University of Queensland

Authors: E Trembizki and D Whiley on behalf of GRAND investigators

N. gonorrhoeae antimicrobial resistance (AMR) is a major global concern. There are limited new treatment options and because of increased use of Nucleic Acid Amplification Testing (NAATs) for diagnosis, there is a lack of AMR data. As a part of the Gonorrhoea Resistance Assessment by Nucleic acid Detection (GRAND) study, we examined the molecular basis of AMR in 2,228 *N. gonorrhoeae* isolates from throughout Australia in the first half of 2012. Mutation profiles were then correlated with minimum inhibitory concentrations and geographical location. Through this screening we identified candidate sequences that predict resistance to penicillin, ciprofloxacin and azithromycin, and have now developed real-time PCR methods to predict resistance to ciprofloxacin and azithromycin. These Cipro-NAAT and azithro-NAAT methods were then applied to NAAT positive clinical samples (N=576) from the Northern Territory for the first half of 2014, and the results compared with bacterial culture-based surveillance. Our data confirms a lack of azithromycin resistance in the NT, but suggest that ciprofloxacin resistance may be overestimated. We are further investigating these results. These data show how molecular AMR surveillance can enhance bacterial culture-based capabilities. In addition, our assays provide promising steps toward individualised treatment strategies for *N. gonorrhoeae* infection.

Epidemiology of gonorrhoea notifications in Australia, 2007–2012

Presenter: April Roberts-Witteveen, ACT Health

Authors: A Roberts-Witteveen, K Pennington, N Higgins, C Lang, M Lahra, R Waddell and J Kaldor

Introduction: In Australia, gonorrhoea is rare apart from among some populations of Aboriginal and Torres Strait Islander people and men who have sex with men. An investigation into the increase in notifications in Australia from 2009 was undertaken.

Methods: Notified gonorrhoea cases reported between 2007 and 2012 were obtained from the National Notifiable Diseases Surveillance System. Analyses undertaken included time trends in counts and rates, according to jurisdiction, gender, Aboriginal status and sexual orientation.

Results: The largest increases in notification rates over the study period were in both sexes in New South Wales (2.9 and 3.7 times in 2012 compared to 2007) and Victoria (2.4 and 2.7), men in the Australian Capital Territory (2.3) and women (2.3) in Queensland. Although their rates decreased over time, the highest notification rates were in Aboriginal women in the Northern Territory and Western Australia. Changes in age and sex distribution, antimicrobial resistance or patterns of exposure and acquisition were not observed.

Conclusion: There is an ongoing gonorrhoea epidemic affecting Aboriginal people in Australia, but the increases in notifications have primarily occurred in non-Aboriginal populations in the larger jurisdictions. Interpretation of these data would be enhanced by laboratory testing data.

Indigenous Populations and Other Vulnerable Groups
Chair: Vicki Krause

Trachoma prevalence according to treatment strategy in Australia between 2007 and 2013

Presenter: John Kaldor, University of New South Wales, New South Wales

Authors: B Liu, C Cowling, A Hayen, G Watt, D Mak, S Lambert, H Taylor and J Kaldor

Background: We examined how different azithromycin treatment strategies have affected trachoma prevalence.

Methods: Annual community-level data on trachoma prevalence and treatment in 5–9 year old children from 3 Australian jurisdictions between 2007–2013 were examined according to the trachoma treatment strategy implemented (no treatment, active case only, household and community-wide). Changes in community trachoma prevalence according to treatment strategy were estimated using random-effects meta-analysis.

Results: 182 communities (42.3% from the Northern Territory, 11.5% from South Australia and 46.2% from Western Australia) had 881 treatment and corresponding trachoma prevalence records. The greatest annual fall in trachoma prevalence was in communities implementing community-wide treatment: absolute reductions ranged from –8%(95%CI –17% to 1%) to –31%(–26% to –37%); these communities also had the highest baseline trachoma prevalence (15.4%–43.9%). Including only communities with moderate trachoma prevalence (5–<20%) at initial measurement, the change in trachoma prevalence from the first to the last year of data recorded was similar for communities implementing community-wide or those using more targeted treatment strategies: absolute reductions were –11%(–8% to –13%) and –7%(–5% to –10%) respectively.

Conclusion: Community-wide azithromycin administration reduces trachoma prevalence. Less intensive treatment in moderate prevalence communities may lead to similar reductions in prevalence. Facial cleanliness and environmental interventions should also be implemented.

Diversity of *emm* types causing Invasive group A streptococcal disease, Northern Territory

Presenter: Rowena Boyd, Centre for Disease Control, Northern Territory Department of Health

Authors: R Boyd, B J Currie, D C Holt, T Harris and V Krause

Background: Northern Australia has high rates of invasive group A streptococcal (GAS) disease, with highest incidence in the Indigenous population. Multivalent GAS vaccines will potentially reduce rates of GAS-related diseases however only cover up to 30 of over 200 *emm* types identified. Our study adds to the limited knowledge of *emm* types circulating and disease transmission which has implications for public health response.

Methods: Laboratory isolation of *Streptococcus pyogenes* from a normally sterile site is notifiable in the Northern Territory. Demographic and clinical data were collected from medical records for notifications between 2011–2013. Molecular typing characterised GAS isolates according to sequencing of *emm* genes.

Results: Of 128 notifications, 81(64%) isolates were available for typing and 28 different *emm* types were identified. Geographical clusters were not evident and no associations were shown between *emm* type and clinical manifestation or illness severity. Typing confirmed transmission of *emm* 207.1 between infant twins and refuted transmission in two household-case pairs.

Conclusions: The diversity of *emm* types limits potential vaccine coverage and highlights the importance of educational, social and environmental interventions that limit spread of GAS in community. Typing of isolates was important to verify transmission but did not point to illness presentation or severity.

Malnutrition increases the risk of lower respiratory infection with respiratory syncytial virus

Presenter: Stuart Paynter, School of Public Health, University of Queensland

Authors: S Paynter, R Ware, L Yakob, M Lucero, V Tallo, H Nohynek, P Weinstein, P Sly, G Williams and E Simoes

Although malnutrition is a well known risk factor for clinical pneumonia in children, it is not clear whether or not malnutrition increases the risk of lower respiratory infection due to viruses. Resolving this question requires large scale longitudinal studies.

We followed up a cohort of 12,191 infants who were part of a pneumococcal vaccine trial in the Philippines. Children who had lower than median growth between their first and third pneumococcal vaccinations had a higher rate of subsequent hospital admission with lower respiratory infection due to respiratory syncytial virus (RSV), compared to those with growth above the median (hazard ratio: 1.34; 95% confidence interval: 1.02–1.76)

In addition, we used a mathematical transmission model to examine whether seasonal malnutrition in children in the study setting had any impact on RSV incidence. The results of the mathematical model indicate that peak RSV transmissibility was highest during the period of seasonal malnutrition.

Poor infant growth appears to increase the risk of hospital admission with lower respiratory infection due to RSV

Reducing rheumatic fever in New Zealand

Presenter: Chrissie Pickin, Ministry of Health, New Zealand

Authors: C Pickin and N Stefanogiannis

Indigenous Māori and Pacific people living in New Zealand experience high rates of rheumatic fever and rheumatic heart disease. The New Zealand Government has committed to tackling this inequity and reducing the incidence of rheumatic fever by two-thirds by 2017. The New Zealand Rheumatic Fever Prevention Programme encompasses a range of innovative activities aimed at preventing the transmission of Group A streptococcal throat infections and ensuring that these throat infections are treated quickly and effectively. The activities include a 'primordial' prevention programme focussed on reducing household crowding in priority communities and improving access to sore throat management services in primary care and community settings.

2014 rheumatic fever hospitalisation data suggest that the programme is having an effect with a statistically significant reduction between 2013 (4.3 per 100,000 hospitalisations) and 2014 (3.4 per 100,000 hospitalisations). The decrease was achieved in both Māori and Pacific people and was statistically significant for Māori.

This presentation will include an overview of this multi-faceted programme and will share lessons for successful programme design and delivery that can reduce health inequity.

The use of routinely-collected primary care data for improving the control of sexually transmissible infections in Aboriginal communities

Presenter: Kathryn Taylor, Aboriginal Health Council of South Australia (AHCSA)

Authors: K Taylor, K Marshall, S Betts and D Scrimgeour

Aboriginal people continue to experience a high prevalence and incidence of sexually transmissible infection (STI), especially in remote locations. We describe the development of an innovative system of collection and analysis of STI testing data from Aboriginal community-controlled health services (ACCHSs) in South Australia to facilitate sexual health quality improvement initiatives and develop a greater understanding of STI epidemiology in Aboriginal communities across the state.

The Aboriginal Health Council of SA (AHCSA) is the peak body representing 10 ACCHSs in South Australia. AHCSA's Sexual Health Program (SHP) began in 2010, building capacity within ACCHSs to deliver sexual health services for Aboriginal communities. This includes supporting ACCHSs to run a 6-week community screening activity, for which testing rates and prevalences are reported annually. In 2013, a partnership was negotiated with SA Pathology, whereby results of all tests conducted at participating ACCHSs for chlamydia, gonorrhoea and trichomoniasis were reported to AHCSA. This has enabled STI data to be analysed and disseminated to health services throughout the year, to identify gaps in service delivery and guide the work of the SHP. We will present the development of the surveillance system, its current uses, findings to date and future directions for the program.

Person-to-person engagement – achieving exceptional program outcomes in remote Indigenous communities

Presenter: Gabrielle Watt, Department of Health, Northern Territory

Authors: J Arnold, S Cooney, B Johnson, D Miller, A Wilson, P Wines and L Wing

Achieving high coverage rates for health service delivery in remote communities is often difficult due to factors including high population mobility, language barriers and cultural differences.

The Northern Territory trachoma program uses a unique approach to delivering health care in remote communities by speaking individually with each person in the community. Community members are provided with individual information to make decisions on screening and treatment options for themselves and their families. Novel in a time of media, texts and computers, this intensive approach has resulted in exceptional screening and treatment coverage rates. In 2014, >95% of 5–9 year old Indigenous children living in at risk remote communities were screened for active trachoma, while >90% of community members received treatment with azithromycin as indicated by the *CDNA Guidelines for the Public Health Management of Trachoma in Australia*.

Australia, the only high income country to still have blinding trachoma, has made a commitment to the World Health Organisation to eliminating blinding trachoma by 2020. Trachoma (*Chlamydia trachomatis*) infection has been around since the Bronze Age. This presentation will outline how community engagement and education can contribute to excellent program outcomes.

Public Health Surveillance 1
Chair: Sonya Bennett

Validity of antenatal influenza vaccination surveillance systems in Western Australia

Presenter: Annette Regan, Department of Health Western Australia

Authors: AK Regan, DB Mak, HC Moore, L Racey, R Saker, C Jones and PV Effler

Background: Although influenza vaccination has been available to pregnant women since 2009 in Australia, data on vaccine coverage are limited. Our aim was to evaluate the validity of existing databases in Western Australia for measuring antenatal influenza immunisations.

Methods: Self-reported vaccination status of 563 women who delivered between March and October 2013 was compared against three data sources: a state-wide antenatal influenza vaccination database maintained by the Department of Health, a public maternity hospital database, and a private health service database. Sensitivity, specificity, and positive and negative predictive values were calculated for each system using self-report as the “gold standard.”

Results: The state-wide antenatal vaccination database detected 45.7% (95% CI 40.1–51.4%) of influenza vaccinations, the public maternity hospital database detected 66.7% (55.1–76.9%), and the private health service database detected 29.1% (20.5–39.4%). The specificity of each system exceeded 90% and positive predictive values exceeded 80%. Sensitivity was lower in women whose antenatal care was provided by a private obstetrician.

Conclusions: Existing influenza vaccination surveillance systems for monitoring influenza vaccine uptake during pregnancy detect between 29% and 67% of vaccinations. Considering the importance of influenza immunisation as a public health intervention, particularly in pregnant women, alternative sources of vaccination information for surveillance should be explored.

Using SMS to monitor communicable disease contacts: the EbolaTracks program

Presenter: Lauren Tracey, Department of Health, Western Australia

Authors: LE Tracey, AK Regan, PK Armstrong, GK Dowse and PV Effler

Background: Monitoring contacts in a disease outbreak requires substantial time, resources, and coordination between health agencies. WA Health built an automated SMS system to facilitate active monitoring of persons travelling from Ebola virus-affected countries for 21 days following their last potential exposure.

Methods: EbolaTracks participants receive automatic SMS messages twice daily to ascertain if they are feeling unwell and to solicit their recorded temperature by SMS reply. If a participant reports symptoms, or does not respond, EbolaTracks automatically alerts the on-call officer via SMS and email, leading to a direct response

Results: EbolaTracks has been used successfully to monitor all travellers to WA from Ebola virus-affected countries. The current response rate is 84% for all SMS sent, saving substantial time and resources that would otherwise be spent on telephone follow-up.

Conclusions: EbolaTracks has demonstrated proof-of-concept for the use of SMS technology to actively monitor contacts exposed to a significant communicable disease. While this system has been successfully used in WA for Ebolavirus, the system could also be applied to more routine disease control contexts (e.g. measles contacts, gastroenteritis outbreaks), as well as for contacts of emerging diseases of public health concern (e.g. MERS-CoV, avian influenza), in both developed and developing country settings.

Ross river virus notifications – challenges in interpreting data

Presenter: Linda A Selvey, School of Public Health, Curtin University

Authors: LA Selvey, J Donnelly, M Lindsay, SP Boddu, V D'Abrera and DW Smith

An increase in Ross River virus (RRV) notifications in South-West Western Australia in the off-season from 2006–2009 prompted an investigation of RRV notifications from Perth and the adjacent Peel region. This included a review of enhanced surveillance, and analysis of laboratory data from the state reference laboratory (PathWest) and from a private laboratory.

We identified some challenges in interpreting RRV notifications data. These include: 34% of winter notifications in the Perth/Peel regions were incorrectly ascribed to either Perth/Peel region or season (vs 5% of notifications from summer months); laboratories don't consistently adhere to the nationally agreed case definition for RRV when notifying; and a single IgM positive laboratory test had a very low PPV –the estimated PPV was 4.0% in the off-season and 24.6% in the RRV season (commercial test kit); and 39.3% in the off season, and 81% in the RRV season for the in-house immunofluorescence test performed by PathWest.

We recommend that IgM positive, IgG negative RRV test result be excluded from the national RRV case definition. Based on our data, this would remove 17% of PathWest notifications and 76% and 65% of notifications from private laboratories in the off-season and RRV season respectively in South-West Western Australia.

Evaluation of *healthdirect* Australia as a surveillance tool for seasonal influenza

Presenter: Tove Fitzgerald, Clinical Nurse Consultant, Hunter New England Population Health, New South Wales, MAE scholar, Australian National University, Australian Capital Territory

Authors: T Fitzgerald, C Dalton, S Carlson, PD Massey and K Viney

Background: *Healthdirect* is a national nurse triage helpline. This is the first evaluation of *healthdirect* for influenza surveillance using CDC guidelines for evaluating public health surveillance systems.

Methods: We described and compared demographics and age standardised influenza-like illness rates by week of *healthdirect* patients to laboratory notified influenza cases and Flutracking participants with fever and cough from 2009–2012. We also described distribution of *healthdirect* calls by weekday in addition to frequency of clinical pathway use and triage outcomes. Stakeholder interviews were conducted.

Results: A total of 180,076 *healthdirect* patients with influenza-like illness were triaged from 2009–2012. Of these, 100,775 (55.9%) were aged 0–4 years, the highest daily call count was 31,743 calls (17.6%) on Sundays and the ‘paediatric colds’ clinical pathway was the most frequently assigned pathway (62,472; 34.7%). The *healthdirect* data was consistent with Flutracking and laboratory data but diverged during the pandemic. There was strong support for jurisdictional level data.

Conclusion: *Healthdirect* is a useful surveillance tool; however high influenza-like illness rates and lower severity calls in 2009 suggests data may be biased in pandemics by community concern. State level data analysis should be explored.

Implementation of enhanced surveillance for early HIV treatment in NSW

Presenter: Melanie Middleton, Communicable Diseases Branch, Health Protection NSW, New South Wales

Authors: M Middleton, B Telfer, V Bowden, V Sheppeard, J McAnulty and C Selvey

Background: The *NSW HIV Strategy 2012–2015* set a target for HIV treatment uptake as it has been shown to significantly reduce the risk of HIV transmission. To monitor this, we introduced a system to collect information on early HIV treatment uptake for people newly diagnosed in NSW.

Methods: Questionnaires were mailed to the treating doctor of all NSW residents whose first diagnosis was in NSW each quarter, prospectively for people diagnosed after 1 September 2013 and retrospectively for people diagnosed between 1 January 2013 and 1 September 2013. Information was collected on the treatment start date, other clinical variables, and the reason for treatment deferral or loss to follow-up where indicated.

Results: Of 534 new HIV diagnoses, 1 January 2013 to 30 June 2014, 451 (84%) had a questionnaire returned. Of these, 7% had been lost to follow-up by the reporting doctor. After excluding 31 people who were no longer residing in NSW, 83% (n=352/420) were retained in care in NSW at least six months post diagnosis and 292 (55%) had commenced treatment within six months of diagnosis.

Conclusions: Enhanced surveillance for early HIV treatment was successfully implemented in NSW, providing useful indicators with which to monitor progress against the HIV Strategy.

One Health in practice

Presenter: Keith Eastwood, Hunter New England Population Health, New South Wales

Authors: B Paterson, K Eastwood, P Massey, D Durrheim, K Cox-Whitton, T Grillo, P Cashman, S Britton, A Lee, B Moloney, T Fitzgerald and P Corben

The concept of One Health is often viewed as an ideal philosophy; rhetorical rather than functional. We demonstrate that a collaborative partnership undertaken in northern NSW between NSW Health, the NSW Department of Primary Industries and allied non-government agencies, contributes to Australia’s

human and animal health security and provides pragmatic 'One Health' solutions. The group is an informal but active partnership which shares zoonotic and public health information. We identify ways to minimise zoonotic risks; ensure members are alerted to emerging risks; jointly manage zoonotic outbreaks; undertake research and participate in disaster preparedness exercises. We have co-published journal articles; contributed to policy development across agencies and drafted fact sheets for the public, doctors and vets. The group meets quarterly by teleconference and maintains regular email contact. Collaborative work completed through the partnership includes public health awareness, applied research and outbreak investigation and has included particular focus on Hendra virus, Australian Bat Lyssavirus, Q Fever, Brucellosis (*Brucella suis*), Cryptosporidiosis and Leptospirosis. In the event of an emergency zoonotic event, such as an outbreak of highly pathogenic avian influenza in New South Wales, established communication and operational mechanisms allows for a rapid and coordinated response. This group is One Health in action.

Vaccine Preventable Diseases 2 Chair: Frank Beard

Is cocooning as a vaccination strategy effective in preventing pertussis in infants?

Presenter: Stacey Rowe, Department of Health, Victoria, Australia

Authors: SL Rowe, EL Tay, LJ Franklin, N Stephens, RS Ware, M Batchelor, RA Lester, M Kaczmarek and SB Lambert

Background: Between June 2009 and June 2012, the Victorian Department of Health implemented a cocooning program whereby parents of new babies were offered a free pertussis-containing vaccination at or around the time of birth. Here we report vaccine effectiveness of the program in reducing the risk of pertussis in infants.

Methods: A matched case–control study was conducted. Notified cases of pertussis aged less than 12 months were matched to controls by area of residence and date of birth. Telephone interviews were conducted with parents to ascertain whether they were vaccinated against pertussis, and when vaccination took place.

Results: Vaccination of both parents after delivery and ≥ 28 days of onset of illness was effective in reducing pertussis infection after adjusting for potential confounding variables: adjusted vaccine effectiveness (VE) 76% (95% CI, 5%–94%). The unadjusted effectiveness of vaccinating mothers after delivery and ≥ 28 days of onset of illness (VE 60%, 95%CI 18%–80%) was lost after adjustment for fathers' vaccination status and other factors (aOR 1.01, 95%CI 0.36–2.86).

Conclusion: In our population, cocooning as a vaccination strategy—when defined as vaccination after delivery and ≥ 28 days of onset of illness—appeared to be effective only when both parents receive timely vaccination.

Pattern of pertussis in a children's hospital in the post PCR era

Presenter: Helen Quinn, NCIRS, Sydney Australia

Authors: S Hale, H Quinn, N Wood and P McIntyre

Background: The recent pertussis epidemic was marked by high rates of notified disease, associated with widespread PCR use and the detection of milder cases. However little information is available for children who presented to hospital with pertussis in this period, particularly those ≥ 12 months of age.

Methods: Retrospective observational study of pertussis cases presenting to hospital during a 6 year period 2007–2012. Laboratory testing method, disease severity, vaccination status and prevalence of comorbidities by age were examined.

Results: Children ≥ 12 months of age accounted for 42% of cases 2007–2012, usually fully immunised and if hospitalised, had comorbidities in 56%, including 80% requiring ICU admission. In 2007–2012, despite PCR having become available, annual culture requests were higher than during the pre PCR 1997–1999

epidemic period. Comparing the two periods, the average annual number of culture positive hospitalisations in infants was similar in 2007–2012 to 1997–1999, but was significantly higher among children ≥ 12 months of age.

Conclusion: Comorbidities were common among older immunised children requiring hospitalisation. Increased numbers of hospitalisations in children ≥ 12 months of age, even when restricted to culture positive cases, is consistent with waning vaccine effectiveness in the absence of a booster dose at 18 months of age.

Clinical severity comparisons between pertactin deficient and pertactin positive *Bordetella pertussis* variants

Presenter: Michelle Clarke, Women's and Children's Hospital, South Australia

Authors: H Quinn, S Octavia, R Lan, N Wood, L Gilbert, V Sintchenko, G Hanly, C Blyth, P McIntyre and H Marshall

Background: Pertussis control remains challenging in Australia despite high coverage for infant pertussis immunisation. Recent literature highlights changes to the circulating *Bordetella pertussis* genotypes, including absence of pertactin (PRN) antigens, one of the primary antigens included in acellular pertussis vaccines. This study aimed to compare clinical disease severity indicators between PRN+ve and PRN-ve infections in children.

Methods: Genotyping of *B. pertussis* isolates was conducted using published methods between 2008 and 2012. Clinical records of culture positive cases with genotype data available were reviewed for participating hospitals in WA, SA and NSW. Severity indicators were compared between PRN+ve and PRN-ve *B. pertussis* infections.

Results: Among 199 *B. pertussis* isolates, 71 (36%) were PRN-ve and 128 PRN+ve. The proportion requiring admission as opposed to emergency department management only was similar (40/71, 56.3% vs 71/128, 55.5%, $p=0.906$) as was median length of stay for admitted cases (4 vs 5 days, $p=0.385$) for PRN-ve vs PRN+ve cases. There was a non-significant trend for PRN-ve cases to require intensive care less frequently than PRN+ve cases (5/71;7.0% vs 16/128;12.5%, $P=0.185$)

Conclusions: Culture positive cases of pertussis predominantly occur in young unimmunised infants. In this opportunistic sample from 3 hospitals, we did not find evidence of significantly different clinical severity between PRN-ve and PRN+ve *B. pertussis* strains.

Factors associated with pertussis hospitalisation in adults-a population based nested case-control study

Presenter: Surendra Karki, University of New South Wales, NSW, Australia

Authors: S Karki, P McIntyre, AT Newall, CR MacIntyre, E Banks and B Liu

Background: Few studies have looked at risk factors for notified pertussis but not for pertussis-related hospitalisation in adults.

Methods: We examined the association between various factors and pertussis-related hospitalisations in a cohort of older adults in the 45 and Up study in New South Wales, Australia, between 2006 to 2012 using record linkage and a nested case-control design.

Results: Among 265,287 participants, the incidence of pertussis notifications and hospitalisations was 77.8 (95% CI, 73.0–82.8) and 2.9 per 100,000 person years, respectively. Defining cases as those hospitalised with pertussis and control as those notified but not hospitalised, we found that increasing age, smoking, and more remote residence were associated with a greater likelihood of pertussis hospitalisation [65–74 years aOR 5.98 (95%CI 1.65–21.68), 75+ years aOR 10.88 (95%CI 2.58–45.77) compared to age category 45–54 years], geographical residence [remote/very remote aOR 10.65 (95%CI 2.28–49.70), outer regional 3.56 (95%CI 1.23–10.29) compared with residence in major city] and smoking [smoking in the past, aOR 2.23 (95%CI 1.01–4.92) compared with people who never smoked].

Conclusions: The primary risk factors for pertussis hospitalisation among those with a pertussis notification were older age, smoking and region of residence. Other potential risk factors such as asthma and high BMI had non-significantly higher odds of hospitalisation.

Factors associated with pertussis vaccination in a cohort of older Australian adults

Presenter: Amalie Dyda, School of Public Health and Community Medicine, UNSW

Authors: A Dyda, S Karki, P McIntyre, CR MacIntyre, J Kaldor and B Liu

In Australia adult pertussis vaccination is not funded by the National Immunisation Program, but is recommended for some. In NSW between 2009–2012 a government program provided free pertussis vaccination to this group.

We used data from the 45 and Up study, a cohort of NSW residents aged >45 years. Using a questionnaire, participants were asked about pertussis vaccination. We estimated coverage and investigated characteristics associated with pertussis vaccination using multivariate logistic regression.

Among 27036 participants, overall 17.8% (95% CI 17.3–18.2) reported pertussis vaccination in the previous 5 years. Reported vaccination coverage was (14%, 95%CI 12.5–14.7) in those aged 45–54 years, peaked in those 60–64 years (23%, 95% CI 21.5–23.7), and was lowest in those >85 years (5%, 95% CI 3.9–6.4). In adjusted analyses other factors associated with vaccination included being female (aOR 2.06, $P<0.01$) and higher income (aOR 1.23, $P<0.01$). Groups less likely to report vaccination included those born in a non-English speaking country (aOR 0.44, $P<0.01$), smokers (aOR 0.58, $P<0.01$) and those living alone (aOR 0.71, $P<0.01$).

The association of vaccination with income, together with the rising burden of adult pertussis, increasing use of grandparent care, warrants consideration of pertussis vaccination strategies for adults.

Determining best strategies for maternally-targeted pertussis vaccination using an individual based model

Presenter: Patricia Campbell, The University of Melbourne, Victoria

Authors: PT Campbell, J McVernon and N Geard

Control of pertussis remains problematic, despite implementation of high-coverage mass vaccination more than sixty years ago. Cocoon and/or maternal vaccination have been implemented in Australia, the United States and the United Kingdom as emergency measures to protect vulnerable infants, who are at greatest risk of severe outcomes. Questions remain about the relative benefit of maternal vaccination over cocooning, and whether repeat immunization is required for every pregnancy.

We simulated pertussis transmission and maternally-targeted vaccination strategies within an individual-based model framework characterizing individuals by their sex, age and family composition. We compared infant disease in vaccinating and non-vaccinating households and estimated household and population impacts of maternal and cocoon vaccination strategies.

At the population level, maternal vaccination at 80% coverage more than halved pertussis incidence in infants under 2 months old. The risk of pertussis among first-born infants of mothers not antenatally immunised was 5 times that of immunised mothers. Revaccination with each pregnancy was required to ensure equivalent protection to subsequent siblings. Compared to maternal vaccination, cocooning was less effective at reducing infant incidence at the population level and provided no direct protection to infants once pertussis was introduced into a household. Our results inform design of these maternally-targeted strategies.

Late Breakers
Chair: Paul Armstrong

A multi-jurisdictional outbreak of hepatitis A associated with consumption of frozen berries

Presenter: Marion Easton, Department of Health and Human Services, Victoria and OzFoodNet

Authors: M Easton, F Romanes, M Antoniou, J Gregory, B Polkinghorne, R Stafford, S Bowden, L Tracy, J McMahon and the OzFoodNet Network

Introduction: Routine follow-up of three locally acquired hepatitis A (HAV) infections in Victoria in January and February 2015 identified a common risk factor of consuming the same brand of frozen mixed berries. An additional case notified in NSW also reported this risk factor which led to the recall of the product and triggered a multi-jurisdictional outbreak investigation co-ordinated by OzFoodNet.

Methods: All jurisdictions reviewed HAV cases with onset of symptoms after 1 October 2014 who had spent any time during their acquisition period in Australia. Sera from cases were submitted for genotyping and sequencing. A food safety investigation and case control study were conducted.

Results: As of 23 April 2015, there were 31 HAV cases who met the definition for a confirmed outbreak case (based on genotyping and sequencing), 12 probable outbreak cases and 39 possible cases. Twenty-six confirmed cases had consumed the same recalled brand of mixed berries and three were secondary cases. Five probable cases also consumed this same brand of berries. A statistically significant association with illness and consumption of the mixed berries was demonstrated in the preliminary univariate analysis (OR 165; 95%CI 17 – 2000; $p < 0.0001$).

Conclusion: There is strong epidemiological and laboratory evidence for an association with consumption of mixed berries and HAV.

Case-study: A retrospective assessment of the impact of Ebola virus disease (EVD) on mortality and health seeking behaviours in a rural village in Kailahun District, Sierra Leone, 2015

Presenter: Clair Mills, Medecins Sans Frontieres

Authors: G Caleo, J Duncombe, K Lokuge, C Mills, F Jephcott, E Looijen, R Kremer, JS Squire and J Greig

Introduction: A state of emergency due to Ebola virus disease (EVD) was declared in Kailahun District on 12 June 2014; Medecins Sans Frontieres (MSF) opened an Ebola Management Centre (EMC) on 29 June. A total of 565 confirmed EVD cases were reported in the district; however official figures do not reflect the true magnitude of the outbreak.

Methods: An exhaustive retrospective mortality survey of one highly affected rural village was conducted. A mixed-method case study approach was employed. All consenting households in the selected village were interviewed. In households with suspected EVD cases or deaths, records were cross-matched against the EMC patient list and the Ministry of Health and Sanitation community burials database. Qualitative interviews were carried out with key local informants and in 20 randomly selected households.

Results: All households ($n=240$) in the village participated in the study, a total of 1120 people. 39 deaths were reported during the recall period. There were 28 EVD confirmed and probable cases. 15 were confirmed in the EMC; 13 of those (86.7%) died. A further thirteen probable cases died in the community; 7 (54%) of these were not detected by the surveillance system.

Qualitative findings will also be presented.

Conclusions: This case study presents, on a small scale, the impact of EVD in rural Sierra Leone. Overall mortality rates were above emergency thresholds; there was significant under-notification of cases. These findings underline the importance of early engagement with the community.

Public health perspective of phase III results of an investigational herpes zoster vaccine

Presenter: Michael Nissen, GSK, Vaccines Value and Health Sciences, Singapore

Authors: L Varghese, M Nissen, A Olivieri and D Curran

A new investigational subunit vaccine (HZ/su) containing the varicella-zoster virus glycoprotein E and the AS01B Adjuvant System has shown a reduction in herpes zoster (HZ) incidence by 97.2% (95% CI: 93.7%–99.0%; $P < 0.0001$) compared to placebo in subjects ≥ 50 years old. Vaccine efficacy did not decrease with age. The potential public health impact of the vaccine was assessed in the Australian population.

A multi-cohort static model was developed in MS Excel. Model inputs included Australian specific data for (1) demographics and natural mortality rates, (2) incidence of HZ and post-herpetic neuralgia (PHN); and vaccine efficacy estimates from a recently published phase III clinical trial. The model projected the number of HZ and PHN cases avoided by vaccinating the Australian population aged ≥ 60 using a lifetime time horizon.

The projected number of HZ cases avoided would be: 1,077,966; 841,149; 679,542, assuming 0%, 2% and 4% annual waning rates of HZ/su efficacy, respectively. The corresponding PHN cases avoided would be: 191,061; 146,977 and 117,328. The number needed to vaccinate to prevent one case of HZ ranged from 4.25–6.74.

If introduced, the new candidate vaccine could prevent between 0.68 and 1.1 million cases of HZ compared to no vaccination in ≥ 60 year olds.

Risk Assessment of Hepatitis A and Transfusion–Transmission associated with Multi-jurisdictional Berry Outbreak

Presenter: Veronica Hoad, the Australian Red Cross Blood Service, Perth

Authors: V Hoad, J Pink, C Seed, P Kiely and A Keller

Background: Hepatitis A is transfusion-transmissible, although case reports are rare. On 14 February 2015 an imported berry mix recall was issued in Australia due to potential hepatitis A contamination. The Blood Service implemented recall and deferral interim instructions for exposed donors as a precaution until a risk assessment was completed.

Methods: Modelling of the risk to the blood supply was undertaken using the following parameters: the number of fresh donations during the at risk period (385,889), a 2% berry consumption, 0.01% or 0.1% attack rate, asymptomatic viraemia of 21 days, 30% asymptomatic infection, 0.41% immunity in recipients and 1.5% severe infection rate.

Results: The risk of an infected donation was negligible at approximately 1 in 3,000,000 donations. Using a 10 factor safety margin the risk of a symptomatic infection occurring in a recipient was estimated at 1 in 735,688.

Conclusion: The risk of a case of transfusion–transmission of hepatitis A associated with this outbreak was not deemed to exceed tolerable risk and thus interim risk management actions were ceased.

Novel MRSA outbreak in the Illawarra Shoalhaven district, August 2013–June 2014

Presenter: Chatu Yapa, Health Protection NSW and National Centre for Epidemiology and Population Health, The Australian National University

Authors: C Yapa, D Cordery, M O’Sullivan, J Harris, D Mayne, J McAnulty and C Boutlis

Methicillin-resistant *Staphylococcus aureus* (MRSA) is a significant hospital-acquired pathogen. A novel MRSA strain was identified in the Illawarra–Shoalhaven district in August 2013, causing an outbreak in nine hospitals. By June 2014, this strain accounted for 45% of all hospital MRSA. We conducted a case-control study to assess risk factors for transmission of this strain.

Cases, defined as hospital in-patients with the novel strain were compared with control patients with other hospital-acquired MRSA strains isolated between 29 August 2013 and 30 June 2014. We collected demographic, clinical and hospitalisation information. Whole genome sequencing (WGS) was conducted on available novel isolates.

We compared 67 cases with 112 controls. The median age of cases was 79 years, 66% were male and 24% lived in nursing homes. In the 90 days before diagnosis, 73% of cases were admitted to ≥ 2 hospitals compared with 47% of controls ($P < 0.01$). WGS for 60 isolates identified nine unique clades. Analysis of these identified several clusters – two associated with one ward and two with a single clinician.

Despite the lack of specific risk factors, the novel strain was rapidly transmitted through several facilities. WGS may allow for better definition of transmission pathways and characterise MRSA outbreaks.

Psittacosis outbreak in veterinary university demonstrating novel source of transmission

Presenter: Bridget Doyle, Public Health Unit, Murrumbidgee Local Health District, Albury NSW.

Authors: J Chan, B Doyle, V Sheppard, J Branley, M Gabor, K Viney, H Quinn and J Heller

A local public health unit was notified in November 2014 of a cluster of respiratory illness in 4 people, all associated with a veterinary school. Active case finding identified another case at a local horse stud. It was identified that all cases had a common exposure to the abnormal equine foetal membranes of Mare A. This tissue subsequently tested PCR positive for *Chlamydophila psittaci*. Active case-finding did not identify any cases of atypical pneumonia not linked to the membranes.

We interviewed university and stud farm staff exposed to the abnormal membranes regarding clinical symptoms, investigations and potential exposures.

Our investigation found that nine people were exposed to the foetal membranes of Mare A. Of these, five cases of psittacosis (three probable, two suspected) were identified. Contact with birds was not associated with illness. People who had direct contact with the abnormal membranes were more likely to develop disease.

Spread from horses has not previously been considered an important pathway for transmission. Previous studies have demonstrated the presence of *C. psittaci* infection in horses. To our knowledge, this is the first report of *C. psittaci* transmission from horse to humans.

Day 2: Harnessing new technologies

Responding to Ebola virus disease: Australia and beyond

Chair: Dr Sonya Bennett

This Breakfast Forum will provide an opportunity for discussion about all things Ebola – from International and National preparedness, to clinical trials of vaccines and therapeutics, and front line experiences of working in West Africa. Short presentations will be followed by a lively question and answer session. Not to be missed.

Conducting clinical trials in high transmissions settings and international issues

Professor Peter Horby

Operation Uplift and planning exercises for EVD

Dr Jeannette Young, QLD CHO

Border preparedness and implementation issues

Dr Jenny Firman, Principal Medical Adviser, Office of Health Protection, Department of Health

Clinical work and other experiences in an EVD affected country

Dr John Gerrard, IDP GCH

Plenary 2. Microbiological challenges and opportunities for controlling infectious diseases

Chair: John Bates

Foodborne and zoonotic disease surveillance: genomics, metagenomics, and the road ahead

Speaker: Dr John Besser, PhD, Deputy Chief, Enteric Diseases Laboratory Branch, Centers for Disease Control and Prevention, Atlanta USA

Advanced technology is changing the field of microbiology at an unprecedented rate, opening up opportunities and challenges for public health that were not imaginable a few years ago. In the area of foodborne disease surveillance, successive laboratory and epidemiology innovations during the last 20 years have increasingly made it possible to detect and solve distributed outbreaks caused by problems in the food supply that would not otherwise have been recognised. Will the real-time use of NGS technology make it possible to detect more outbreaks more quickly and make them easier to solve? The U.S. Centers for Disease Control and Prevention, in collaboration with multiple U.S. and International agencies and all 50 U.S. states, initiated a nationwide real-time whole genome sequencing (WGS)-based surveillance project for *Listeria monocytogenes* in late 2013. Impacts were immediate, with *Listeria* outbreaks dominating headlines. Lessons learned will be presented, along with a description of the nationwide wgMLST-based infrastructure developed to monitor foodborne diseases. Uses of NGS technology for other diseases such as Ebola and influenza will be briefly mentioned along with applications for metagenomics that are rapidly emerging from the realm of science fiction into clinical diagnostic and public health practice.

Winds of change: the evolving diagnostic microbiology laboratory – a personal reflection

Speaker: Dr Jenny Robson, Sullivan Nicolaides Pathology (SNP), Brisbane

Clinical microbiology is undergoing rapid change not only in the way things are done but also the physical organization of facilities. Microbiology laboratory networks are consolidating with centralisation of many of their functions. This talk will examine the changing Australian landscape with respect to private microbiology and describe those forces that have reshaped laboratories recently. These include the widespread application of molecular technologies including multiplexed panels, and more recently microarrays and automation of molecular tests; matrix-assisted laser desorption ionization–time of flight mass spectrometry methods and their replacement of other identification systems for microorganisms; and the shift to liquid-based specimens enabling the introduction of partial and full laboratory automation. The impact on patient care and on public health surveillance including enteric pathogens, respiratory viruses, and sexually transmitted infections will be discussed together with the challenges that these changes pose. No doubt even newer technologies such as next generation sequencing will appear on the scene and be embraced in the clinical laboratory armamentarium at a rapidly evolving pace.

Communicable Diseases Surveillance and Response in Pacific Island countries and territories: Challenges and Opportunities

Speaker: Dr Salanieta Taka Saketa, Epidemiologist, Research, Evidence and Information Programme, Public Health Division, Secretariat of the Pacific Community, Suva Office, Fiji

High speed global communication and travel poses risks of spread of communicable diseases within a matter of days and weeks and the natural protective factors of distance and islands is inconsequential. Pacific Island Countries and Territories (PICTs) are faced with the challenges and opportunities of implementing surveillance systems that can communicate information and prepare communities; faster than the spread of these diseases. Innovative strategies and technologies are needed to enhance surveillance and response capabilities in PICTs both at the national and regional level, bearing in mind the unique challenges of the region.

Foodborne Diseases and Outbreaks
Chair: Ben Polkinghorne

Whole genome sequencing can assist in monitoring community outbreaks of salmonellosis

Presenter: Anastasia Phillips, Centre for Infectious Disease and Microbiology, ICPMR, Westmead, New South Wales

Authors: A Phillips, Q Wang, N Holmes, C Furlong, C Sotomayor, P Howard, K Ward and V Sintchenko

Background: *Salmonella* Typhimurium (STM) is an important aetiological agent in foodborne outbreaks. Subtyping is critical to outbreak investigation, yet current techniques (e.g. multilocus variable number tandem repeat analysis, MLVA) often do not provide sufficient discrimination. Whole genome sequencing (WGS) of STM may have greater discriminatory power to support disease control.

Methods: STM isolates of a single, endemic MLVA type causing two independent outbreaks along with sporadic cases in NSW during 2014 were selected for WGS. DNA extracted from case and environmental isolates was sequenced (HiSeq, Illumina) and variation was assessed by single nucleotide polymorphism (SNP) analysis. SNP analysis was compared to known epidemiology.

Results: Thirty-four outbreak, 17 sporadic, one secondary and 10 environmental isolates were included in the analysis. WGS analysis supported known epidemiological hypotheses and genomes of within-outbreak isolates were nearly identical. Sporadic cases differed from outbreak cases by a small number of SNPs. Among sporadic cases, WGS detected previously unrecognised mini-clusters.

Conclusions: Clustering of STM cases based on WGS data correlates well with epidemiology and further differentiates sporadic from outbreak cases. WGS offers the opportunity to further cluster sporadic isolates within endemic MLVA types of STM and to improve the resolution of public health laboratory surveillance.

Incidence and risk factors for hospitalisation with gastroenteritis in a cohort of older Australians

Presenter: Yingxi Chen, The Australian National University

Authors: Y Chen, B Liu, K Glass and M Kirk

Background: Infectious gastroenteritis is an important cause of morbidity in Australia. We aimed to estimate the incidence and risk factors for gastroenteritis related hospitalisation in older Australians.

Methods: The 45 and Up Study is a large-scale Australian cohort of NSW aged ≥ 45 years in 2006–2008. Self-reported demographic data from 265,440 participants were linked to hospitalisation data. We used Stata 12 to estimate hazard ratios (HR) of incident hospitalisation for gastroenteritis using Cox regression, adjusting for socio-demographic, health and behavioural status, with age as the underlying time variable.

Results: There were 6,077 incident gastroenteritis admissions over 1,111,000 person years. Incidence increased exponentially with increasing age; incidence was 0.24 per 1,000 (95% CI 0.22–0.25) in 45–54 year olds and 2.18 per 1,000 (95% CI 2.02–2.36) in those aged 85+ years. After adjustment, gastroenteritis hospitalisation was significantly associated with proton pump inhibitors (PPIs) usage (HR 1.57, 95% CI 1.49–1.67), and no fruit and vegetable consumption (HR 1.93 95%CI 1.36–2.75). In addition, the risk was over 300% greater for those with poor health than those with excellent health.

Conclusion: Hospitalisation for gastroenteritis is more common in the elderly, those in poor health and those using PPIs. Prevention strategies could potentially focus on dietary modification.

Outbreak of *Salmonella* Typhimurium 9 infection amongst Christmas function attendees, December 2014

Presenter: Caitlin Graham, Communicable Disease Control Branch, SA Health, South Australia

Authors: JH Stephens, C Graham, EJ Denehy and AP Koehler

On 15 December 2014, the Communicable Disease Control Branch (CDCB) South Australia was notified of an outbreak of gastrointestinal illness amongst attendees of a recent Christmas function. The objective of the investigation was to identify the potential source of infection and establish appropriate intervention strategies to prevent further illness. A retrospective cohort study was conducted among 24 guests of the function. A telephone questionnaire was used to collect information on demographics, illness, and menu items consumed. Descriptive statistics, univariate analyses, and Poisson regression were performed. The questionnaire response rate was 96%. The attack rate was 58.3%. Seven cases were confirmed as having a *Salmonella* Typhimurium phage type 9 infection. There was a significant association between the consumption of tiramisu and illness (RR 11.2, 95% CI 1.65–75.93, $P=0.0004$). The ingredients of the homemade tiramisu included raw eggs, and this was identified as a high risk food item. This outbreak adds to the ongoing evidence that produce made from raw egg is hazardous. Education should be extended to cooking in the home.

Illness in children associated with the consumption of raw unpasteurised milk

Presenter: Nectaria Tzimourtas, Department of Health and Human Services, Victoria

Authors: D Thaker, N Tzimourtas and J Gregory

Background: In October 2014, a cluster of Haemolytic Uraemic Syndrome (HUS) cases and a separate cluster of Cryptosporidiosis cases, all living in the same outer Melbourne metropolitan area were detected in Victoria. An investigation was initiated to determine if there was a common source.

Methods: Cases of HUS were interviewed using the national OzFoodNet STEC/HUS questionnaire. The Department used its own Cryptosporidiosis questionnaire with food exposures added to interview the cases of Cryptosporidiosis. Responses were compared for a common link. Case finding was conducted with other state and territories through OzFoodNet and CDNA.

Results: Three cases of HUS and two cases of Cryptosporidiosis were found to have consumed the same brand of unpasteurised milk, sold as 'bath' milk, in their incubation period. One case of HUS died. Public health warnings and subsequent media resulted in Dairy Food Safety Victoria tightening controls on the availability of dairy products not intended for human consumption such as unpasteurised milk.

Conclusion: The consumption of unpasteurised milk is a well-documented risk factor for gastrointestinal diseases including Cryptosporidiosis and Shiga toxin producing *E. coli* infection and was the suspected source of illness. The sale of unpasteurised milk for human consumption in Australia is prohibited.

Epidemiology of bacterial toxin-mediated foodborne outbreaks in Australia

Presenter: Fiona May, Australian Government Department of Health and Australian National University, Australian Capital Territory

Authors: B Polkinghorne, E Fearnley and F May

Foodborne outbreaks caused by bacterial toxins such as *Clostridium perfringens*, *Staphylococcus aureus* and *Bacillus cereus* are an often overlooked cause of morbidity. We aim to describe the epidemiology of these outbreaks in Australia, establish those groups at highest risk and identify where preventative measures should be focussed.

All foodborne and suspected foodborne outbreaks in Australia are collated in the OzFoodNet Outbreak Register. We extracted data on all toxin mediated outbreaks notified to the register between 2001 and 2013. Descriptive analyses were undertaken using Stata 13.

There were 272 toxin mediated outbreaks reported, of which 39% were laboratory confirmed. These outbreaks affected 4,066 people, including 70 hospitalisations and 13 deaths, 12 of which occurred in aged care facility residents. *Clostridium perfringens* was suspected or confirmed as the causative agent in 63% of outbreaks. Restaurants (31%) and aged care facilities (32%) were the most commonly reported settings for outbreaks and inadequate temperature control of pre-cooked foods was the most commonly reported contributing factor (60%).

Toxin mediated outbreaks cause significant preventable morbidity in Australia, and disproportionately affect those living in aged care facilities. Public health efforts aimed at improving pre-cooked food storage habits could help to reduce the magnitude of this problem.

First outbreak of locally acquired hepatitis E virus infection in Australia

Presenter: Catriona Furlong, NSW Health Protection

Authors: C Yapa, C Furlong, A Rosewell, K Ward, S Adamson, J Kok, S Bowden, C Shadbolt, L Smedley, M Ferson, T McNeill, M Staff, V Sheppard and J McAnulty

Background: In May 2014, an outbreak of hepatitis E linked to a single restaurant was identified.

Methods: A case series was conducted using a standardised questionnaire. Co-diners were also interviewed and tested. Further cases were identified testing patients in whom viral hepatitis screening was requested at a major private and public reference laboratory where other infections had been excluded, and by alerting medical practitioners to the outbreak. Serum isolates were genotyped and sequenced. Implicated foods were traced back to the source.

Results: We identified 17 cases who reported dining at a single restaurant in their incubation periods. Consumption of the pork liver pâté was identified as the highest risk for developing HEV. Seven additional locally acquired cases were detected due to enhanced surveillance. All had consumed pork or pork liver in their incubation period. Seventeen of 24 cases were genotype 3. Pork livers were traced back to a single farm.

Conclusions: This is the first HEV outbreak in Australia. We recommend that clinicians in Australia consider the diagnosis of HEV in patients presenting with a compatible illness in the absence of overseas travel history. Further, the food service industry should ensure that pork liver products are thoroughly cooked.

Public Health Surveillance 2

Chair: Vicky Sheppard

Trends in species, serotype and antimicrobial susceptibility of *Shigella* isolates, Victoria, 2000–2015

Presenter: Mary Valcanis, University of Melbourne

Authors: M Valcanis, CR Lane, A Kuzevski and B Howden

Aim: To report the trends in species, serotype and antimicrobial resistance in isolates of *Shigella* in Victoria.

Methods: We performed identification, speciation, serotyping and *S. sonnei* biotyping on all isolates of *Shigella* submitted to the MDU PHL between 2000 and 2015. Susceptibility testing to 12 antimicrobials (azithromycin since 2014) was performed by agar dilution for epidemiological purposes.

Results: Over 1,600 confirmed *Shigella* isolates were included in the analysis, ranging from 51(2003) to 297(2014) annually. The dominant species was *S. sonnei*, of which biotype g was most common in all years, followed by *S. flexneri*. Less than 10 cases of *S. boydii* and *S. dysenteriae* were seen in any year. Emerging serotypes, such as *S. flexneri* 1c and 4d, have been identified in Victoria. Ninety-six per cent of *Shigella* isolates were resistant to at least one antimicrobial. Decreased susceptibility to ciprofloxacin was noted in 2003; by 2014, 62% (75/122) of *S. sonnei* isolates exhibited full ciprofloxacin resistance. In late 2013, azithromycin resistance was first observed in *S. flexneri* 3a among men who have sex with men. Resistant strains, previously seen in overseas travellers, have been increasingly identified amongst locally acquired infections.

Conclusions: Isolate characterisation is vital to monitor and track *Shigella* types circulating and emerging in the population. Resistance profiles must be available to guide appropriate treatment.

A NSW program to improve management of people newly diagnosed with HIV

Presenter: Jeremy McAnulty, Communicable Diseases Branch, Health Protection NSW, New South Wales

Author: B Telfer, V Bowden, M Middleton, V Sheppard, J McAnulty and C Selvey

Background: In NSW half of new HIV diagnoses are made by general practitioners often inexperienced in HIV. The *NSW HIV Strategy 2012–2015* calls for enhanced case support at the time of diagnosis to help achieve prevention and treatment targets. In May 2013 the HIV Support Program (HSP) commenced.

Methods: A laboratory notification of HIV infection triggers a phone call to the diagnosing doctor from a local HSP Coordinator with HIV expertise. The Coordinator provides support and advice so that the newly diagnosed patient receives appropriate clinical management, psychosocial support, counselling about HIV treatment and prevention of transmission of HIV to others, contact tracing assistance and linkage to specialist, community and peer support services.

Results: From 9 May 2013 to 30 September 2014 the HSP supported 186 doctors of whom 156 (84%) were HIV-inexperienced primary care doctors. Of 186 doctors supported, 114 intervention forms were returned by Coordinators; 103 (90%) doctors welcomed support by the HSP, 61 (54%) had just made their first HIV diagnosis, 59 (52%) were aware of how to do contact tracing and 49 (43%) were interested in shared care.

Conclusions: The HSP has been well received by diagnosing doctors. Further evaluation will be done from 2015.

The National Notifiable Diseases Surveillance System (NNDSS) 1991–2011: Expanding and improving

Presenter: Katherine Gibney, Monash University, Victoria

Authors: K Gibney, A Cheng, K Leder and R Hall

Background: We reviewed the system characteristics, data quality and performance of the NNDSS over its first 21 years of operation.

Methods: Line listed data for all cases notified to NNDSS from 1991–2011 were reviewed. Changes in conditions notified, data fields included, data completeness, and notification delays were examined at national and jurisdictional levels.

Results: The number of notifiable conditions increased from 34 to 65, with 22 conditions notifiable by all jurisdictions from 1991–2011. Demographic data were near complete except Indigenous status which was missing for 56% of cases nationally (jurisdictional range 13%–81%). Vaccination status and travel data were missing for 89% and 76% of relevant notifications. Data completeness improved over the study period for 24/26 (92%) variables. Median delay to NNDSS notification was 8 days (interquartile range 4–17 days), varying between jurisdictions from 5 to 15 days ($P<0.001$) and decreasing from 11 days in 1991–1997 to 5 days in 2005–2011 ($P<0.001$).

Conclusion: NNDSS expanded during its first 21 years. Overall, data completeness and notification timeliness improved, but there were marked inter-jurisdictional differences. Examination of delays and low completion of specific data field is important for devising strategies to improve future data collection.

Implementation of an automated notifiable disease surveillance tool in Victoria

Presenter: Stacey Rowe, Communicable Disease Epidemiology and Surveillance, Department of Health, Victoria

Authors: S Rowe, J Lawrie, B Cowie, J Carlin and N Stephens

Background: The increasing volume of communicable disease notifications presents a challenge to conventional surveillance programs. In Victoria this led to the development of an automated outbreak detection tool, the Public Health Outbreak Surveillance System (PHOSS).

Methods: Based on the model developed by Farrington et al in the UK Health Protection Agency, PHOSS is a web application written in R that automatically receives new notifications from the surveillance database daily, with retrospective data back to 1991. It provides a list of notifiable diseases ordered by how much they exceed the calculated warning threshold ('Exceedance score'), together with a range of user interfaces for examining time series and disease maps.

Results: PHOSS has been implemented in the weekly surveillance meeting in Victoria and is used to highlight possible outbreaks, and to examine temporal and geographic trends of conditions of interest. A number of worked examples of outbreaks detected by PHOSS and demonstration of the tool's use in public health practice will be presented.

Conclusion: Together with existing communicable disease surveillance approaches, automated outbreak detection tools can act as a safety net in detecting additional outbreaks, and can also augment the utility and accessibility of existing datasets to support daily public health practice.

Can adverse event signals be detected by electronic GP data?

Presenter: Rob Menzies, National Centre for Immunisation Research and Surveillance

Authors: L Trihn, K Macartney, A Dey, C Chiu and P McIntyre

Background: In early 2011 there was an increase in reports of severe injection site reactions (ISR) in adults following receipt of pneumovax.

Methods: Data from the General Practice Research Network (GPRN) were analysed retrospectively to determine whether the increase in ISR could be detected.

Results: Electronic clinical records of 95,760 pneumococcal and 683,829 influenza vaccine doses administered between 2002 and 2012 were received, from 1,088 participating general practitioners (GPs) in 402 practices. The seasonality and age distribution of vaccinations, dose numbers and revaccination intervals were consistent with recommended usage of both vaccines. Following receipt of Pneumovax, there were 233 ISR (243 per 100,000), including 40 severe ISR (42). As expected, pneumovax ISR for second or subsequent doses (398 per 100,000), were higher than the rate for first doses (239). However, the number of local reactions following receipt of Pneumovax between January and March 2011 (just before the public announcement of a batch recall) was only 3 cases, similar to the same period of the previous year (5 cases between January and March 2010).

Conclusions: The GPRN data appear to be broadly coherent and consistent with recommended usage. However, a larger GP network would be needed for rapid AEFI surveillance.

A web-based system for mass-gathering surveillance: Experience from the 8th Micronesian Games, 2014

Presenter: Paul White, Research Evidence and Information Programme, Public Health Division, Secretariat of the Pacific Community

Authors: S Saketa, E Johnson, S Gopalani, E Edward, C Loney, A Mercier, T Toata, C Leppers, R Wojcik, S Lewis, A Roth, Y Souares and D Hoy

Background: Web-based surveillance tools provide near-real time updates of disease patterns, facilitating prompt investigation and response. A web-based surveillance platform based on SAGES developed by JHU/APL and SPC was used in partnership with Pohnpei public health to enhance surveillance at the 8th Micronesian Games hosted by Pohnpei State in July 2014' a mass gathering of 1,700 participants from nine Micronesian states and countries.

Methods: The mass gathering surveillance comprised daily reporting of 8 syndromes using standardised case definitions from 11 sentinel points-of-care with data entered in a centralised location and summarised in daily situation reports (Sitreps).

Results: 5,640 encounters and 408 syndromes were recorded. The Sitreps helped monitor public health threats, and in particular an ongoing measles outbreak, identifying early increases of acute fever and rash as well as diarrhoea.

Conclusion: The enhanced surveillance helped mitigate public health risks. SAGES allowed easy data entry, analysis and accelerated Sitrep production while cloud storage was advantageous in reducing local server costs, facilitating remote support and analysis and increasing off-site data security. As a successful tool, SAGES features in the public health surveillance sustainability plan of Pohnpei State.

Influenza and Other Respiratory Diseases **Chair: Rhonda Owen**

Simulating enhanced pandemic influenza surveillance strategies

Presenter: Nicholas Geard, Melbourne School of Population and Global Health, Victoria

Authors: N Geard, A Black, J Ross, J McCaw and J McVernon

The collection of enhanced epidemiological data in the early stages of an influenza pandemic ("first few hundred" studies) can help to estimate its likely impact, and inform decision making about the appropriate scale of response. The key characteristic of interest is the reproduction number R_0 , which provides information on how quickly a pathogen is likely to spread through a population.

An effective surveillance plan must balance the need to collect sufficient data to enable accurate estimation of disease parameters against the sustainability of obtaining quality data alongside other response activities. Here we describe a method for estimating epidemic parameters from imperfectly observed data, together with a computational model that simulates both the disease outbreak and the surveillance strategy. The output of the disease model provides a 'true' picture of all cases occurring in the outbreak, while the output of the surveillance model provides the subset of cases that we anticipate will be detected using that particular strategy, and hence which are available for the purposes of parameter estimation.

Thus we can evaluate and compare alternative enhanced surveillance strategies, and gain insight into the required duration of enhanced data collection, based on the precision of the estimated epidemic parameters.

Influenza vaccine effectiveness for hospital and community patients, Auckland, New Zealand, 2014

Presenter: Heath Kelly, Victorian Infectious Diseases reference Laboratory, Melbourne, Australia

Authors: N Pierse, H Kelly A Bissielo, S Radke, QS Huang, M Baker and N Turner on behalf of the SHIVERS investigation team

Background Trivalent seasonal influenza vaccines have been used for more than 60 years but published estimates of vaccine effectiveness (VE) from observational studies vary widely. We aimed to estimate the protection afforded by trivalent inactivated influenza vaccines, in both primary care and hospital settings, in a well characterised urban population in Auckland during 2014.

Methods Using two different comparison groups, patients with no virus detected and those with a non-influenza respiratory virus detected, VE estimates were made using a test-negative study design. VE was stratified by community and hospital patients, age group, and influenza type and subtype.

Results 1039 hospitalised and 1154 community patients met all the study inclusion criteria and had a respiratory sample tested for influenza and other respiratory viruses. The adjusted VE using all influenza negative controls was 42% (95% CI: 16%–60%) for hospital patients and 56% (95% CI: 35%–70%) for community patients. No significant difference was seen when patients testing positive for a non-influenza respiratory virus were used as the control group. No protection was found against influenza A(H3N2), although power was limited.

Conclusion This study contributes to the validation of the test negative design and confirms that inactivated influenza vaccines continue to provide modest but significant protection against laboratory-confirmed influenza.

FluMum: Influenza and pertussis vaccine uptake in pregnancy among a cohort of 7000 women recruited from six study sites in Australia, 2012–2014

Presenter: Ross Andrews, Deputy Director, Menzies School of Health Research, Charles Darwin University, Casuarina, NT

Authors: R Andrews, KA O'Grady, T Nolan, P Richmond, N Wood, H Marshall, S Lambert, M Chatfield, L McHugh, SA Le-Gros Wilson, P Binks, K Watson, J Zenchyson, E Clarke, M Kefford, V Hill and C Talbot

Background: Influenza vaccine is recommended in pregnancy (nationally funded), whilst pertussis vaccination is now proposed for every pregnancy in recent Immunisation Handbook changes. Uptake of neither of these vaccines is systematically monitored in Australia.

Methods: We analysed self-reported data on influenza and pertussis vaccine uptake within our ongoing "FluMum" cohort study of mother-infant pairs recruited from participating sites in Darwin, Brisbane, Sydney, Melbourne, Adelaide and Perth from 2012–2014 inclusive. The data presented here are from preliminary analyses that may be subject to change.

Results: Among 7184 women, self-reported uptake of influenza vaccine in pregnancy was 33.2%, most women (66.7%) had not been vaccinated, 0.4% were unsure and 0.7% were not recorded. Coverage rates were similar in 2012 (32%) and 2013 (30%) but marginally higher in 2014 (36%). Factors associated with influenza vaccine uptake will be presented. In 2014, 6.4% of 1324 women self-reported receiving pertussis vaccination in pregnancy.

Conclusion: Immunisation of pregnant women is a significant weakness in immunisation programs where uptake is poor. There is a critical need to drive improvements, particularly for influenza and pertussis, where potential to prevent death and disability from these infectious diseases is paramount.

Electronic health record extraction from general practice for monitoring influenza vaccine coverage and effectiveness

Presenter: Annette Regan, Department of Health Western Australia

Authors: AK Regan, R Gibbs, L Tracey and PV Effler

Background: Influenza vaccination is recommended annually to prevent serious infection. Reliable and timely estimates of vaccine uptake are necessary to better inform prevention programs; effectiveness estimates inform annual antigen selection. However, limited annual data are available to produce these estimates. We explored the use of electronic health record (EHR) extraction from general practice (GP) for these purposes.

Methods: Data from 142 GPs were extracted by the Western Australia Department of Health. Data were aggregated to estimate the proportion of patients immunised and vaccine effectiveness based on pathology results. In 2015, a validation study was conducted to determine the validity of estimates derived from EHRs.

Results: According to EHRs extracted from 650,701 patients, 16.3% of the population received an influenza vaccination between 2012 and 2014. Vaccination coverage was highest in adults ≥ 65 years with medical conditions (63.1%) and lowest in children < 2 years (7.3%). A total of 7,207 pathology testing results were extracted; vaccine effectiveness ranged from 30–56% (2012:30%; 2013: 56%; 2014: 46%). Validation results will be available in March 2015.

Conclusions: Systems employing data extraction of EHRs could provide more timely estimates of influenza vaccination coverage and effectiveness. Such information is valuable for improving prevention programs.

Peer-led, student-centered interventions the key to student health care worker influenza vaccination

Presenter: Munyaradzi G Nyandoro, Alumnus School of Medicine University of Notre Dame, Fremantle (UNDF), Western Australia

Authors: MG Nyandoro, D Kelly, D Macey and DB Mak

Background: Vaccination is the most effective influenza prevention strategy recommended for all health care workers (HCW), including students. However Australian HCWs' uptake is poor (16.3% – 58.7%).

Methods: Self-reported influenza vaccination uptake among student HCWs at UNDF was measured using on-line surveys to assess the impact of a peer-led vaccination campaign on uptake.

Results: In 2013 (pre-campaign) influenza vaccination uptake was 36.3% (95% CI = 31.8%–40.8%); students identified awareness, cost and convenience as key barriers. The campaign used posters of, and presentations by, current HCW students and key staff to raise awareness of the importance and benefits of vaccination, and provide information on how to access free and low-cost vaccination. In 2014 (post-campaign), vaccination rate increased to 55.9% in 2014 (95% CI = 52.2% – 59.6%). Multivariate logistic regression showed that HCW students in 2014 (OR 2.2, CI 1.7–2.9, $P < 0.001$), and those who were eligible for government-funded vaccine (OR 12.3, 6.3–24.0, $P < 0.001$), enrolled or enrolled in nursing/midwifery (OR 1.6, 1.1–2.4, $P = 0.016$), or employed as a HCW (OR 1.6, 1.5–2.6, $P < 0.001$) were more likely to be vaccinated.

Conclusion: HCW students' influenza vaccination uptake improved significantly following a low-cost, peer-led promotional campaign. This approach can be adapted to other settings.

Seasonal influenza vaccine effectiveness against medically-attended influenza in Victoria, 2014

Presenter: James Fielding, Victorian Infectious Diseases Reference Laboratory

Authors: J Fielding, K Grant, K Carville, J Druce, I Barr and H Kelly

Background: We used a test negative case control design to estimate effectiveness of the seasonal trivalent influenza vaccine against medically-attended influenza during the 2014 influenza season in Victoria.

Method: Patients presenting with influenza-like illness (ILI) to general practitioners (GPs) in a sentinel surveillance network during 2014 were tested for influenza. Cases were influenza positive by PCR and controls tested negative for influenza. Vaccination status was recorded by sentinel GPs. Vaccine effectiveness (VE) was calculated as $[(1 - \text{adjusted odds ratio}) \times 100\%]$.

Results: A total of 427 ILI patients were included in the study. There were 170 cases of influenza, of which 164 (96%) were type A. Receipt of the 2014 vaccine was reported for 123 patients (29%). Adjusted VE against subtype A/H1N1 infection was 23% (95% CI, -40% to 58%) and against A/H3N2 infection was 3% (95% CI, -105% to 54%).

Conclusions: This study suggests that in 2014, the seasonal trivalent influenza vaccine provided relatively low protection against influenza A/H1N1 infection, despite apparent vaccine and circulating strain match. Consistent with other studies, the vaccine conferred no protection against influenza A/H3N2.

Project launch: Linkage of the Australian Childhood Immunisation Register (ACIR) data to state-based health datasets to evaluate and inform Australia's immunisation program

We would like to invite conference delegates to help us celebrate the successful linkage of the ACIR to state-based health datasets in Western Australia and New South Wales. Over the past 3.5 years a strong collaboration between researchers and state and national agencies has led to the linkage of a 17-year birth cohort (over 2 million children) to ACIR and health outcome data, particularly about vaccine preventable diseases. This was achieved through project funding from the Population Health Research Network, as part of the National Collaborative Research Infrastructure Strategy, and researcher support from the National Health and Medical Research Council. We will provide an overview of the project, highlight the achievements to date (including the establishing a process for data release under the Commonwealth data integration policy), and describe the main objectives and planned priorities for analysis. This will be an opportunity to better understand the process of conducting linkage using Commonwealth datasets, propose specific questions that could be answered with our study data, and identify preferred mechanisms for stakeholder feedback.

Short Oral Presentations
Chair: Paul Armstrong

Forensic surveillance: are we missing fatal communicable disease cases?

Presenter: Keith Eastwood, Hunter New England Population Health, Newcastle NSW

Authors: Keith Eastwood, Bev Paterson, Rexson Tse, Leah Clifton, Rod Givney, Allan Cala, Yvonne Tin, Carly Pedersen and Stephen Graves

Background: Communicable disease surveillance systems are geared for cases that present through conventional health services with laboratory confirmation, however, cases of serious infection resulting in rapid death and proceeding directly for coronial examination may be missed.

Methods: A partnership between northern NSW forensic medicine, pathology and public health services was commenced in 2014. It reviewed existing systems for identifying deaths of potential public health significance and developed a case definition, designed an algorithm to aid pathologists in selecting optimal specimens and diagnostic tests, drafted a questionnaire for use by grief counsellors to collect medical information from relatives, modified the forensic patient database to flag patients of interest and set up a pathology alert to facilitate access to laboratory results.

Results: Overall 37 patients of interest have been identified in the initial 10 month review period. Causes of death included pneumonia (15 cases), meningitis (2), non-localised sepsis (5), gastroenteritis (3). Cases study examples will be presented.

Conclusion: Unless forensic surveillance is integrated into notification systems, it is possible for fatal communicable disease cases to go unreported. Our partnership has had broad benefits in optimising specimen collection, selecting appropriate pathology tests, interpreting results, informing public health authorities and improving response times.

The epidemiology of hepatitis A in Queensland, 1988–2014

Presenter: Lisa McHugh, MAE scholar, Queensland Children's Medical Research Institute and Communicable Diseases Unit, Queensland Health and Australian National University, ACT

Authors: L McHugh, SB Lambert and K Viney

Background: In Australia, where hepatitis A (hepA) has low endemicity, the most likely mode of transmission is from common source outbreaks. However this does not appear to be the case in Queensland, where most notified cases occur following international travel. The introduction of hepA vaccine for Indigenous children in north Queensland in 1999 has also contributed to this change in epidemiology over time.

Methods: We present a retrospective case-series analysing the source and incidence of notified cases of hepA infections in Queensland. We examine epidemiologic and virus genotype data to assess if there remains a circulating endemic strain in Queensland.

Results: From 1988–2014 there were 6,748 hepA notifications in Queensland, with a median age of 25 years (28% aged 20–29 years). Major risk factors for hepA acquisition were overseas travel (47%) and locally-acquired, foodborne-related (shellfish/ sun-dried tomato, 25%). Of those who acquired infection from international travel, only 3% reported being vaccinated prior to travelling.

Conclusion: Based on a combination of epidemiologic and genotype data, hepA infections in Queensland are largely acquired from international travel. With targeted immunisation allowing for enhanced disease control, improved vaccination rates in prospective overseas travellers could reduce current case numbers markedly.

Australia's meningococcal C immunisation program: long term impact and implications

Presenter: Glenda Lawrence, University of New South Wales

Authors: G Lawrence and P McIntyre

Background: Australia's national meningococcal C program commenced in 2003 targeting those born after 1983 and aged ≥ 12 months. Many developed countries also implemented programs using a range of strategies and several recently recommended an adolescent booster dose to enhance disease control. Several have recently introduced an adolescent booster dose.

Methods: Age- and region-specific serogroup C and non-serogroup C notification rates were estimated from NNDSS data after adjusting for untyped notifications, and were compared for the pre (2000–2002) and post (2010–2012) program periods. Confirmed vaccine failures 2003–2012 were identified.

Results: Adjusted serogroup C notifications have declined by 96% (95% CI 94–98) compared with an independent reduction in non-serogroup C notification of 55% (95% CI 51–59). Sustained reductions in both C and non-C serogroup categories occurred in all regions and age groups. Serogroup C disease declined in both immunised and non-immunised age groups including those aged <12 months (88% (61–97)). Five vaccine failures were confirmed: two vaccinated in adolescence and three aged 1–3 years. The median period to disease onset was 2 years.

Conclusion: A substantial post-program reduction in serogroup C meningococcal disease with widespread herd effects has occurred concurrently with an independent reduction in non-serogroup C disease. The small number of serogroup C vaccine failures suggests that a booster dose is not yet required. Ongoing monitoring and evaluation of population immunity is essential.

2012–13 HPV serosurvey

Presenter: Alexis Pillsbury, National Centre for Immunisation Research and Surveillance (NCIRS)

Authors: A Pillsbury, H Quinn, L Hueston, S Lesic and P McIntyre

Background: Australia introduced funded HPV vaccination in 2007 for girls aged 12–13 years with catch-up to 26 years of age. Early surveillance data demonstrated genital wart and *cervical intraepithelial neoplasia* (CIN) incidence reduction in women, and herd immunity benefits for males. The program expanded to adolescent boys in 2013. We assessed HPV seroprevalence among males aged 15–39 years in 2012–13, comparing results to those from a 2005 serosurvey prior to female program commencement.

Methods: Residual diagnostic sera were obtained and serum antibody levels to HPV types 6, 11, 16 and 18 measured using Luminex immunoassay. Proportion seropositive was calculated for age groups 15–19, 20–29 and 30–39 years according to pre-defined cut-off values.

Results: Among those aged 20–29 and 30–39 years, proportion seropositive was lower for all types in the 2012–13 serosurvey compared to the 2005 serosurvey. The most notable decrease occurred for HPV6 among those aged 30–39 years; 25.9% to 7.0%. There was no difference in seroprevalence between serosurveys among those aged 15–19 years.

Conclusion: Results provide further evidence of the positive herd immunity impact of female HPV vaccination upon males. Results demonstrate the utility of serosurveillance as a non-invasive indicator of population infection/immunity trends.

The impact of changes in healthcare-seeking behaviour and testing on influenza surveillance.

Presenter: Lisa McCallum, Hunter New England Local Health District

Authors: L McCallum, C Dalton, S Carlson, H Kelly and D Durrheim

Background: There were 37,000 more influenza notifications to the National Notifiable Diseases Surveillance System (NNDSS) in May–October 2014 than during the same period in 2013. However, this increase was not reflected in the Flutracking online community survey of influenza-like illness.

Methods: We used changes in healthcare-seeking behaviour and health provider testing from 2013 to 2014 among Flutracking participants to explore potential impacts on laboratory notified influenza cases. The proportion of Flutracking participants reporting being tested for influenza, and the proportion testing positive were calculated for 2013 and 2014. We calculated the ratio of the 2013:2014 proportions of Flutracking participants reporting being tested for influenza and testing positive for influenza. We applied these ratios to the number of NNDSS notifications to estimate the additional number of notifications due to the increased health-care seeking and testing.

Results: Approximately two-thirds of the increase (24,000) was due to additional people seeking medical care and being tested; the remaining third (approximately 10,000) was due to the increased proportion testing positive.

Conclusion: Accounting for changes in healthcare-seeking behaviour and testing practices enables trends in surveillance data to be interpreted more fully.

Maternal and birth characteristics associated with pertussis during early infancy

Presenter: Lisa McCallum, University of Western Sydney, Hunter New England Health

Authors: L McCallum, B Liu, P McIntyre and L Jorm

Background: Birth and maternal characteristics have been associated with an increased risk of infection in childhood. However, few studies have evaluated maternal or birth characteristics as risk factors for pertussis.

Methods: We constructed a cohort of mothers and their infants using routinely collected population-based datasets in New South Wales (NSW), Australia. All singleton infants born to NSW resident mothers from 01 Jan 1994 – 31 Dec 2008 were included in the study.

Results: Characteristics associated with increased risk of pertussis during early infancy included having a young (aged 10–19 years) mother, being born in a high prevalence year and mother having hypertension during pregnancy. Infants whose mothers had pertussis during pregnancy or soon after their birth had significantly increased risk of pertussis during early infancy, particularly when aged less than three months (RR73.8; 95%CI 45.4 – 120.1; $P < 0.001$).

Conclusion: Socioeconomic factors appeared to be associated with an increased risk of pertussis during early infancy. Protecting mothers from pertussis is likely to reduce the risk of pertussis during early infancy. This work provides additional evidence to support immunising mothers against pertussis during pregnancy, especially during periods of increased pertussis activity.

Challenges in managing a school-based measles outbreak—Melbourne, Victoria, 2014

Presenter: Katherine Gibney, Department of Health and Human Services, Victoria

Authors: A Brahmi, L Franklin and K Gibney

Background: In 2014, Victoria experienced the highest number of confirmed measles cases since 2001, including an outbreak with school-based transmission.

Methods: Confirmed measles cases notified in 2014 were reviewed to identify affected school students and their immunisation status. Surveillance data, correspondence and investigation notes related to a primary school-based measles outbreak were analysed to assess the adequacy and usefulness of school-based immunisation records in the management of this outbreak.

Results: Of the 75 confirmed measles cases notified in Victoria in 2014, 23 cases (31%) were among school-aged students (defined as aged 5–18 years), of whom three had a documented history of measles vaccination, 17 were unvaccinated, and three had unknown vaccination history. Seven measles outbreaks were identified in Victoria in 2014, including a primary school-based outbreak with nine confirmed measles cases. Of the six unvaccinated pupils in the affected school, five contracted measles. The proportion of the school's prep students with documented vaccination records, as required by law, ranged from 39% in 2013 to 97% in 2014.

Conclusion: Inadequately vaccinated students constitute a vulnerable population and schools are a potential site for measles outbreaks. Inadequate enforcement of school-based immunisation records impact the management and control of school-based measles outbreaks.

Verification of measles elimination in Australia

Presenter: Nicolee Martin, Department of Health, Canberra, ACT

Authors: N Martin, D Durrheim, V Stambos, H Gidding, A Dey, T Tran, M Chiew, H Kelly G Dowse, E Denehy and S Lambert

In 2013, World Health Organization (WHO) Western Pacific Region member countries, including Australia, were invited to address five lines of evidence for measles elimination outlined in WHO's *Guidelines on Verification of Measles elimination in the Western Pacific Region*: 1. A detailed description of measles epidemiology following introduction of measles vaccine in the national immunisation program (NIP); 2. Quality of epidemiological and laboratory surveillance; 3. Population immunity; 4. Sustainability of the NIP; 5. Genotyping supportive of measles virus transmission interruption.

In its submission Australia demonstrated: low measles incidence; decreasing outbreak size/duration over time; 84% of cases documented as imported or import-related; childhood measles vaccine coverage >90% for two doses; national estimates of effective reproduction number (R) well below the epidemic threshold; high levels of population seropositivity; and the absence of sustained transmission of any single measles genotype. These findings provided strong evidence for interruption of endemic measles virus transmission.

In March 2014, Australia was formally verified by the WHO Regional Verification Commission as having achieved measles elimination for at least 36 months from 2009. Continuing high-quality surveillance, virus genotyping, tight outbreak control and maintenance of uniformly high levels of routine two dose measles vaccine coverage are required to maintain Australia's measles elimination status.

Genotyping evidence to support measles elimination in Australia

Presenter: Thomas Tran, Viral Identification Laboratory, Victorian Infectious Diseases Reference Laboratory, The Doherty Institute, Melbourne

Authors T Tran, V Stambos, H Kelly and J Druce

Background: It has been previously argued that Australia had interrupted the transmission of endemic measles (that is, had achieved measles elimination) in the years between 1999 and 2005 but it was not until March 2014 that measles elimination was officially declared in Australia. Genotyping evidence was a critical to this declaration. We aim to review the genotyping evidence from 2008 to 2012 as evidence for measles elimination.

Methods: Scientists at the WHO measles regional reference laboratory in Victoria tested measles virus samples from around Australia to differentiate wild-type virus from vaccine-associated virus, to genotype circulating wild-type viruses and to monitor the absence of endemic measles transmission of any one genotype for ≥ 12 months. Measles viruses were identified by RT-PCR and characterised by nucleic acid sequence analysis of the nucleoprotein gene. Sequencing allowed construction of phylogenetic trees.

Results: From 2008–2012, 354 cases of measles were detected with genotype data available for 309 (87%) cases. Of these, 293 were identified as wild-type strains and 16 were vaccine-associated. A diverse range of genotypes was identified, including B3, D4, D5, D8, D9, G3 and H1. Only genotype D9 was detected over a prolonged period, for 33 weeks in 2010–2011, but phylogenetic studies combined with epidemiological investigations demonstrated recurrent importations of D9 measles viruses rather than persistence of a single lineage. No single genotype has persisted since 2012.

Conclusion: Genotyping data from 2008–2012 were critical in supporting evidence for measles elimination in Australia. Ongoing monitoring, required to maintain elimination status, has confirmed no single genotype has persisted in Australia since 2012.

Short Oral Presentations 2

Chair: Jeremy McAnulty

The effect of prior vaccination on estimates of seasonal influenza vaccine effectiveness

Presenter: Kylie Carville, Epidemiology Unit, Victorian Infectious Diseases Reference Laboratory

Authors: H Kelly, C Lane and K Carville

Background Influenza vaccination is recommended annually, although effects of repeated annual vaccination have been questioned over the last 35 years. We explored the effect of vaccination in the previous year on estimates of influenza vaccine effectiveness (VE) using data from Victorian sentinel general practices, 2011 to 2013.

Methods The test negative design was used to estimate influenza VE, defined as $1 - \text{adjusted OR}$. Patients testing positive for influenza were cases and those testing negative were non-cases (controls). Analysis was adjusted for year, age group, comorbidity and calendar time and restricted to patients presenting within 7 days of symptom onset during the influenza season. We calculated VE for patients vaccinated in consecutive seasons, in the current season only, previous season only, and in neither season (reference).

Results 1369 patients were included, 487 (36%) were influenza positive. In 2012, VE was highest amongst those vaccinated in the current season only (VE=83% (95%CI 24, 96)), followed by those vaccinated in both the current and previous seasons (VE=41% (-4, 67)) and lowest amongst those vaccinated in the previous season only (VE=19% (-43, 55)). No consistent trend was seen in the other years.

Conclusion Results from this study, although limited by small numbers, are consistent with prior hypotheses and with other recent studies.

Transmission of the first influenza A(H1N1)pdm09 pandemic wave in Australia was driven by undetected infections: pandemic response implications

Presenter: James Fielding, Victorian Infectious Diseases Reference Laboratory

Authors: J Fielding, H Kelly and K Glass

Background: During the first wave of influenza A(H1N1)pdm09 in Victoria, Australia the rapid increase in notified cases and the high proportion with relatively mild symptoms suggested that community transmission was established before cases were identified. This led to the hypothesis that those with low-level infections were the main drivers of the pandemic.

Methods: A deterministic susceptible-infected-recovered model was constructed to describe the first pandemic wave in a population structured by disease severity levels of asymptomatic, low-level symptoms, moderate symptoms and severe symptoms requiring hospitalisation. The model incorporated mixing, infectivity and duration of infectiousness parameters to calculate subgroup-specific reproduction numbers for each severity level.

Results: With stratum-specific effective reproduction numbers of 1.82 and 1.32 respectively, those with low-level symptoms, and those with asymptomatic infections were responsible for most of the transmission. The effective reproduction numbers for infections resulting in moderate symptoms and hospitalisation were less than one. Sensitivity analyses confirmed the importance of parameters relating to asymptomatic individuals and those with low-level symptoms.

Conclusion: Transmission of influenza A(H1N1)pdm09 was largely driven by those invisible to the health system. This has implications for control measures – such as distribution of antivirals to cases and contacts and quarantine/isolation – that rely on detection of infected cases. Pandemic plans need to incorporate milder scenarios, with a graded approach to implementation of control measures.

Influenza pandemic planning – How prepared are you?

Presenter: Elizabeth Biribilis, Department of Health and Human Services, Victoria

Authors: E Biribilis and R Lester

Influenza pandemic planning is a key activity for most health departments and ministries throughout the globe. Effective preparation and planning are essential elements to mitigate the health, social and economic impacts of influenza pandemics.

In November 2014 the Victorian Department of Health and Human Services published the *Victorian health management plan for pandemic influenza*. Based on the *Australian health management plan for pandemic influenza*, and using lessons learnt from the 2009 pandemic, the Victorian plan takes a unique approach by providing operational guidance to health and primary care services using a settings-based approach. Specific planning considerations are included for educational and child care facilities, laboratories, local government, emergency services and for residential facilities, such as aged care, disability and custodial.

The guidance is delivered through a series of operational appendices which are written within the context of the existing policy environment. A staged approach is used, based on the Australian pandemic stages and is consistent with Victoria's strategic approach to emergency management.

This up to date plan provides a framework to minimise the overall impact of an influenza pandemic on the Victorian community.

Visualising severity of influenza seasons in Australia using the online Flutracking.net survey

Presenter: Sandra Carlson, Hunter New England Health

Authors: C Dalton, M Butler, S Carlson, L McCallum, D Durrheim

Background: Flutracking is an online weekly survey of influenza-like illness (ILI), health seeking behaviour and laboratory investigation, and illness severity that has operated nationally in Australia since 2008. In 2014, approximately 18,000 participants responded to the survey each week.

Methods: We compared two indices of ILI severity to develop a visual display of the relative severity of annual influenza seasons: the average percentage of respondents with cough and fever by week (on x axis), and the average number of days off normal duties (on the y axis) from 2008 to 2014 for NSW and Australia.

Results: The influenza seasons of years 2009, 2012 and 2014 cluster in the upper right quadrant indicating greater severity whereas the 2010 and 2011 seasons cluster in the lower left quadrant consistent with lesser severity. The visualisation produces an intuitive insight into the relative severity of influenza seasons that anecdotally accords with clinical and public health practitioner perceptions. The visualisation overcomes some of the biases and misperceptions regarding the severity of a particular influenza season associated with variations in influenza laboratory testing frequency.

Conclusion: The Flutracking community data provides a useful and intuitive visualisation to communicate influenza season severity. (Graphic available to view at: <http://goo.gl/m3xC8H>)

Disproportionate burden of influenza virus infections among Aboriginal infants

Presenter: Faye Janice Lim, Wesfarmers Centre of Vaccines and Infectious Diseases, Telethon Kids Institute, The University of Western Australia, Western Australia

Authors: FJ Lim, CC Blyth, P Fathima, N de Klerk and HC Moore

Background: Influenza viruses are an important cause of respiratory infections in children and pose a significant burden on families and the community. Using linked administrative data, we describe the burden of influenza virus among children.

Methods: We selected records with a notification or diagnosis of influenza in 2000–2012 for all children born in Western Australia, 1996–2012. We linked these with state-wide routine laboratory records of specimens collected within 48 hours of notification or hospitalisation. Using person-time-at-risk as the denominator, we calculated the incidence of influenza virus-positive detections by age and Aboriginal status.

Results: In total, there were 5168 notifications (1.5 per 1000 child-years) and 2303 hospitalisations (0.6 per 1,000 child-years) for influenza. 81.7% of notifications and 60.7% of hospitalisations linked to an influenza virus test record. Infants less than 12 months had the highest influenza virus-positive notification and hospitalisation rates. Incidence rates among Aboriginal infants less than 6 months were 4 times higher than non-Aboriginal infants for influenza virus-positive notifications (IRR=4.6, 95% CI=3.3,6.2) and hospitalisations (IRR=4.3, 95% CI=2.9,6.1).

Conclusion: Aboriginal young children bear a disproportionate burden of influenza virus infections. These data will enable us to track the impact of including influenza vaccine for Aboriginal children in the National Immunisation Program.

Interseasonal influenza in the Australian Capital Territory, 2012–2013

Presenter: April Roberts-Witteveen, ACT Health

Authors: A Roberts-Witteveen and L Ford

Background: An increase in influenza notifications was investigated in the summer of 2012/2013 in the Australian Capital Territory.

Methods: Notified cases of influenza with specimen collection between 24/12/2012 and 30/6/2013 were interviewed using a standardised questionnaire. Data about diagnosis method, symptom profile and duration, delay between onset and diagnosis, other laboratory testing and vaccination history were collected. Adjusted odds ratios, *P*-values and confidence intervals were calculated in StataIC v12.1.

Results: Of 100 notified cases in the study period, 98 were interviewed. Compared to serology ($n=67$), cases diagnosed by PCR ($n=31$) were statistically significantly more likely to have a fever, cough and fever, or an emergency department presentation and less likely to have been vaccinated in the previous 12 months. Fifty-eight (87%) cases diagnosed by serology met one or more of the following categories: a delay between onset and diagnosis of 10 or more days, influenza vaccination in the previous 12 months, or a negative PCR test in conjunction with the positive serology test. These cases were assessed as unlikely to be true recent infection.

Conclusion: Characteristics of influenza cases differed by diagnosis method. The value of serology in the interseasonal period could be enhanced by case follow-up.

Declining seasonal influenza vaccine effectiveness for pandemic A(H1N1)pdm09, 2010–2014, Victoria, Australia

Presenter: Kylie Carville, Epidemiology Unit, Victorian Infectious Diseases Reference Laboratory

Authors: K Carville, J Fielding, C Lane and H Kelly

Background: Since its emergence in 2009, influenza A(H1N1)pdm09 has become the predominant H1N1 influenza virus circulating globally. In subsequent years the World Health Organization has recommended that the annual influenza vaccine contain viruses that are antigenically and genetically similar to influenza A(H1N1)pdm09.

Methods: Seasonal influenza vaccine effectiveness (VE) is calculated annually in Victoria, using data from the GP Sentinel Surveillance System in the test-negative design. Patients testing positive for influenza are classified as cases and those testing negative are classified as non-cases (controls).

Results: VE against pH1N1 in 2010 was 78% (95%CI 33, 93), in 2011 74% (95%CI –69, 100), in 2012 59% (–95, 91), in 2013 64% (95%CI–89, 93), and in 2014 23% (95% –44, 59).

Discussion: Our data are limited by small numbers, but the decline is unexpected as circulating and vaccine virus strains have been the same. In Canada the pandemic A(H1N1)pdm09 VE estimate for 2013–2014 was 74% (95%CI 58–83). However, a European hospital network has also reported a low pandemic A(H1N1)pdm09 VE of 24% for 2013–2014. We hypothesise that VE may be moderated by past infection or previous immunisation.

Predictors of sustained participation in an online influenza-like illness surveillance system

Presenter: Sandra Carlson, Hunter new England Population Health, New South Wales

Authors: S Carlson, C Dalton, L McCallum, M Butler and D Durrheim

Background: This analysis seeks to identify the factors that have led to Flutracking becoming the largest, most rapid growing, and highest participation rate online influenza-like illness surveillance system in the world.

Method: The proportion of surveys completed each year was calculated from 2011 to 2014. A logistic regression was used to assess factors associated with participation in all four years of surveys versus one to three years.

Results: There were 24 to 25 surveys per year available for completion. Of participants who completed a survey during the first four survey weeks of each year, 71%, 69%, 67% and 79% completed greater than 90% of available surveys in 2011, 2012, 2013 and 2014 respectively. Among 12,084 participants who completed a survey for themselves and other participants in 2014, age greater than 40 years (OR: 2.58, $P<0.01$) and working face to face with patients (OR: 1.39, $P<0.01$) increased the odds of participating in all four

years of the survey. Being female decreased the odds of participating in all four years (OR: 0.82, $P < 0.01$). Vaccination against influenza and having children in the household were not associated with participating in all four years of the survey.

Conclusion: Age greater than 40 years and male gender were associated with sustained participation in this online weekly health survey.

Evaluation of the South Australian Surveillance System for Influenza based on notifications

Presenter: Salenna Elliott, Communicable Disease Control Branch, Department for Health and Ageing, South Australia

Authors: SR Elliott, C Graham, M Miller and J Raupach

Seasonal influenza became notifiable in South Australia (SA) in 2008. Major objectives are to monitor seasonal epidemics, identify outbreaks and support pandemic preparedness. This evaluation aimed to describe current operation, determine whether the system is meeting objectives and assess performance.

Analysis of notification data (2010–2013) investigated data completeness, representativeness and timeliness. Interviews with stakeholders from the public laboratory, Communicable Disease Control Branch (CDCB) and a small convenience sample of clinicians provided feedback about operation, usefulness and performance attributes including simplicity, acceptability, flexibility and stability.

The system generates timely and complete data that are broadly representative. It is simple, flexible and stable, but has several manually-dependent steps which may limit acceptability, timeliness and flexibility. Whilst laboratory and CDCB stakeholders found the system to be acceptable, clinicians questioned the need for dual notification and were uncertain how surveillance data were used. This could contribute to observed delays in submission of medical notifications, potentially delaying detection of outbreaks.

The surveillance system is achieving major objectives, but has some limitations. Recommendations include: 1) development of an electronic medical notification form, 2) establishment of regular direct reporting of influenza surveillance data to health service providers, and 3) education of institutions to directly report influenza outbreaks.

Short Oral Presentations 3 **Chair: Martyn Kirk**

***Escherichia coli* O157:H- outbreak associated with an agricultural show in Brisbane**

Presenter: Bhakti Vasant, Public Health trainee, Queensland Health

Authors: B Vasant, R Stafford, S Vlack, P Titmus, AV Jennison, H Smith, J Barrett, CA Quagliotto, M Young, K Jarvinen, S Bennett and SB Lambert

Background: An *Escherichia coli* O157 H- outbreak associated with an annual agricultural show in Brisbane, 2013, was the largest outbreak of Shiga toxin-producing *Escherichia coli* (STEC) infection reported in Australia.

Methods: Our response included case questionnaires, a case-control study, and investigation and sampling of humans, animals, and the environment. A communication strategy was implemented, outbreak reports compiled, and formal debriefing conducted.

Results: Of 57 cases identified, 37 (65%) were children (median age 9 years; range 1–77 years). There were no cases of haemolytic uraemic syndrome, and no deaths. Epidemiological and microbiological investigations supported the hypothesis that STEC was transmitted from animals to humans. Daily outbreak management teleconferences co-ordinated investigation and management. Clinical, community, and media communications enhanced case finding and management. Prolonged duration of STEC carriage in some cases (median: 18 days, range: 2–52 days) presented significant challenges for public health follow-up. We were unable to identify changes in infection prevention at the show compared to previous years.

Conclusion: Revised *Infection Control Guidelines for Animal Contact* highlight the importance of hand-washing, risks with feeding animals, and cleaning animal enclosures. With further infection control measures implemented, surveillance did not detect any STEC cases associated with the 2014 show.

Outbreak of sporotrichosis in the Southwest of Western Australia

Presenter: Naru Pal, WA Country Health Service, Bunbury, Western Australia

Authors: N Pal, G Dowse, A Whittle, C Golledge and I Arthur

Background: An outbreak of cutaneous sporotrichosis, caused by the fungus *Sporothrix schenckii*, occurred in the Margaret River region of Western Australia between October 2012 to December 2013, with 24 cases identified.

Methods: We conducted a retrospective case review and used a questionnaire to determine case characteristics and risk factors.

Results: The median age of cases was 52 years (range, 6–86 years), the median duration of active lesions was 3.9 months (range, 2–12 months), and the median treatment duration was 4 months (range, 2–8 months). All cases eventually received treatment with oral itraconazole, although more than half (54%) received inappropriate antibiotics prior to laboratory confirmation. Ninety-two per cent of cases reported direct contact with straw mulch and hay products prior to development of lesions, with 80% linked to a particular supplier. 60% of cases used gloves and other protective measures when handling straw, but lesions occurred in areas not sufficiently protected. Case numbers declined after various public health measures were implemented.

Conclusion: This was the third and largest outbreak of sporotrichosis recorded in the Margaret River region, following clusters in 2000/01 and 2003/05. Outbreaks appear to be associated with moist conditions that lead to contamination of hay and straw products.

An emerging strain of *Salmonella* Typhimurium (STm) in south east Queensland

Presenter: Vicki Slinko, Metro South Public Health Unit, Brisbane, Queensland

Authors: VG Slinko, R Bell, J Bates, R Stafford, A Neill, G Pollard, L Hiley, G Micalizzi, T Graham, P Seal, J Barten, A Khan and KAJ Jarvinen

Salmonella notifications have increased significantly in South East Queensland recently. We investigated four outbreaks (OB) of *Salmonella* Typhimurium (STm) infection since mid-December 2014, with over 250 cases (115 laboratory confirmed). Two closely related MLVA strains were detected (STm-OB): 03-12-11-12-524 and 03-12-12-12-524. Most isolates were phage type U307 whereas other recent outbreak strains have been phagetype 135 or 135a.

Epidemiology implicated deep fried ice cream as the likely vehicle of transmission in Outbreak 1 (case series), 2 (RR 3.3; 95%CI: 2.3, 4.8) and 3 (RR undefined, $P < 0.001$). STm-OB was detected in uncooked ice cream balls and restaurant environmental samples, with opportunities for cross contamination at each kitchen. All eggs came from the same producer. STm-OB was detected in drag swabs and used chicken feed from the farm. Outbreak 4 involved consumers of Kimbap sushi from various outlets with STm-OB detected in sampled whole sushi. No further investigations were possible as the supplier was not contactable.

MLVA genotyping has proved useful in identifying and linking outbreaks while epidemiology promptly implicated the vehicle of transmission. EH traceback and investigations revealed the likely source. Eggs need to be regarded as a contaminated product with appropriate food safety practised in food establishments.

Increasing incidence of *Salmonella* notifications in Australian States and Territories from 2000–2013**Presenter:** Laura Ford, Australian National University, ACT**Authors:** L Ford, K Glass, M Veitch, R Wardell, T Dobbins, B Polkinghorne and M Kirk

In Australia, salmonellosis is a major cause of bacterial gastroenteritis. National surveillance figures show that the number of *Salmonella* notifications has been increasing over time. We used negative binomial regression to estimate incidence rate ratios for sex, age, jurisdiction, and trend by jurisdiction for *Salmonella* Typhimurium and non-Typhimurium *Salmonella* serotypes separately. From 2000 to 2013, almost all states and territories had significantly increasing trends of infection for both *S. Typhimurium* and non-Typhimurium *Salmonella*, with significant state and territory incident rate ratios of annual increases ranging from 1.03 (95% CI 1.02–1.05) to 1.12 (95% CI 1.10–1.14) for *S. Typhimurium* and from 1.02 (95% CI 1.01–1.03) to 1.07 (95% CI 1.06–1.08) for non-Typhimurium *Salmonella*. *S. Typhimurium* rates were higher than non-Typhimurium rates in most age groups in the south eastern continental states, while non-Typhimurium *Salmonella* rates were higher in most age groups elsewhere. For all jurisdictions, the *S. Typhimurium* incidence rate peaked at 12–23 months of age and the non-Typhimurium *Salmonella* incidence rate peaked at 0–11 months of age, which may indicate different sources of transmission. Salmonellosis notifications are increasing in Australian states and territories. The trends and subtypes seen vary across the country and differ from trends reported internationally.

A case of foodborne botulism in Wellington, New Zealand: The public health experience**Presenter:** Eamonn Deverall, Regional Public Health Wellington**Authors:** E Deverall, S Jefferies, N Esson, M Gibson, A Nesdale, M Balm and I Rosemergy

Regional Public Health, responsible for the Greater Wellington region of New Zealand, received a notification of a suspected case of botulism on 19 December 2014. The patient's rapid deterioration, clinical presentation and EMG studies were compatible with the classic symptoms of botulism. This is only the 3rd case of botulism to be reported in New Zealand, and the first for 30 years.

This was an interesting and challenging case to investigate as the index case was unable to provide any information and had recently arrived from overseas. The likely source was identified as a wet risotto, produced in New Zealand. It had been kept beyond its best before date and stored inappropriately at room temperature for several months. Investigating the case highlighted the important potential risks posed by minimally heated, chilled foods and identified several areas for product safety improvement.

Informing the public health management of typhoid and paratyphoid in Australia**Presenter:** Megan Young, Metro North Public Health Unit, MNHHS and Griffith University, Queensland**Authors:** MK Young, V Slinko, J Smith, H Carroll, S Bennett, S Appleton and BJ McCall

Background: Queensland guidelines for the public health management of notified enteric fever cases changed in 2010. We aimed to determine the impact of this change on the likelihood of cases and contacts adhering to recommendations for faecal clearance/screening, and assess the duration of infectiousness of cases and extent of local transmission to contacts.

Methods: Data from notification records of typhoid and paratyphoid infection in southeast Queensland in 2008–2012 (inclusive) were extracted and analysed.

Results: Sixty-nine of 85 cases and 218 of 265 contacts submitted at least one faecal specimen. Cases were 2.7 (95%CI 1.2–6.0) and contacts were 4.4 (95%CI 3.0–6.4) times more likely to complete recommended faecal clearance/screening under previous compared to recent guidelines (requiring more specimens). In ten cases with positive post-treatment specimens, last recorded infectiousness was 19 days to six months after notification. The documented rate of local transmission of infection was 18/1000 contacts submitting at least one faecal specimen (95% CI 6–48/1,000).

Conclusion: Local transmission risk of enteric fever is low, although small numbers of cases may have prolonged bacilli excretion post-treatment. More complex clearance/screening regimens are associated with decreased compliance. Pursuing extensive faecal clearance/screening regimens is unlikely to be an effective means of preventing transmission in this setting.

Screening and monitoring travellers to detect and prevent the Ebola virus disease (EVD) in NSW

Presenter: Jocelyn Chan, Masters of Philosophy (Applied Epidemiology) scholar at Communicable Diseases Branch, Health Protection, NSW Health

Authors: J Chan, M Patel, S Tobin and V Sheppeard

Introduction: While entry screening and monitoring of arrivals from EVD affected countries has been adopted by US and Canada, some have asserted these measures are resource intensive and provide little additional risk mitigation. We report NSW's experience with screening and monitoring.

Methods: Data on arrivals from EVD affected countries were provided daily by immigration authorities between 1 October 2014 and 14 January 2015. Public health units performed exposure risk assessments and followed-up daily.

Results: Of the 67 arrivals, 66 were assessed and monitored. Returning aid workers were the largest category (n=23). 57 had no known exposures to EVD, 11 had low risk exposures and none had high risk exposures. 46 were followed up by phone, 13 by texting, and 7 by email; one developed fever and two others had transient vomiting and headache. None required assessment at a designated hospital or developed EVD.

Conclusion: As expected, the risk of disease in this cohort was low. Public health units supported arrivals in recognising and managing symptoms. While economic costs were not estimated, screening and monitoring five arrivals per week was feasible using existing public health infrastructure; this was considered essential given serious implications of missing even one case of EVD.

Western Australian policy for the management of pregnant women and neonates with Ebola virus disease

Presenter: Anna Beswick, WA Health

Authors: A Beswick, Terri-Lee Barrett, P Armstrong and A Robertson

Background: During preparedness efforts for Ebola virus disease (EVD) in Western Australia, the potential for cases in pregnant women or neonates, albeit small, was acknowledged and a lack of management policy identified.

Method: A working group comprising clinicians and public health officials was formed to review the ethical issues, examine the literature and current situation and develop a policy for clinicians

Result: There have been no reports of EVD in pregnant women or neonates in high income countries to date and limited reports of those managed in Africa. Key aspects of the policy include deployment of specialist resources to manage cases at quarantine hospitals and early recognition and treatment of haemorrhage and spontaneous abortion. Where invasive procedures for management of fetal distress may pose too high a risk of transmission to staff, fetal monitoring is not advised.

Conclusion: This policy filled a gap in the state policy regarding management of EVD and highlights the ethical difficulties in developing policy when there is little applicable evidence base. Nationally-agreed guidelines would be of benefit.

Investigation of a dramatic increase in community-associated MRSA in the Kimberley region of Western Australia

Presenter: Anna Beswick, Disaster Management, Regulation and Planning, WA Health

Authors: A Beswick, P Armstrong, G Coombs and S Tempone

Background: Infections caused by community-associated strains of methicillin resistant staphylococcus aureus (CA-MRSA) are an important cause of morbidity in the community and notifications in Western Australia have increased markedly in recent years, particularly in the Kimberley region of Western Australia.

Methods: Notification and laboratory data for the period 2005–2013 were analysed. Hospital inpatient data for MRSA-associated admissions, and distribution data for antibiotics used for MRSA infections, were examined. Semi-structured interviews were conducted with Kimberley-based clinicians experienced in the treatment of these infections.

Results: From 2005–2013, there was a 10-fold rise in the number of CA-MRSA notifications from the Kimberley. Four main CA-MRSA clones were responsible, three of which were positive for the Panton-Valentine leucocidin (PVL) gene. The number of hospital admissions and procedures for MRSA-associated conditions increased over this time period, as did the pattern of distribution of antibiotics active against MRSA, suggesting the increase is real. However, the propensity for testing for skin sepsis also seems to have occurred over the period, evidenced by increasing samples positive for Group A streptococci and reports from clinicians.

Conclusion: The rapid rise of CA-MRSA notifications in the Kimberley is probably due to a combination of increased incidence and increased testing for skin sepsis.

Short Oral Presentations 4 **Chair: John Bates**

Evaluation of hepatitis A surveillance in Australia: Enhancements for multi-jurisdictional outbreak detection

Presenter: Courtney R Lane, University of Melbourne, Victoria.

Authors: CR Lane, N Stephens and M Kirk

Background: Surveillance of hepatitis A in Australia may be insensitive to outbreaks due to insufficient viral strain typing. We evaluated hepatitis A surveillance to identify the perceived benefits of, and barriers to, enhancing current practices through the national collation of laboratory characterisation and case exposure data.

Methods: We followed established guidelines to evaluate attributes of current hepatitis A surveillance using literature review and semi-structured interviews with stakeholders. We used 2011–2013 hepatitis A notifications from two Australian jurisdictions and created a pilot database to assess data completeness and estimate resource requirements for enhanced surveillance.

Results: We found storage of laboratory and exposure data is fragmented and informally reported between stakeholders, which may decrease timeliness in outbreak investigations and hinder the detection of small temporally or geographically dispersed clusters. Four Australian jurisdictions do not routinely sequence locally acquired specimens and sequences are not routinely compared between laboratories. Sequencing of all locally acquired isolates and national collation of exposure data would require limited additional resources, approximated at \$10,600 and 416 minutes annually. However, barriers to the comparison of laboratory and exposure data exist.

Conclusion: Enhanced national surveillance may improve cluster detection and decrease investigation time through national analysis of exposure information and comparison of sequence data.

Salmonella point source outbreaks in South Australia, investigation trends and findings, 2008–2014

Presenter: Emma Denehy, Communicable Disease Control Branch, SA Health, South Australia

Authors: E Denehy, M Miller and A Koehler

A retrospective analysis of *Salmonella* point source outbreak investigations conducted at the Communicable Disease Control Branch of the South Australian Department for Health and Ageing was undertaken. The objectives were to characterise *Salmonella* point source outbreaks, describe investigation techniques and findings.

A descriptive analysis of *Salmonella* point source outbreaks recorded in the South Australian Department of Health Notifiable Infectious Disease Surveillance database and corresponding outbreak reports were reviewed from 2008 through 2014.

Among the forty outbreaks investigations, primary pathogens were *Salmonella* Typhimurium phage type 9 (55%), *Salmonella* Typhimurium phage type 135 (15%), and *Salmonella* Typhimurium phage type 44 (13%). The majority of outbreaks (70%) were investigated using descriptive case series analysis, with the remaining using analytical study tools. An implicated source was identified in 26 outbreaks, of these 22 (85%) were related to eggs, predominantly raw egg products, two to chicken and two to pork. The incidence of point source outbreaks has increased with time with the three year average outbreak investigations increasing from three (2008–2010) to nine (2012–2014).

The increasing number of investigations highlights the need for ongoing improvements in food safety, particularly for handling raw egg products. Efforts also need to be focused to intensify intervention strategies at the industry level.

Investigation of a possible outbreak of Barmah Forest virus infection

Presenter: Peter Markey, Disease Surveillance, Centre for Disease Control, Northern Territory Department of Health, Darwin, Northern Territory, Australia

Authors: N Kurucz, P Markey, A Draper, L Melville, R Weir, S Davis, A Warchot R Boyd and D Stokeld

Between October 2012 and October 2013, unprecedented high numbers of Barmah Forest virus (BFV) disease cases were reported in the Northern Territory (NT). An investigation was launched by the NT Department of Health in cooperation with the Department of Primary Industry and Fisheries and the Department of Land Resource Management. The investigation included mosquito virus isolations from mosquitoes collected in Darwin urban areas, BFV antibody testing in small peri-urban mammals and investigation of human cases reported in Darwin, nearby Palmerston and Alice Springs. No BFV was isolated from the 4641 mosquitoes tested, none of the mammals tested positive for BFV antibodies and the high BFV disease case numbers did not correlate with the relatively low mosquito vector numbers trapped in 2012/13. It was estimated that 26% of the 79 human cases investigated in the NT did not have an acute arboviral illness and therefore were false positives. Other jurisdictions in Australia also reported high numbers of BFV disease cases, and investigations elsewhere led to the withdrawal of the Alere PanBio BFV IgM ELISA test kit used in most laboratories. Current testing methods and case definitions need to be revised to reflect the true numbers of BFV disease cases occurring in Australia.

OzFoodNet: 15 years of enhanced foodborne disease surveillance in Australia

Presenter: Ben Polkinghorne, Australian Government Department of Health

Authors: B Polkinghorne, M Miller, A Draper, R Leader, K Knope and G Fitzsimmons

OzFoodNet is a national network of foodborne disease epidemiologists with a mission to investigate and describe the epidemiology of foodborne disease, and to devise methods to minimise foodborne illness in Australia. From 2001–2013, OzFoodNet investigated over 1,600 foodborne and suspected foodborne outbreaks affecting nearly 26,000 people with over 1,900 associated hospitalisations and 68 reported deaths. Overall, food prepared in restaurants was involved in 41% of outbreaks, *Salmonella* Typhimurium was the suspected or confirmed aetiological agent for 29% and dishes containing raw or under-cooked eggs were the suspected or confirmed food vehicle in 18%.

OzFoodNet has investigated more than 40 multi-jurisdictional outbreaks. Pathogens included hepatitis A, norovirus, typhoid, *Salmonella*, Shiga toxin-producing *Escherichia coli* and *Listeria monocytogenes*. Food vehicles identified include varied produce such as rockmelons, papaya, poultry, alfalfa sprouts, cheese, semi-dried tomatoes, almonds, oysters and eggs.

OzFoodNet has enhanced national foodborne investigation and research capacity and positively influenced national food safety policy. OzFoodNet needs to maintain vigilance as national and global food transportation make multi-jurisdictional outbreaks an ever-present risk and novel pathogens like hepatitis E emerge in Australia. OzFoodNet must advocate strongly to ensure the adoption of rapid microbial diagnostic techniques doesn't reduce our capacity to detect outbreaks or monitor trends.

Sources of salmonellosis in South Australia

Presenter: Kathryn Glass, Australian National University, ACT

Authors: E Fearnley, H Hocking, J Raupach, M Veitch, L Ford and MD Kirk

Salmonellosis is a significant cause of foodborne gastroenteritis in Australia, and rates of notified illness have increased over recent years. We adopt a Bayesian source attribution model to estimate the contribution of different foods at the animal reservoir level to illness due to *Salmonella* spp. in South Australia between 2000 and 2010, together with 95% Credible Intervals (CrI). We excluded known travel associated cases and those of rare subtypes (fewer than 20 human cases or fewer than 10 isolates from included sources over the 11 years). The remaining 76% (5591/6559) were classified as sporadic or outbreak associated. We attributed 35% (95% CrI: 20–49) of sporadic cases to chicken meat and 37% (95% CrI: 23–53) of sporadic cases to eggs. Of outbreak-related cases, 33% (95% CrI: 20–62) were attributed to chicken meat and 59% (95% CrI: 29–75) to eggs. Analysis of source-related parameters showed higher risk of illness from contaminated eggs than contaminated chicken meat, despite low *Salmonella* prevalence on eggs, suggesting that consumption and handling practices potentially play a bigger role in illness due to eggs than chicken meat. Our results strengthen the evidence that eggs and chicken meat are important sources and vehicles for salmonellosis in South Australia.

When is an increase in cases of acute rheumatic fever an outbreak?

Presenter: Kate Hardie, Centre for Disease Control, Northern Territory

Authors: J Francis, C Gargan, E Schimann, D Holt, B Remenyi, M Fittock and V Krause

Acute rheumatic fever (ARF) is endemic in Aboriginal communities in the Northern Territory (NT). In September 2014 doctors at a remote Aboriginal community-clinic in the NT reported a higher than expected number of cases of ARF and apparent clustering within households.

There were 13 cases of definite ARF during a 4-month period compared with an expected 2.2 for that period (6.6 cases per year). We report this series of ARF cases and describe our search for guidance on whether a public health response was required and if so, what form that should take.

Ultimately the public health response was informed by consultation with specialists in fields including pathology, cardiology, public health, paediatrics and infectious diseases and involved education targeting household contacts, throat and skin sore swabs from contacts to identify if a single dominant strain of Group A *Streptococcus* (GAS) was circulating, and administration of benzathine penicillin-G to contacts.

An increased incidence of ARF to unprecedented levels prompted a public health response designed to limit disease spread and improve understanding of GAS transmission and its impact on ARF within the community. We discuss whether there should be nationally consistent guidance on how to investigate and manage a possible ARF outbreak.

Salmonella Typhimurium phage type 44: A Victorian outbreak and review of MLVA patterns

Presenter: Zoe Cutcher, Australian National University, ACT, and Department of Health, Victoria

Authors: Z Cutcher, J Gregory, M Valcanis, K Mercoulia, M Kirk, N Stephens, and M Easton

Background: In December 2014, a *Salmonella* Typhimurium phage type 44 (STm44) outbreak occurred following a function in Victoria. We investigated the outbreak to determine a cause and compared multi locus variable-number tandem repeat analysis (MLVA) patterns to previous cases.

Methods: We conducted a cohort study using a menu based questionnaire and calculated relative risks for all food items. We compared MLVA patterns for the outbreak strain against other Victorian STm44 cases and reviewed outbreak investigations from 2009–2014 to examine potential sources.

Results: There were 10 cases among 29 guests interviewed. Risk of illness increased with consumption of the appetiser and frittata. Cross contamination from eggs was suspected. The outbreak strain was indistinguishable from 1.7% (7/ 392) of MLVA patterns since 2009. A predominant historical pattern accounted for 45% of all patterns; another 51% were closely related including the outbreak strain. There were 5 historical STm44 outbreaks (78 cases) and 1 cluster (102 cases); all were related to the predominant MLVA pattern. Previous investigations all implicated or suspected eggs as the source.

Conclusion: We were unable to identify a specific source for this outbreak, but cross contamination from eggs appears likely. MLVA provided limited differentiation between STm44 isolates.

Why HITnet kiosks didn't hit the mark for sexual health education of Western Australian Aboriginal youth

Presenter: Donna Mak, Communicable Disease Control Directorate, WA

Authors: D Vujcich, N Hadland, S Clews, B Sullivan and D Mak

Objective: To assess the use and appropriateness of sexual health modules installed on Heuristic Interactive Technology (HITnet) kiosks at Aboriginal Community Controlled Health Services (ACCHS), and aimed at Aboriginal teenagers visiting these sites.

Methods: Modules were assessed for cultural appropriateness using Yunkaporta's Aboriginal pedagogy framework. Data measuring kiosk use were obtained through kiosk activity reports. An online survey of ACCHS staff was used to qualitatively assess use and staff perceptions of HITnet kiosks.

Results: Modules were consistent with seven of the eight elements of Yunkaporta's framework. Generally, usage by teenagers (13–19 years) was low and the majority of users (56%) were either under 12 years or over 19 years of age. Key issues reported by ACCHS staff (n=11) included: lack of clarity regarding staff responsibility for overseeing kiosk functionality; kiosks attracting "inappropriate ages"; and "lack of privacy" based on kiosk location, screen visibility, and absence of headphones preventing discreet access.

Conclusions: While the modules were tailored to a young Aboriginal audience through technology thought to be appealing to this group, there were a number of practical barriers to their use. Information that is accessible via personal devices may be a better vehicle than public kiosks for conveying sensitive subject matter.

Trachoma prevalence trend in Australia

Presenter: Carleigh Cowling, University of New South Wales, New South Wales

Authors: C Cowling, M Kong, B Liu, T Snelling, D Wilson and J Kaldor

Background: Australia is the only high-income country where trachoma is endemic, occurring primarily in remote Aboriginal communities in the Northern Territory(NT), South Australia(SA) and Western

Australia(WA). The Australian Government funds trachoma surveillance, reporting and control programs which are largely based on the WHO SAFE strategy and is a signatory to the Global Elimination of Trachoma by 2020 initiative.

Methods: Data are collected annually in accordance with CDNA *Guidelines for the public health management of trachoma in Australia* from communities identified by jurisdictions as being at-risk or potentially at-risk of trachoma. We restricted comparisons over time to the 5–9 year age group, which is the target a group for the trachoma screening programs in all regions.

Results: Overall trachoma prevalence has declined from 15% in 2009 to 4% in 2012, and plateaued at 4% in 2013 at the National level across all communities screened, however this trend varies at a jurisdictional and regional level. Treatment coverage has increased from 65% in 2011 to 81% in 2013, and the doses of azithromycin distributed have also increased from 1738 in 2007 to 10,219 in 2013.

Conclusion: Trachoma prevalence in Australia has declined, however concerted effort is still required to eliminate trachoma at the regional level.

Plenary 3: Disease elimination and eradication in Australia and internationally **Chair: Associate Professor Martyn Kirk**

In this panel session, expert presenters will discuss the eradication and elimination of diseases of public health importance including trachoma, measles and polio. In particular, we are approaching eradication for some of these diseases. Presenters will discuss some of the success stories, challenges and the future for these efforts in Australia and globally. The panel session will highlight the importance of collection of high-quality surveillance data in supporting and verifying disease control efforts.

Progress towards trachoma elimination in Australia and internationally

Professor John Kaldor, Professor of Epidemiology and NHMRC Senior Principal Research Fellow, Public Health Interventions Research Group, Kirby Institute, University of New South Wales, Sydney

Measles elimination in Australia: the path behind and road ahead

Associate Professor Stephen Lambert, Medical Epidemiologist, Queensland Centre for Children's Health Research, Brisbane

Polio eradication: is the elusive goal just around the corner?

Professor David Durrheim, Professor of Public Health Medicine, University of Newcastle and Director Health Protection, Hunter New England Area Health Service, NSW

Poster abstracts

Persistent STEC infection: Investigating delayed clearance of O128 in Queensland patients

Presenter: Rikki Graham, Molecular Epidemiology, Public Health Microbiology, Forensic and Scientific Services, Department of Health, Queensland, Australia

Authors: RM Graham, NX Fang, CJ Doyle and AV Jennison

Shiga-toxigenic *Escherichia coli* (STEC) is an important cause of human illness, and while focus has traditionally been on serogroup O157 STEC, non-O157 STEC are increasingly being recognised as being of public health significance. Our laboratory has found that serogroup O128 STEC has been associated with diarrhoeal disease in a number of cases but upon the resolution of symptoms, prolonged asymptomatic carriage occurs for extended periods of time.

According to Queensland Communicable Disease Control Guidelines, STEC positive patients are required to provide two negative clearance stool samples at least 24 hours apart. Cases from high risk

groups including children under 5 years, carers of children, healthcare workers and food handlers are typically excluded from high risk roles/attendance until clearance is recorded. For these reasons, failure to achieve clearance can cause social and emotional stress.

This study reports on the use of whole genome sequencing to investigate persistent O128 STEC isolates from Queensland patients and gain insight into genetic characteristics that may contribute to their ability to not only cause disease but to then persist asymptotically in the host. Furthermore, the prolonged length of carriage (>14 months) of one case has provided a unique opportunity to study within-host genomic changes over time.

RAPID (Response and Analysis for Pacific Infectious Diseases): translating research into action

Presenter: Tony Merritt, Hunter Medical Research Institute, University of Newcastle, New South Wales

Authors: B Paterson, D Durrheim, T Merritt, K Eastwood and J Flint

Ideally, surveillance evaluation research should not only describe surveillance systems but provide evidence to improve public health practice. This presentation documents how knowledge gathered through a syndromic surveillance evaluation in Pacific Island Countries (PICs) with local health personnel was translated into action, in collaboration with global health partners. The evaluation identified a critical need to better equip local public health officials with the knowledge and skills to rapidly and appropriately respond to suspected infectious disease outbreaks across the Pacific. Principally funded by Australian aid and developed in partnership with the World Health Organization, the Secretariat of the Pacific Community and the Pacific Public Health Surveillance Network, *RAPID (Response and Analysis for Pacific Infectious Diseases)*: is an example of a multi-organisational approach to swiftly address identified surveillance issues and strengthen regional surveillance capacity. Training, on-site capacity building, mentoring, peer-to-peer exchanges, outbreak support, and surveillance and response tool development were included in the project.

The *RAPID* project is a notable example of how evidence gathered through a surveillance evaluation can be used to improve public health surveillance practice. The project showcases how gains in surveillance capacity in lower and middle income countries can be achieved through cooperative partnerships and flexible approaches.

Ebola epidemic in West Africa: review of Australia's response

Presenter and author: Rosalie Schultz, Aspen Medical, NT

Ebola Virus Disease is a severe and frequently fatal illness caused by a zoonotic virus of the family Filoviridae whose likely main reservoir is bats. Human to human transmission of Ebola Virus occurs through contact with body fluids from infected patients. Patients are known not to be infectious until symptoms develop.

WHO declared the Ebola outbreak that began in 2013 in West Africa a Public Health Emergency of International Concern in August 2014. As part of its Ebola Response Roadmap, WHO recommended that all countries develop procedures to detect and respond to an Ebola exposure.

Australians have supported the global response to the outbreak through WHO and NGOs. The Australian government responded in November 2014, contracting an Australian company to manage an Ebola Treatment Centre in Freetown, Sierra Leone. The government also issued a ban on the issue of visas to people from countries affected by the outbreak. Australia's health protection services at national and state/territory levels have developed protocols to screen and manage all in-coming travellers from Ebola affected countries, including potentially exposed aid workers entering Australia.

While the Ebola affected countries in West Africa are remote geographically, the international concern of Ebola has demanded action from Australia.

Active TB case finding in the outer islands of Kiribati: A golden opportunity

Presenters: Onofre Edwin A. Merilles, Jr., Secretariat of the Pacific Community, Noumea New Caledonia and Takeieta Kienene, Ministry of Health and Medical Services, Republic of Kiribati

Authors: OE Merilles Jr., T Kienene, R Stapledon, R Lumb, R Brostrom and A Roth

Setting: Republic of Kiribati, ranks first in tuberculosis case notification rate in Western Pacific Region, 5-year annual average contact tracing yield of 14 cases (~3%), GeneXpert MTB/RIF in place, and Commonwealth of Australia funded 5-year project to accelerate scale-up

Objective: Expand TB case-finding efforts to high tuberculosis-burden outer islands through nurses doing island census

Design: Prioritisation of target islands; development of protocols to guide screening and diagnosis; training of nurses on symptom screening tool; training of clinic and laboratory staff on use of the GeneXpert MTB/RIF machine and implementation of algorithm; screening done from 23 February to 23 March 2015

Results: 3 outer islands targeted for screening with 13,373 population; Hawaii TB Symptom Screening tool customised for use in Kiribati; GeneXpert algorithms for diagnosis developed; village nurses trained on the screening protocol; 26 clinicians and 5 laboratory staffs trained on GeneXpert; 137 persons with suspicion of TB expected to be identified; yield of at least 24 bacteriologically confirmed pulmonary smear positive and negative TB cases

Conclusions: The TB programme envisions demonstrating that increasing the scope and scale of TB case-finding need not be expensive. Coordinating the initiative with other routine health activities and aligning screening and diagnostic work-up with new technologies are keys to success.

The Ebola 'end game' in Montserrado County, Liberia – some of the challenges

Presenter and author: Linda A Selvey, School of Public Health, Curtin University

I spent four weeks as WHO Field Coordinator for Montserrado County in January/February 2015. Montserrado county is the largest county in Liberia and includes the capital city, Monrovia. At that time, Montserrado was the only county in Liberia with ongoing Ebola transmission. Transmission was localised to two densely populated communities within the county in two transmission chains. While that might suggest that elimination of transmission was very close, three cases presented very late and between them exposed over 100 high-risk contacts, including in other communities and another county.

Community leadership conflicts, denial about Ebola, fear of the ETU and mistrust of contact-tracers impeded efforts to stop transmission. In this presentation, I will discuss these challenges, and initiatives that were put into place to address them.

Treatment delay among the tuberculosis patients of Bangladesh

Presenter: Mahfuza Rifat, University of Newcastle, Australia

Authors: J Hall, C Oldmeadow and A H Milton

Background: Bangladesh is one of the WHO ranked high burden country for tuberculosis. Delay in treatment may lead to progression of disease, poor outcome and increased risk of transmission. We conducted this study to identify the delays in treatment of tuberculosis and its association with other factors.

Method: Observational study including cross section of 646 drug sensitive tuberculosis patients. Information was collected through face-to-face interviews and record reviews. Unadjusted and multivariable regression were used.

Result: Median patient, health system and total delay were 2 weeks, 6 weeks and 9 weeks respectively. Compared to 'no education', patients with some education had less total delay (P 0.014); who consulted the informal providers (P 0.029) had more total delay compared to the designated centres of National

Tuberculosis programme. Health system delay was associated with private (P 0.007) and informal providers (0.004) and it was less with 'some level education' (0.004). Patient delay was associated with some occupations such as 'service' (P 0.042) and 'homemakers' (0.05).

Conclusion: Although the median delays have been much reduced compared to the previous studies conducted in Bangladesh, the health system delay showed that involvement of private and informal providers are still needed to improve the control programme.

Identification of measles vaccine virus by PCR in children more than 100 days following first dose of measles-containing vaccine

Presenter: Vicki Slinko, Metro South Public Health Unit, Brisbane, Queensland

Authors: VG Slinko, J McMahon, F Moore, CA Quagliotto, KAJ Jarvinen, BJ McCall, J Smith and SB Lambert

Fever, rash, and malaise due to measles-containing vaccines (MCVs) are well recognised adverse events, commonly occurring 7–10 days (range 5–12 days) after administration, and generally lasting 2–3 days. During these episodes, measles vaccine virus can be detected in clinical specimens, but detection long beyond this time frame, or person-to-person transmission of measles vaccine virus, has not been described.

Here we report a series of six children with detection of measles vaccine virus by polymerase chain reaction (PCR) testing during a clinical illness where measles testing was undertaken. In each child, vaccine virus was identified more than 100 days (up to 548 days) after administration of their most recent dose of MCV (first dose of measles-mumps-rubella vaccine in each case). Increasing clinical suspicion due to regular importations of measles into south-east Queensland over recent years, and the expanded use of PCR methods for diagnosis, has revealed these occurrences. Measles vaccine virus is identified by the Queensland public health virology laboratory following an initial positive measles PCR, with subsequent PCR and/or sequencing for vaccine strain. These findings alter the public health response required, with vaccine virus considered non-infectious, and also have implications in the longer term, for progress towards measles elimination.

Innovative uses of hepatitis A molecular testing in South East Queensland

Presenter: Vicki Slinko, Metro South Public Health Unit, Brisbane, Queensland

Authors: VG Slinko, J McMahon, KAJ Jarvinen, R Stafford, R Bell, K Heel, J Northill and BJ McCall

Diagnosis of hepatitis A infection has previously relied on demonstration of IgM antibodies against hepatitis A virus (HAV) in serum of acutely ill or recovering cases. Recently polymerase chain reaction methods (PCR) of HAV detection are being utilised in South East Queensland (SEQ) to confirm the diagnosis, identify further cases to detect outbreaks and even determine likely infectivity. Genotyping and/or sequencing of HAV have been used to link cases and by referencing an international database the possible origin may even be determined.

We present information on multiple cases and clusters of hepatitis A infection where this innovative use of HAV PCR has been used in SEQ. Serum or faecal PCR testing has identified both secondary cases as well as asymptomatic primary cases in young children thought to have infected older family members who developed symptomatic disease. Faecal PCR testing was used to assume clearance for school attendance in a young asymptomatic child. A large community outbreak was able to be linked through combination of genetic testing and epidemiological contact tracing to a child care centre at the epicentre of HAV infection. The outbreak ceased after attendees and staff members were vaccinated.

Understanding Q fever in Australia, 1991 to 2013

Presenter: Timothy Sloan-Gardner, Australian Government Department of Health, ACT

Authors: T Sloan-Gardner, P Massey, P Hutchinson, K Knope and E Fearnley

In Australia, abattoir workers and farmers, or those handling animal birthing products or slaughtering animals are at higher risk of Q fever.

We analysed data from the National Notifiable Diseases Surveillance System from 1991–2013, along with enhanced data from New South Wales and Queensland, to examine changes in the epidemiology of Q fever. Data were analysed using negative binomial regression using Stata 13.

There was a significant reduction (IRR 0.80 CI 0.68–0.95) in the Q fever notification rate after the end of the National Q Fever Management Program, however, the rate appears to increase in 2013.

The highest rates were in 40–59 year old males from Queensland and New South Wales. The age of Q fever cases and the proportion that were female both increased over time. The most frequently listed occupation for Q fever cases involved contact with livestock (15%), followed by no known risk occupations (10%).

We found that Q is no longer confined to abattoir workers and farmers. It is time to re-evaluate the at-risk groups recommended for vaccination. Additionally, more comparable and complete enhanced datasets, either at the jurisdictional or national level, would aid in the understanding of the epidemiology of Q fever in Australia.

Are we ready for rubella elimination? A review of rubella and congenital rubella syndrome (CRS) notification and hospitalisation data, Australia, 2008–2012

Presenter: Jocelyn Chan, National Centre for Immunisation Research and Surveillance (NCIRS), New South Wales

Authors: J Chan, A Dey, H Wang, N Martin and F Beard

Introduction: Following the successful elimination of rubella in the Americas, the Western Pacific Region of the World Health Organization proposed in 2014 a goal of regional rubella elimination, with a target date to be determined. In the context of this impending push towards elimination, we reviewed rubella epidemiology in Australia between 2008 and 2012.

Methods: Data were extracted from national notification (2008–2012) and hospitalisation (2008–2011) databases. Data were analysed by year, age, sex, state/territory, vaccination status, Indigenous status and place of acquisition.

Results: The average annual rubella notification rate between 2008 and 2012 was 0.18 per 100,000. The average annual hospitalisation rate between 2008 and 2011 was 0.03 per 100,000. One case of CRS was notified in 2012 and one hospitalisation with a principal diagnosis of CRS was recorded in 2008. Thirty seven per cent of notifications were acquired overseas and 89% of notifications were diagnosed by serology alone.

Conclusion: Rubella continues to be well-controlled in Australia and CRS is rare. The very low incidence and increasing proportion of imported cases suggest that elimination has been achieved. However, formal verification of rubella elimination in Australia will require the expansion of genotypic surveillance to demonstrate the absence of endemic strains.

Are health care workers aware of vaccination recommendations and do they support mandatory vaccinations?

Presenter: Helen Marshall, The University of Adelaide, South Australia

Authors: J Tuckerman, L Shrestha, J Collins and H Marshall

Background: Understanding HCWs knowledge and awareness of vaccination recommendations is important for determining strategies to improve uptake.

Methods: A quantitative survey (n=92) of HCWs and qualitative semi-structured one-to-one interviews with 22 HCWs examined their awareness of recommended vaccines, vaccine uptake and mandatory vaccination. Descriptive statistics, thematic analysis and coding were used to examine data.

Results: Besides the influenza vaccine, awareness of recommendations was low, as was recall of vaccinations received in the last five years. Despite HCWs being aware of the process required for patients to receive vaccinations, few knew how to access the appropriate service for themselves.

HCWs' opinions towards mandatory vaccinations were divided. Many felt that the decision to receive a vaccination was a personal choice and that making any vaccinations mandatory would remove autonomy. Others insisted that vaccinations for HCWs should be mandatory or if not, stricter workplace regulations should be enforced. Agreement towards mandatory vaccination for seasonal influenza was strongly aligned with HCWs' perception of risk, even in otherwise vaccine objectors. Conversely, there was also a strong sense of disapproval, at the prospect of mandatory seasonal influenza vaccination, even from vaccine acceptors.

Conclusion: Increasing HCWs' knowledge and awareness of vaccination recommendations and vaccine access is needed to improve uptake.

ADVALUE: Incorporating young people's views into priority setting for immunisation programs

Presenter: Helen Marshall, Women's and Children's Hospital and Robinson Research Institute, University of Adelaide

Authors: H Marshall, A Parrella, J Ratcliffe, R Tooher and A Braunack-Mayer

Adolescents' views and preferences are often over-looked when public health strategies that affect them are being considered for implementation. This study aimed to assess adolescent views and preferences for determining priorities for immunisation programs. A youth jury was held to deliberate on the question "What criteria should we use to decide which vaccines for young people in Australia should receive public funding?"

Jury members were selected using a stratified sampling technique and were recruited from the community through a market research company. The Jury was conducted in metropolitan Adelaide over two days. Fifteen youth aged 15–19 years participated in the jury. The jury's key priorities for determining publicly funded vaccines were:

Disease severity – whether the vaccine preventable disease (VPD) was life threatening and impacted on quality of life.

1. Transmissibility – VPDs with high/fast transmission and high prevalence.
2. Demonstration of cost-effectiveness, taking into account purchase price, program administration, economic and societal gain.

Youth jurors also indicated that there should be targeted programs for children at high risk of severe disease where a publicly funded program was unavailable and that social disadvantage 'socially at risk' should be a priority group in addition to 'medically at risk' children.

Characteristics associated with pertussis notification during pregnancy

Presenter: Lisa McCallum, University of Western Sydney, Hunter New England Health

Authors: L McCallum, B Liu, P McIntyre and L Jorm

Background: Mothers are one of the most likely sources of pertussis infection in infants; however studies reporting the epidemiology of maternal pertussis infection are few.

Methods: We constructed a cohort of mothers and their infants using routinely collected population-based datasets in New South Wales (NSW), Australia. All NSW resident mothers who gave birth to a singleton infant from 01 Jan 1994 – 31 Dec 2008 were included in the study.

Results: Among mothers, there were 3,887 pertussis notifications, with 386 notified pertussis infections occurring during pregnancy giving a rate of 30.2 (95% CI 21.1–43.1) per 100,000 pregnancies during the 15-year period. After adjusting for all other covariates, older mothers, delivering in an epidemic year, having had a previous pregnancy and living in a high socioeconomic area or giving birth in a private hospital were associated with increased risk of pertussis notification during pregnancy. Smoking during pregnancy, having a first antenatal visit later in the pregnancy and being born overseas were significantly associated with a lower risk of pertussis notification during pregnancy.

Conclusion: Diagnosis of pertussis in pregnant women is affected by socioeconomic status and access to health services. These factors should be taken into consideration when using disease notifications to understand the epidemiology of pertussis.

NetEpi as a tool for managing contact tracing during a measles outbreak

Presenter and author: Anthony Draper, Centre for Disease Control, Northern Territory and MAE Scholar, Australian National University

A single case of measles, let alone an outbreak can stretch the resources of a public health unit. An intensive contact tracing effort is essential to reduce secondary cases and the subsequent significant costs to the health care system and loss of productivity in the community. Contact tracing is labour intensive with public health unit staff involved in telephoning contacts, arranging follow up, undertaking enhanced surveillance and additional tasks that take them away from other duties in the public health unit. The time staff dedicate to a measles outbreak results in a considerable financial/resource cost to the unit.

In response to a large outbreak of measles in early 2014, the NT began to use the internet based NetEpi tool to manage contact tracing activities. Using NetEpi streamlined and simplified our subsequent measles responses.

Measles activity in Queensland since 2013

Presenter: Jamie McMahon, Public Health Virology, Queensland Forensic and Scientific Services

Authors: J McMahon, J Northill, J Cameron, G Hewitson, D Genge and F Moore

Measles cases in Queensland have been on the rise endangering Australia's measles free status. Public Health Virology provide a statewide molecular testing service that includes both PCR testing and genotyping of samples to assist in contact tracing. The rate of measles testing increased sharply in August 2013, which saw the start of the largest number of measles cases in Queensland since 1994. These cases were determined to be not one continuous outbreak but many clusters originating from imported cases from within the Asia/Pacific region. It has also been observed that with a heightened awareness of measles in the community there is an increase in detection rates of measles vaccine reactions.

The identification of a hepatitis A cluster linked to the consumption of imported frozen berries through phylogenetic analysis

Presenter: Jamie McMahon, Public Health Virology, Forensic and Scientific Services, Health Support Queensland, Department of Health

Authors: J McMahon, J Northill, G Hewitson, J Cameron, D Genge and F Moore

Hepatitis A infections from contaminated food sources has been an ongoing problem with the globalisation of the world food trade. In recent years there have been significant outbreaks of Hepatitis A in developed countries linked to contaminated food grown or processed in countries where sewage management and sanitisation is poor. These have included frozen berries, lettuce and salad products, raw vegetables, sun-dried tomatoes and shellfish originating from areas of South America, Asia, Africa and the Middle East.

We report on the recent cluster of Hepatitis A cases linked to frozen berries imported from China. Identification of this cluster in Queensland has been performed by PCR and the genotyping of samples has been able to confirm the cases are genetically identical. A phylogenetic analysis on interstate genetic sequences has confirmed the cases are linked to a nationwide cluster of Hepatitis A with an epidemiological link to frozen berries originating from China and Canada.

Immunisation by community pharmacists – more than just a ‘flu shot’

Presenter: Nicole Flyod, The Pharmacy Guild of Australia

Author: K Gourlay

With vaccination recognised as within the scope of practice for a pharmacist by the Pharmacy Board of Australia, this presentation will discuss the benefits of utilising community pharmacies within the current immunisation process in Australia, how this could be enhanced to increase the coverage of immunisations against vaccine preventable disease.

This presentation will:

- Provide a brief overview of the international experience,
- Outline the activities in preparation for the practice of immunisation by community pharmacist immunisers, including competencies,
- Explore opportunities beyond just seasonal influenza immunisation, particularly measles and pertussis, particularly in regional and remote locations; and
- Provide an overview of pandemic preparedness in community pharmacy.

Community dispensing of s100 HIV medicines – what does this mean?

Presenter: Nicole Flyod, The Pharmacy Guild of Australia

Author: K Gourlay

From 1 July 2015 amendments will be made to the prescribing and dispensing arrangements for HIV antiretroviral agents that will allow these medicines to be dispensed through a pharmacy of the patient's choice regardless of where they were prescribed.

Previously these medicines, known as Section 100 Highly Specialised Drugs (s100 HSD) through the Pharmaceutical Benefits Scheme (PBS), were unable to be dispensed at a community pharmacy. Eligible community based prescribers and patients are required to be associated with a hospital to be able to access these medicines.

In addition, the restriction preventing the manufacture and sale of HIV in vitro diagnostic devices (home self-tests) has been removed via an amendment to the *Therapeutic Goods (Excluded Purposes) Specification*

2010. While there are currently no HIV self-tests included in the Australian Register of Therapeutic Goods, it is expected that when a listing is made, this will improve testing rates and lead to earlier diagnosis, intervention, treatment and better health outcomes.

This presentation will provide an overview of these changes, what this means for community pharmacy, and importantly, what it means for people living with HIV.

Chlamydia screening through community pharmacy – a missed opportunity

Presenter: Nicole Flyod, The Pharmacy Guild of Australia

Author: K Gourlay

Chlamydia is the most common Sexually Transmissible Infection in Australia. At 6 February 2015 there were already 6,501 notifications for 2015, with more than 81,000 notifications in 2014. Research reveals less than 10% of young people in the high-risk age group for chlamydia attending general practice are tested despite a high attendance rate (85.6% female and 64.4% male).

With the recommendation for annual testing for all sexually active men and women aged 15–25 in Australia, access to screening through Australia's most accessible health care destination, community pharmacy, is essential to reduce the incidence and long-term health consequences of chlamydia through early detection.

Further, more than 400,000 units of emergency hormonal contraception (EHC) are provided each year, predominantly at community pharmacy. There is a need to ensure all consumers receiving EHC have the opportunity to be tested for chlamydia given current prevalence and re-infection rates.

This presentation will:

- Provide a brief overview of community pharmacy involvement in the UK National Chlamydia Screening Programme;
- Provide an overview of Australian activities and research to-date; and
- Explore options, referral pathways and barriers and enablers to chlamydia screening through community pharmacy.

Improved chlamydia surveillance in New Zealand: interpreting the data

Presenter and Author: Jill Sherwood, Public Health Physician, Health Intelligence Team, Institute of Environmental Science and Research Ltd, Wellington

Background: Chlamydia is the most commonly reported sexually transmitted infection (STI) in New Zealand. Historically STI surveillance was a clinic based sentinel system with data also provided by a limited number of laboratories. Recent improvements in laboratory-based surveillance have enhanced the analysis of incidence trends, testing patterns and test positivity.

Methods: Data were collected from laboratories in all district health boards (DHBs). Repeat tests within a defined episode period were removed. Population-based rates, testing rates and test positivity were calculated by DHB, age group and sex.

Results: The national chlamydia rate for 2013 was 633 per 100 000 population (15–19 year age group: 3080 per 100 000 and 20–24 year age group: 2981 per 100 000), all decreases from 2012. Test positivity was 7.8% (8.6% in 2012); highest in females aged 15–19 years (15.4%) and 20–24 years (9.2%). Testing rates were highest in those aged 15–19 years (205 per 1000) and 20–24 years (298 per 1000).

Conclusions: The reduction in rates should be interpreted with caution. The improved rate calculation is not directly comparable with previous estimates. Testing rates in the 15–24 years age group were lower than the rate mathematical modelling suggests is required to decrease prevalence.

Human papillomavirus control: how are we going with vaccination coverage 7 years in?

Presenter: Julia Brotherton, National HPV Vaccination Program Register, VCS, Victoria

Authors: J Brotherton, G Chappell, J Brosi, K Winch, B Barbaro and M Saville

The National HPV Vaccination Program was launched in April 2007. The National HPV Vaccination Program Register monitors the population coverage achieved by the program using doses notified to the register as the numerator and ABS estimated resident population estimates as the denominator.

This presentation will discuss the latest HPV vaccination coverage estimates from the Register, including updated national and state based estimates for females and males, and analyses by area level measures of socioeconomic status and remoteness. Trends over time will be highlighted, including the marked improvements in coverage noted in some States and Territories since the initial launch of the program.

Acute rheumatic fever – a public health dilemma

Presenter: Keith Edwards, Centre for Disease Control, Royal Darwin Hospital, NT

Authors: K Edwards, M Fittock, C Chamberlain, N Davies, M Van Leeuwen, N Missen and D Williams

Acute rheumatic fever (ARF) is a disease of poverty, poor living conditions and disadvantage. Indigenous people living in tropical north Australia have the highest recorded incidence of ARF in the world (3%). A first episode of ARF usually occurs in childhood and causes joint pains and inflammation but recurrent episodes severely damage heart valves leading to the need for major cardiac surgery. Despite surgery, heart damage results in early death for many affected Indigenous people. The underlying cause is the social determinants of health and improvement in living conditions progresses slowly for Indigenous people. The only way to control the impact of this disease is to provide four weekly injections of LA Bicillin to those who have had a first episode so as to prevent recurrence. This injection prevents streptococcal infection which is the trigger for the disease. The Department of Health NT has put in place a Rheumatic Heart Disease Control Program since 1997 based in the Centre for Disease Control. This presentation will outline the development of the program, its difficulties and successes and the way forward to control and prevent the impact of this disease until it can be eradicated by improved living conditions for Indigenous people.

Challenges and opportunities in implementing routine bacterial genomics in public health microbiology.

Presenter: Takehiro Tomita, Microbiological Diagnostic Unit Public Health Laboratory, University of Melbourne at The Doherty Institute for Infection and Immunity, Melbourne, Australia

Authors: T Tomita, T Seemann, M Valcanis, K Stevens, D Bulach, J Kwong, J Coventry, K Mercoulia, T Stinear and B Howden

A range of typing methods have been employed for bacterial pathogen characterisation and epidemiological surveillance, such as serotyping, phage typing, and MLVA. Whole genome sequencing (WGS) has the potential to revolutionise the assessment of pathogen relationships in public health settings. However, it is not straightforward to implement WGS in a highly regulated microbiology environment.

At the MDU PHL, we have invested significantly to confront the challenges of WGS in a public health laboratory, with a vision to make WGS the primary typing method. We have found in-house sequencing capacity is critical, allowing rapid turn-around times in urgent cases. Close collaboration with microbial bioinformaticians has been vital for rapid, automated data analysis, including in silico MLST predictions, resistome information, and SNP based phylogeny. Pathogens analysed by WGS to date include: *Listeria monocytogenes*, VRE, *Yersinia enterocolitica*, Shiga toxin-producing *E. coli*, and KPC-producing *Klebsiella pneumoniae*. Reports to stakeholders contained a phylogeny including publicly available reference genomes, epidemiological data, metadata and interpretations useful for consideration in epidemiological investigations.

Key challenges include: defining and maintaining QC criteria in an environment where technology is continually changing; developing WGS workflows that optimise cost-effectiveness and timeliness; and reporting methodologies that satisfy consumers who have extensive experience interpreting traditional typing methods.

What's happening in rural NSW; what can enhanced gonorrhoea surveillance tell us?

Presenter: Priscilla Stanley, Western NSW/Far West Local Health District

Authors: PL Stanley, AM Parker and DA Belshaw

Background: As a notifiable condition, gonorrhoea continues to increase throughout NSW. Enhanced gonorrhoea surveillance (EGS) was implemented for 6 months in NSW from August 2013. Prior to EGS, limited information existed about gonorrhoea transmission in regional/remote western NSW.

Methods: An epidemiological scan from EGS undertaken for Far West and Western NSW Local Health District, specifically looked at treatment, sexual orientation, infection source and Aboriginality.

Results: During the period of EGS, 92 new cases of gonorrhoea were reported. 67% of these gonorrhoea notifications occurred in regional/rural locations and 33% in remote locations. 70% of treating clinicians returned EGS forms. An epidemiological scan indicates 66% of notifications compliant in recording Aboriginality. Geographic variations were evident in recording infection source and sexual exposure with homosexual transmission common in central NSW, reflecting inner Sydney patterns and Aboriginal/heterosexual transmission frequent in remote regions and mixing of infection sources between sub-populations occurring in these regions.

Conclusions: Ongoing epidemiological analysis of gonorrhoea cases will monitor trends amongst western NSW sub-populations. The Population Health Unit coordinates GP sexual health training focussing on service provision to priority sub-populations as identified in the 3rd National STI Strategy 2014–2017, along with specific messaging based on geographic trends promoting services and safe sex messaging.

Making the numbers speak – Creative presentations of notifications data

Presenter: Kari Jarvinen, Metro South Public Health Unit, Queensland

Authors: K Jarvinen, G Pollard, A Neill and D Seesaengnom

Background: The greater Brisbane Metro South Hospital and Health Service (Metro South Health, MSH) covers a population of 1,052,000 including significant cultural diversity. Over 13,500 notifiable conditions are reported annually.

Methods: We developed MS-Excel™ templates to automate detailed analysis of disease notifications and trends in MSH compared with rest of Queensland. Annual average notification rates were calculated for 2011 to 2013, and trends over the 2004 to 2013 period were compared. Tabular and diverse graphical representations are used to analyse and illustrate disease trends.

Results: There has been an increase in chlamydia notifications among 15–29 year olds, demonstrated poignantly by topographical and 3D-mapping. Gonorrhoea notifications have increased among a slightly older age group, while a broader increase has been evident for syphilis. Pertussis notifications showed distinct ‘mountain peaks’ of increased notifications among children and older age groups during the 2009–2012 epidemic years. A concerning increase was seen in the proportion of annual notifications in children. Varicella rates have increased among the elderly. Cyclic peaks are seen for diseases such as cryptosporidiosis.

Conclusion: Automated data analysis templates have proved useful in detailed analysis of notifications data, including through generation of multiple formats for presenting information.

Is the National Notifiable Diseases Surveillance System an effective surveillance system for flu?

Presenter: Anna-Jane Glynn-Robinson, Office of Health Protection, Australian Department of Health, Canberra, Australian Capital Territory.

Authors: AJ Glynn-Robinson, M Kirk, K Pennington and R Owen

Background: Influenza is an acute viral infection that spreads easily from person to person, and is a serious public health problem that can affect any age group. Robust, reliable and adaptable influenza surveillance systems are therefore required to provide national policy makers with data to guide appropriate public health responses. In Australia, the National Influenza Surveillance Scheme combines data from a variety of surveillance systems, including community, primary and tertiary healthcare settings and laboratories, to estimate the impact of seasonal influenza. We have evaluated the National Notifiable Diseases Surveillance System (NNDSS) captures of laboratory-confirmed influenza notifications against the six objectives of national influenza surveillance.

Methods: Stakeholder surveys and notification data from 2008–2013 were used to examine the systems attributes, including simplicity, acceptability, flexibility, sensitivity and data quality. To assess the demographic representativeness of the system, we compared NNDSS notifications with data from the Australian Sentinel Practice Research Network and the Influenza Complications Alert Network.

Conclusion: The study found four of the six national influenza surveillance objectives are currently being met by the NNDSS. As an acceptable, simple and usable system, that provides high quality data, the NNDSS serves an important function in the national surveillance of influenza in Australia.

Who is at risk of *Legionella* infection in Australia?

Presenter: Anna-Jane Glynn-Robinson, Office of Health Protection, Australian Department of Health, Canberra, Australian Capital Territory.

Authors: AJ Glynn-Robinson, M Kirk, T Dobbins and R Owen

Background: *Legionella* causes atypical pneumonia after susceptible persons inhale the bacteria in soil or water. Two main species cause infection in Australia – *L. pneumophila* and *L. longbeachae*. We describe the epidemiology of legionellosis in Australia from 2001–2012.

Methods: We analysed notification data on legionellosis from the National Notifiable Diseases Surveillance System by person, place and time using denominator data from ABS. We conducted negative-binomial regression examining notification rates for separate species using Stata 13.1.

Results: *L. longbeachae* was responsible for 50% of the 3,862 notifications, compared to 45% for

L. pneumophila and 5% other species. The median age for *L. longbeachae* cases was 63 years (13–99 years) and 60% were male. Rates were highest in Spring (NRR 1.24, 95%CI 1.1–1.4) and in Western Australia (NRR 5.24, 95%CI 5.0–6.5). The median age for *L. pneumophila* cases was 60 years (1–97 years) and 69% were male. Rates were highest in Autumn, and in Victoria (NRR 1.64, 95%CI 1.44–1.86).

Conclusion: Older males were at greatest risk of infection. *L. pneumophila* predominated in eastern states, while in contrast *L. longbeachae* was more common in the west. Prevention measures should target the main infecting species in each jurisdiction.

Can molecular epidemiology enhance the surveillance of HIV in Queensland?

Presenter: Craig Davis, School of Population Health, University of Queensland, Queensland

Authors: C Davis, K Hawke, S Lambert, C Lang, C Gilks, L Fitzgerald and S Reid

Molecular epidemiology (ME), which employs both molecular and epidemiological methods to better understand the genetic diversity, aetiology and distribution of diseases, has only recently begun to be applied to understanding the dynamics of HIV transmission HIV. We systematically applied ME methods

with two linked data sets with the aim of better understanding the dynamics of HIV transmission in Queensland: (1) results of routine drug resistance testing in Queensland from 2008–2013 period; and (2) notification surveillance records (including demographic, exposure, and clinical information).

Of 1,767 sequences, 88% (1,563) could be linked with notification records. Overall, 78.7% (1,390) of sequences were subtype B, with the remaining comprised of subtypes C (9.4%, 166), CRF-AE (6.5%, 115), and other mainly recombinant subtypes (5.4%, 96). Subtype B sequences significantly decreased over the period ($p < 0.01$) whereas CRF-AE significantly increased ($p < 0.05$). The majority of clusters identified were small in size (< 5) although several large clusters were also identified of which the largest (> 50) was subtype B and comprised mainly of men who have sex with men. We discuss the potential uses of this information to inform prevention and control efforts, as well as discuss the challenges and limitations of using these methods for ongoing surveillance.

Spatiotemporal model of anaemia intensity and helminth co-infection in Burundi

Presenter: Mohamad Assoum, The University of Queensland

Authors: M Assoum, R Magalhaes, G Ortu, MG Basanez, C Lau, L Veerman and A Clements

Longitudinal data was collected from 40,553 children over the course of 5 years in 31 locations in Burundi. These locations acted as satellite collection points. Data that was collected included: egg counts for *Ascaris*, *Trichuris*, hookworm and *mansoni*, blood iron levels, age, sex, weight and height. Locational data also include the GPS x and y coordinates, average land surface temperature, NDVI, average precipitation and the distance to perennial water bodies. Univariate, multivariate, geospatial analysis and statistical temporal analysis of the combined data was conducted based on previously produced prevalence, intensity and co-infection models. The spatiotemporal model produced demonstrated the correlation between the aforementioned environmental conditions, intensity of infections and the prevalence of co-infection and a rise in the prevalence and intensity of anaemia in children throughout Burundi. It was seen that in areas which are closer to perennial water bodies and as such *Schistosomiasis mansoni* rates are high as well as increased prevalence of co-infection led to a significant increase in anaemia prevalence and intensity in the first year. However, over the course of the five years, with the introduction of *Schistosomiasis* treatments, a gradual decline in the intensity of anaemia was found in the same areas, although the prevalence did not change very much. Thus this model established a direct correlation between the environmental factors, co-infection prevalence and infection intensity and the onset of anaemia and its varying intensities over a five year period. This paper demonstrated how to utilise spatiotemporal models to help track and predict incidences of disease, thus acting as a pertinent public health surveillance system.

Pandemic level notifications in 2014 highlights problems with messages about influenza

Presenter: Heath Kelly, Victorian Infectious Diseases Reference Laboratory, Melbourne

Authors: H Kelly, K Grant, M Chilver, L McCallum and C Dalton

Background Influenza notifications in Australia were higher in 2014 than in the pandemic of 2009 and public messages suggested the ‘killer flu was sneaking in early’. However, even early in the season, it was apparent that 2014 was unlikely to be severe. We aimed to evaluate notifications as a method for assessing the relative intensity of influenza seasons.

Methods Influenza notifications were retrieved from the National Notifiable Diseases Surveillance System from 2005–14. Notifications from reference laboratories were noted. We compared all notifications with assessment of influenza activity using two national syndromic surveillance systems, the ASPREN network of general practitioners and Flutracking.net, an online survey of community members throughout the influenza season. A similar analysis was made using only data from Victoria.

Results Nationally there were 67,783 influenza notifications in 2014, compared with 59,028 in 2009. Notification numbers had been steadily increasing since 2009 but syndromic surveillance systems in Australia and Victoria indicated that 2014 was a mild to moderate season. Since 2009, increasing numbers of influenza notifications have been received from non-reference laboratories.

Conclusion It is clear that notifications no longer reflect influenza activity in the Australian or Victorian communities. Emphasising only notification numbers led to inappropriate messages about the influenza season in 2014. Balanced messaging requires an understanding of all data sources providing information on seasonal influenza activity.

Human astrovirus in South-East Queensland 2014

Presenter: Judith Northill, Public Health Virology, Queensland Health Forensic and Scientific Services.

Authors: J Northill, V Horton-Szar, G Hewitson, D Genge, J Cameron, J McMahon, S Schlebusch and F Moore

Mamastrovirus 1, also known as Human Astrovirus (HAstV) is a species of virus currently known to have 8 genotypes and belongs to the family *Astroviridae*, genus *Mamastrovirus*. HAstV is a common cause of gastrointestinal disease in humans worldwide.

From August to December 2014, faeces samples were screened for common pathogens using a commercial multiplex tandem nested PCR at Mater Pathology. Samples where Astrovirus was detected were forwarded to Forensic and Scientific Services for confirmation and further genotyping. In total 29 samples were detected and phylogenetic analysis performed to determine the current genotypes circulating in South-East Queensland.

Shiga toxin-producing *Escherichia coli* screening in the Australian Capital Territory

Presenter: Laura Ford, ACT Health, ACT

Authors: L Ford, C Moffatt and K Kennedy

Background: Shiga toxin-producing *Escherichia coli* (STEC) causes acute gastroenteritis and can result in severe illness and large outbreaks. Previously only 1 case of STEC has been detected in the Australian Capital Territory (ACT). This study aimed to enhance local laboratory capacity and undertake enhanced laboratory-based surveillance in the ACT.

Methods: Between October 2011 and December 2013, selective screening for *stx1* and/or *stx2* toxin genes using a nucleic acid based test was performed on 901 faecal samples. Interviews were conducted with patients with positive *stx* samples. Notification rates were adjusted to the age and sex structure of the ACT population.

Results: STEC was detected in 17 of 791 samples included in the final study. Of the 17 positive isolates, 14 were from 680 residents of the ACT, which equates to a prevalence of 2.1% and an annualised notification rate of 1.6 STEC cases per 100,000 (95% confidence interval 0.8–2.5 cases per 100,000) in the ACT.

Conclusion: This study demonstrates that STEC is a cause of gastroenteritis in the ACT. Local laboratory testing capability can help effectively and efficiently monitor STEC in a small jurisdiction.

Public health challenges in dealing with a *Salmonella* outbreak

Presenter: Satyamurthy Anuradha, QLD Health

Authors: S Anuradha, S Jurd, F Vosti, I Hunter, J Markey, D Finnigan, D Jurgeneit, L Mundy, A Regan, D Brook, V Dingjan, E Pullen and P Van Buynder

Background: Raw eggs have been linked to more than one-third of food-related salmonella infections. In January 2015, the Gold Coast Public Health Unit investigated an outbreak of *Salmonella* Typhimurium (MLVA type STm3-12-11-12-524) that was linked to raw eggs used in desserts supplied to a sushi franchise chain, with nine out of 11 outlets being implicated.

Methods: Initial notifications for Gold Coast were of sporadic cases that on questioning were linked to sushi outlets within the area. Further epidemiologic investigation pointed to the dessert from these outlets as the culprit rather than the sushi. We undertook a systematic environmental health assessment, including sampling and/or environmental swabs from the dessert manufacturer, sushi retail outlets and egg producers.

Results: Our investigations showed positive results for the same MLVA type in all three locations. Poor sanitation in the farm, ignorance of the risks associated with the handling of raw eggs in food products and time-temperature abuse at the outlets were all contributing factors.

Conclusion: A comprehensive through-food-chain approach to investigating outbreaks will allow prompt identification of the source. More timely and appropriate public health interventions are critical to protect the public and should be enacted at every level of the food industry.

Investigating an outbreak of *Staphylococcus* food-poisoning amongst travellers across two Australian states

Presenter: Stephanie Fletcher, Public Health Unit; South Western Sydney Local Health District

Authors: L Boonwaat, T Moore, R Chavada and S Conaty

Background: *Staphylococcus aureus* is a common cause of food poisoning in Australia. Outbreaks associated with commercial caterers have been reported. However, outbreaks often go undetected because laboratory testing for enterotoxin producing *S. aureus* is not routinely done for this self-limiting condition.

Methods: A retrospective cohort study was conducted among a group of tourists who were hospitalised in Sydney shortly after travelling from Queensland. The group had consumed food from a restaurant on the Gold Coast prior to transit. Laboratory analysis on stool specimen and environmental assessment of the implicated restaurant was conducted.

Results: Epidemiological investigations linked the outbreak to a restaurant in the Gold Coast where the suspected food was produced. Two stool samples from of hospitalised cases were confirmed to have enterotoxin producing *S. aureus* and several environmental samples were found to be contaminated with *S. aureus*. Investigations suggested that mishandling of food at the implicated restaurant was the likely cause of this outbreak.

Conclusion: Food poisoning due to toxin mediated *S. aureus* is frequently undetected and under reported. Public health units should consider laboratory diagnosis of toxin-producing pathogens such as *S. aureus* when investigating outbreaks with very acute and self-limiting presentations after consuming food.

A parsimonious model for estimating influenza vaccine effectiveness

Presenter: Courtney R Lane, Victorian Infectious Diseases Reference Laboratory, Melbourne, Victoria

Authors: CR Lane, K Carville and H Kelly

Background: Influenza vaccine effectiveness (VE) is increasingly estimated using the test negative study design. Cases have a symptom complex consistent with influenza and test positive for influenza, while non-cases have the symptom complex but test negative. We aimed to determine a parsimonious logistic regression model for this study design.

Methods: We constructed directed acyclic graphs (DAGs) using publicly available software to determine the minimum covariate set required. VE was estimated as 1-adjusted odds ratio. Changes in VE from addition of specified covariates were examined using surveillance data from 2007–13, excluding 2009. Using the parsimonious model VE was estimated for each year, for all years combined, and for influenza type and sub-type for all years combined.

Results: The DAG indicated that covariates specifying year (season), age group, co-morbidity, and week of onset were required. Restriction by time between onset and swab was also necessary. The inclusion of

comorbidity was not validated when testing inclusion of the variables using 7 years of data. VE for all years combined was estimated as 53% (38,64). For H3N2 VE was estimated as 42% (19,59), for H1N1pdm2009 75% (51,88) and for influenza B 63% (38,79).

Conclusion: With the exception of comorbidity, theoretical covariates specified by the DAG were validated when tested against surveillance data. A parsimonious model using the case test negative design allows regular estimates of VE.

Influenza outbreak management in residential care facilities

Presenter: Robin Gilmour, Communicable Disease Branch, NSW Ministry of Health

Authors: R Gilmour, S Tobin and V Sheppard

Residential care facilities (RCF) are not required under the NSW Public Health Act, 2010 to report influenza outbreaks to public health units (PHU), although many still do. Across facilities management and recognition of an outbreak often varies. To understand this further NSW Health developed a survey to generate information on how RCFs prepare for and respond to influenza and influenza like illness outbreaks.

An email containing a weblink to an online survey was sent to 528 RCFs service providers requesting the survey be completed by the Director of Nursing or a senior nursing staff member. Responses were received from 236 (45%) facilities. Preliminary results indicate that overall 223 (95%) responding facilities were familiar with the National Guidelines, however only 50% (118 facilities) of all nursing staff at a facility would have read or have ready access to the guidelines. The majority of facilities (94%) were able to identify residents with signs and symptoms of influenza but only 47% of facilities answered correctly the number of residents with an influenza like illness required to declare an outbreak.

Overall the majority of RCFs reported to be adhering to the National Guidelines. Information obtained through this survey will assist NSW Health plan future resources needed to prevent and help manage influenza outbreaks in RCFs.

Influenza in South Australia – is 2014 our worst year on record?

Presenter: Caitlin Graham, Communicable Disease Control Branch, SA Health

Authors: C Graham, E Denehy, J Raupach and A Koehler

Influenza became notifiable in South Australia in May 2008, since then notifications have ranged approximately 4,000 to 11,000 laboratory confirmed cases each year.

A descriptive analysis including hospitalisation at the time of notification for influenza in South Australia across a five year period (2009–2014) was undertaken using the South Australian Department of Health Notifiable Infectious Disease Surveillance database. Death information was obtained using medical notifications and records maintained by the Department of Births, Deaths and Marriages.

An average of 6991 cases per year was notified for the 2009 to 2014 period. During 2014, 11,054 cases of influenza were reported in South Australia. The dominant influenza type was influenza A (92%), which was higher than the previous year (43%), and closely resembles the 2012 season (90%).

In 2014, 14% of notified influenza cases were hospitalised; equivalent to the average percentage of hospitalisations for the last five years. In 2014, 44 deaths were notified; a rate of 40 deaths per 10,000 notifications. Reported death rates between 2009 and 2013 have ranged from 7 and 27 deaths per 10,000 notifications.

Continued surveillance will help describe the changing nature of influenza and to guide public health control measures.

Hepatitis A virus antibodies in Australian blood donors

Presenter: Megan Young, School of Medicine and MHIQ, Griffith University, Queensland

Authors: MK Young, HM Faddy, J Fryk, GR Nimmo, AW Cripps

Background: A recent Australian outbreak of hepatitis A associated with consumption of contaminated berries highlighted the importance of post exposure prophylaxis as a means of control in low incidence countries. Passive immunisation is required for the most vulnerable populations in the event they are exposed. Trends in hepatitis A seroprevalence may impact on the production of effective immunoglobulin products for passive immunisation.

Methods: The seroprevalence of hepatitis A antibodies in Australian blood donors was measured and compared to published literature to gauge the likelihood of a decline in immunity. Hepatitis A antibodies were quantified in a random sample of those who were seropositive.

Results: An estimated 51% (95%CI 48–54%) of Australian blood donors were seropositive for hepatitis A. Rates varied across the country and increased with age. Comparison with published data supported an increase in seroprevalence in younger age groups. The geometric mean titre (GMT) of those who were seropositive was 1246.8 mIU/mL (Geometric Standard Deviation 11.8 mIU/ml) and increased with age.

Conclusion: A seeming increase in seroprevalence among donors is encouraging regarding Australia's ability to maintain immunoglobulin sufficiency. However, the overall GMT of hepatitis A antibodies in donations may be prone to decrease as current donor cohorts age.

Laboratory characterisation of invasive *Listeria monocytogenes* in New South Wales between 2011–2014: from molecular subtyping to the whole genome sequencing

Presenter: Qinning Wang, Centre for Infectious Disease and Microbiology, Public Health, ICPMR Westmead Hospital. NSW

Authors: Q Wang, N Holmes, P Howard, G Hill-Cawthorne and V Sintchenko

Listeriosis is a life-threatening foodborne disease caused by *Listeria monocytogenes* (Lm). In NSW, a binary typing (BT) and multi-locus variable number tandem repeat analysis (MLVA) have been used routinely to detect clusters and track the food sources of infection. Between 2011 and 2014, 114 clinical and 65 environmental and food isolates were characterised. The majority of them were obtained from the elderly or immunocompromised patients. Molecular typing identified 14 and 25 BT unique types for environmental and human cases, respectively. BT 255 was the commonest (21.1%) type among human isolates followed by BT 254 (19.3%) and BT 158 (14%). BT 82 was the predominate type (32.3%) for the environmental isolates followed by BT158 (18.5%) and BT 154 (12.3%). 44 MLVA types were identified in which the predominant MLVA type (04-17-16-05-03-11-14-00-16) was associated with 13.8% of the cases, followed by another two types linked to 12.5% and 10% of cases, respectively. These MLVA types were associated with a multi-jurisdictional outbreak and a hospital-acquired outbreak in NSW. Application of the whole genome sequencing of Lm significantly improved the resolution of subtyping and assisted in establishing potential links between production facilities and sources of environmental contamination leading to outbreaks of listeriosis.

Recent evolution of human *Salmonella enterica* serovar Typhimurium in New South Wales

Presenter: Cristina Sotomayor, Sydney Medical School, Westmead, The University of Sydney, and the NSW Enteric Reference Laboratory (ERL), ICPMR-Pathology West, Westmead, New South Wales

Authors: C Sotomayor, Q Wang, P Howard and V Sintchenko

Background: Multi-locus variable number tandem-repeat analysis (MLVA) typing has been implemented for *Salmonella enterica* serovar Typhimurium (STM) in New South Wales since 2006. It has significantly improved the resolution of public health surveillance of STM infections. The aim of this study was to examine the diversity and trends of STM MLVA patterns.

Methods: All STM isolates genotyped by MLVA at the NSW ERL between January 2009 and December 2014 were analysed.

Results: 11,209 isolates were included in the study. The yearly counts have significantly increased from 1636 (2009) to 2548 (2014). The most dominant MLVA pattern was 3-9-7-13-523 (phage type 170) and its complex (variants with single tandem repeat differences in the second, third and fourth loci) represented 27.1% of all STM. The diversity of the STM population showed seasonal variation but remained stable over the study period, with a McIntosh's index of diversity between 0.58 and 0.78. The proportion of novel MLVA patterns varied between 7.2 and 38.1% (17% on average).

Conclusions: Prospective genotyping of STM has documented the establishment of successful PT170 clones and the sustained level of STM diversity that accompanies the increasing incidence of human STM infections in NSW in the last 6 years.

An ongoing public health response to a syphilis outbreak in the North.

Presenter: Mark Russell, Centre of Disease Control, Alice Springs, Northern Territory

Authors: L Garton, TW Yip, M Gunathilake, JY Su, A Ishwar, J Creighton, R Sherry, A Hope, C Beatson, H Goodwin, N Ryder, M Thalanany, V Krause

In September 2013, a localised increase in syphilis notifications was detected in central Australia. A few further cases were detected, in this region, until numbers began to rise July 2014 with linkages back to 2013. The Centre for Disease Control (CDC) determined an outbreak was underway and formed an outbreak response team to plan and implement a public health response. Screening for syphilis in all sexually active individuals aged 30 years or less, was recommended. The outbreak case definition expanded to include Katherine and Barkly regions by end of 2014, due to enhanced monitoring of cases detected.

Using a point of care test (PoCT), community screens in population aged 12 to 30 years, were implemented, in addition to increasing opportunistic testing in remote clinics. Testing was performed by both CDC and local staff teams, with local clinical and community leaders integrally involved in conducting the activities.

As of 10/04/2015, 115 outbreak cases have been detected, with 57% of cases being aged 15–19 years.

CDC continues enhanced surveillance of the outbreak to rapidly identify and contain new cases. Further community screens are being conducted. CDC is in close communication with other jurisdictions, to monitor epidemiological links across borders.

The health professional behind the syringe: benefits of a pharmacist vaccination program

Presenter: Lisa M Nissen, Queensland University of Technology, Queensland

Authors: LM Nissen, ETL Lau, C Campbell, H Kastrissios, BD Glass, A Drovandi and M Rosenthal

Background: The Queensland Pharmacist Immunisation Pilot (QPIP) which ran in 2014 was Australia's first to allow pharmacists to administer vaccinations. An aim of QPIP was to investigate the benefits of trained pharmacists administering vaccinations in a community pharmacy setting.

Methods: Participant demographics and previous influenza vaccination experiences were recorded using *GuildCare* software. Participants also completed a 'post-vaccination satisfaction survey' following their influenza vaccination.

Results: A total of 10,889 participant records and 8,737 satisfaction surveys were analysed. Overall, 1.9% of the participants reported living with a chronic illness, and 22.5% were taking concomitant medications. As part of the consultation before receiving the vaccine, participants acknowledged the opportunity to discuss other aspects of their health with the pharmacist, including concerns about their general health, allergies, and other medications they were taking. It was worth noting that 17.5% of people would not have received an influenza vaccination if the QPIP service was unavailable. Additionally, approximately 10% of all participants were eligible to receive a free vaccination from the National Immunisation Program, but still opted to receive their vaccine from a pharmacist.

Conclusion: The findings from this pilot demonstrate the benefit of a pharmacist vaccination program in increasing vaccination rates, and have helped pave the way for expanding the scope of practice for pharmacists.

Harnessing the mobile phone market: SMS for salmonellosis public health follow-up

Presenter and author: Neil Franklin, Health Protection NSW

NSW has over 4000 salmonellosis notifications each year which makes public health follow up of most cases impractical. When follow-up does happen, it is often weeks later and the ability to prevent further cases has passed.

Between 24/1/2015–20/4/2015 all salmonellosis cases notified by electronic laboratory reporting (ELR) in NSW were sent an SMS asking them to reply with information on businesses they ate at prior to becoming ill. The SMS included a link to the fact sheet and a public health contact number.

1,449 salmonellosis cases were notified during the study period. 438 (30%) cases notified by ELR were sent the text asking for risk information. Preliminary results include 187 (42%) replies. 12% reported overseas travel and 7% reported only eating food at home. One outbreak was detected by this method with 2 cases reporting the same event. Six cases mentioned food venues that were already identified via direct complaint about the venue or later identified from cluster investigation

Texting proved to be a quick method to contact salmonellosis cases and gather specific risk information. This pilot extended to all cases may prove a useful way to collect important risk information and detect outbreaks quickly.

Challenges in the management of Ebola Virus Disease: Experience from Medecins sans Frontieres (Sierra Leone)

Presenter: Clair Mills, Medecins sans Frontieres

Authors: C Mills, R Kremer, G Caleo and K Lokuge

In response to the 2014 West Africa Ebola outbreak, Medecins Sans Frontieres (MSF) opened five Ebola treatment centres in Sierra Leone. Surveillance and contact tracing, health promotion and psychosocial support activities were also implemented. Treatment capacity was grossly inadequate from May to end November. With 450–600 reported cases per week, there were only three designated Ebola treatment centres in Sierra Leone functioning, two of them run by MSF.

As of 7 April 2015, MSF had admitted 2,405 patients, 1,572 who were confirmed with Ebola. 740 died (CFR 47%).

The nature of Ebola and the unprecedented scale of this outbreak, combined with the delayed national and international response, led to very challenging situations and ethical dilemmas for the MSF field teams. Staff were faced with overwhelming needs, a high case fatality rate and extremely limited treatment options – while working in physically and mentally gruelling conditions.

Balancing risks to staff versus benefits to patients; the limitations of clinical care for patients with Ebola in this context; prioritising resources for treatment compared with prevention and control; and the need for rapid implementation of new drug and vaccine trials versus pressing operational demands are some of the challenges that will be discussed.