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ABSTRACTS – IN ORDER OF PRESENTATIONS AND WHERE RECEIVED

PIGS, POTIONS AND PUBLIC HEALTH: INFECTIOUS DISEASES GENOMICS IN NEW ZEALAND AND BEYOND.Dr Deborah Williamson

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Whole-genome sequencing is revolutionising the diagnosis, detection and tracking of infectious diseases. The high degree of resolution provides information on a wide range of clinically and epidemiologically relevant characteristics of a pathogen, and will result in a paradigm shift in infectious diseases epidemiology. This talk will provide an overview of WGS technologies applied to public health, and will highlight the utility of this technology in the investigation of three national outbreaks of public health importance, namely *Yersinia pseudotuberculosis*, livestock-associated MRSA and antimicrobial-resistant *Campylobacter*. In all three of these outbreaks, the use of WGS provided information on transmission networks and source-tracking that would not have been detected using 'conventional' typing methods. In addition, SNP-based phylogeographic analysis of each of these outbreaks illustrate the unique characteristics of these strains in a global context, and provide important information on how pathogens emerge and evolve in an era of mass globalisation.

WHOLE-GENOME SEQUENCING OF MULTIDRUG-RESISTANT *MYCOBACTERIUM TUBERCULOSIS* FROM MYANMAR.

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Drug-resistant tuberculosis (TB) is a major threat to global health. Rapid detection of drug-resistant strains of *M. tuberculosis* is essential to treat patients with drug-resistant TB. Conventional laboratory procedures for drug susceptibility testing (DST) take several weeks due to the requirement for bacterial culture followed by laborious phenotypic testing. In an attempt to overcome this rate-limiting step, several genotypic DST assays such as the Xpert MTB/RIF diagnostic test have been developed. Unfortunately, these assays only interrogate the most frequent resistance mutations for a limited number of antibiotics. Whole-genome sequencing (WGS) has the potential to overcome this limitation and can be used to identify patients with drug-resistant tuberculosis. While WGS is being considered for routine diagnosis and management of drug-resistant TB in well-resourced, low-TB burden, settings, it is also important that new tools with the potential to improve TB control are adopted as early as possible where they are needed the most. We, therefore, conducted a preliminary evaluation of the potential utility of WGS and this talk will provide insights into the potential incorporation of WGS into routine clinical management of drug-resistant TB in Myanmar, one of the 22 high-burden tuberculosis countries, with a high prevalence of multidrug resistant-TB.

ANTIMICROBIAL RESISTANCE (AMR) AND THE ROLE OF VETERINARIANS IN GLOBAL HEALTH.Mark A. Bryan¹

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The New Zealand Veterinary Association (NZVA) recently launched their aspirational statement on antimicrobial

resistance (AMR) that 'by 2030, NZ Inc will not need antibiotics for the maintenance of health and welfare in animals'.

The driver for this strategic positioning has been the increasing call for a national 'One Health' approach to one of the gravest global threats to human health in recent times.

The science is complex and at times contradictory. A significant risk of debating the more complex science in public is that the general population will start to be disenfranchised by science *per se*. Yet the one aspect that all scientists agree on is that as use of antimicrobials increases the risk of AMR also increases.

The NZVA believes that veterinarians are well placed to provide leadership in the area of AMR, given that the profession is small and New Zealand is one of the lower users of antimicrobials in animals in the world.

Veterinarians' roles frequently place them at the intersection of the animal, human and environment in various capacities. Their involvement is an important part of a multi-disciplinary approach to global health.

NEW TECHNOLOGY TO ENABLE RELIABLE NUCLEIC ACID SAMPLE PREPARATION IN LOW RESOURCE SETTINGS.

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The rising importance of point-of-care technologies and qPCR-based diagnostics highlights the need for simple approaches to nucleic acid isolation that remove risks of sample cross-contamination and failed extraction.

Technologies based on blotting paper mediums have been developed but extraction efficiencies using these approaches are not at the levels required for routine point-of-care screening in low resource settings. We have invented a new nucleic acid extraction device that is fully self-contained and has no complex moving parts. We call this device the PDX. The PDX accepts the collected sample into a reservoir where it is incubated to cause tissue lysis and protein breakdown. The PDX is then triggered to change conformation expelling the sample lysate into a receptacle for qPCR diagnosis. The team has just received

substantial New Zealand government funding in the Smart Ideas program (MBIE) to develop the PDX technology. In this seminar we will give an overview of our invention and some initial experimental results.

SKELETAL GROWTH IN INFANTS AND CHILDREN WITH THE INTENSIFICATION OF AGRICULTURE FROM THE LATE PREHISTORIC SITE OF BAN NON WAT, NORTHEAST THAILAND.

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The bioarchaeological model predicts deterioration in population health with the adoption and intensification of agriculture. Bioarchaeological research in mainland Southeast Asia challenges this model, showing no clear pattern of health deterioration over time. To further test the applicability of the model in SE Asia, the study investigates childhood growth from the late prehistoric site of Ban Non Wat in Northeast Thailand. Linear and appositional growth patterns of infants and children (n=65) were compared from the Neolithic to the Iron Age (1750 B.C.- 430 A.D) for assessing variability between the periods which may indicate growth disturbances as a response to agricultural intensification over time. Comparative analysis of linear and appositional growth exhibited no significant differences in the growth of infants and children between the Neolithic, Bronze and Iron Age samples. These findings are consistent with other health research in prehistoric SE Asia. A gradual transition to intensified agriculture over time and retention of a broad-spectrum based diet in SE Asia may have buffered the population from the biological stress that is found in other prehistoric populations of the world during agricultural intensification.

ACCEPTABILITY OF A BEEF POWDER SUPPLEMENT AMONG YOUNG INDONESIAN CHILDREN AND THEIR CAREGIVERS.

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Micronutrient deficiencies are a public health concern among infants and young children in resource-poor countries. One promising approach to improve the nutritional status of children at risk is the use of a desiccated beef powder, which can be added to home-prepared foods and meals. Desiccated beef powder presents an accessible and affordable option as it is made up of under-utilised edible meat by-products such as liver. The optimal amount of beef powder and preferred use on complementary foods is unknown. Thus, we conducted a series of sensory acceptability studies of three different beef powder formulations and a beef flavoured placebo powder among 96 apparently healthy children aged 12-24 months and their caregivers in West Java, Indonesia. The study began in October 2015 and was conducted in 3 phases: 4-day direct observation feeding test, 2-week home use trial and focus group discussions aimed at collecting maternal reports of their child-feeding experiences during the home use trial. Preliminary results will be reported in the presentation. The findings will inform the design of a randomized controlled trial to test the effectiveness of a desiccated beef product as a home fortification strategy for preventing micronutrient deficiencies. Funding was provided by Meat & Livestock Australia.

THE PROBLEM OF DIABETES IN INDONESIA.

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In Indonesia, in 2014, the prevalence of diabetes in adults was 5.8%, with a total of 9.1 million of adults diagnosed with diabetes and 4.5 million of adults with undiagnosed diabetes. Recent studies have found that diabetes is a risk factor for developing tuberculosis. Therefore, diabetes could be a major threat as about 10% of world TB patients lived in Indonesia. The heavy financial burden of diabetes-related complications may also hinder the universal health coverage programme that has been implemented gradually since 2014.

The diabetes management in Indonesia poses many challenges, as it depends on people's perception about the disease and its modern treatment. Commonly, people have negative perception towards diabetes and unrealistic optimism about their risk factors, so that many of them are late diagnosed and only seek help after experiencing complications. Traditional or alternative medicine are also more favoured than modern medicines. This results in non-compliance in taking modern medicines. Many of them only

take medicines when they perceive that their condition deteriorated. Additionally, many diabetic patients also alternate or combine modern medicine with traditional or alternative medicines. Therefore, their blood glucose were never controlled.

This study will involve focus group discussions with diabetic people in urban and rural areas in two culturally diverse provinces in Indonesia.

CERVICAL CANCER INCIDENCE AND MORTALITY IN GHANA.

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Background: Cervical cancer is a very important public health issue in the world, with about 528,000 new cases and 266,000 deaths occurring in 2012. There is high disparity in the incidence of cervical cancer between high-income and low-income countries, and more than 85% of the disease occurs in low and middle-income countries. Cervical cancer ranks as the most frequent cancer among women in Ghana. The true incidence and outcomes of the disease in Ghana are not known.

Aim: To estimate the incidence and mortality rates of cervical cancer in Ghana.

Methods: Information on invasive cervical cancer cases diagnosed between 2010 to 2013 were collected from Komfo Anokye and Korle Bu Teaching Hospitals through review of medical, pathology and computer records at the oncology unit and the obstetrics and gynaecology department. These are the main referral centres and where patients with suspected malignancies are diagnosed and treated. Telephone interviews were also conducted with patients and relatives to gather further data. Patients with cervical cancer receive diagnosis and treatment at these hospitals. Data were recorded on a standardised study questionnaire and analysed using summary statistics.

Results: A total of 1,725 women with cervical cancer were included in the study. Their age ranged from 11-100 years with a mean of 56.9 years. Histology of primary tumor was the basis of diagnosis in 77.5% with clinical diagnosis accounting for 22.5%. For the 1,336 women with tumor grading information available, moderately differentiated tumors accounted for 34.5%. Late stage at presentation was common. The highest number of cases was reported for women aged 50-54 years. As expected, the incidence of cervical cancer increased with age. However, the incidence

was highest for the 75 to 79 year age group and begun to decrease at older ages. The estimated crude incidence rate was 11.6 (95% CI: 11.0-12.2) per 100,000 person-years, and the ASR rate (World standard population) for incidence was 18.7(95% CI: 17.8-19.6). This is higher compared with those reported in high-income countries.

Conclusions: Late stage at diagnosis is common. The incidence and mortality rate of cervical cancer in Ghana increased with age. The results from this study will inform policy decisions for the implementation of cervical cancer control strategy in Ghana.

REVIEW AND HARMONIZATION OF PHARMACEUTICAL POLICIES, LEGAL AND REGULATORY FRAMEWORKS IN EAST AFRICAN COMMUNITY (EAC).

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Background: African countries, as net importers of medicines, face challenges regarding availability, quality, affordability and safety of medicines. EAC, a regional-intergovernmental organization of five Partner States¹, has prioritized harmonization of pharmaceutical policies (NMPs), legal and regulatory frameworks to improve access. NMPs and regulatory systems of EAC were reviewed to inform the harmonization process.

Methodology: Data for this descriptive study were collected through document reviews and key informant interviews between May – June 2015 by a team of Pharmaceutical and legal experts. Representatives from Partner States ² validated the findings.

Findings: Countries are at different levels of developing and implementing NMPs and regulatory frameworks. Limited resources and capacity is delaying reform and enforcement. NMPs are implemented in three countries; four countries have legal frameworks for semi-autonomous Medicine Regulatory Authorities. Legislation needs to be reviewed to address all regulatory functions.

Recommendations: NMPs, legal and regulatory frameworks need to be harmonized to be in line with the EAC integration agenda.

¹ Republic of Burundi, Republic of Kenya, Republic of Rwanda, Republic of Uganda and United Republic of Tanzania

² Partner States experts were drawn from Ministries of Health, National Medicines Regulatory Authorities, Pharmaceutical Industry, Medical Stores Departments, Ministry of Justice and Ministry of Industry and Trade

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GLOBAL HEALTH AND LAW.

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Description: This paper illustrates how international legal trade frameworks are major determinants for global health. The prevention and control of noncommunicable disease (NCDs) is used as an example of a global health issue.

Background: The principal legal frameworks summarised in the paper relate to international trade, investment, and intellectual property (ITIIP law): law that is administered by the World Trade Organization and also trade agreements such as the Trans Pacific Partnership.

Analysis: The paper reviews health implications from ITIIP law that arise from assumptions, content, scope, and lack of focus on health objectives. While ITIIP law has implications for all health issues, including communicable disease, this paper focuses on noncommunicable disease (NCDs).

The ‘menu of options’ outlined by WHO for addressing NCDs include product bans (e.g. transfats), packaging/labelling requirements, import tariffs, sales taxes, subsidies, licences, restrictions on promotion and regulation of product content. All such options, even health education, can infringe international trade rules.

Discussion: The paper identifies options for reconstructing ITIIP law to promote, or at least not frustrate, health objectives. Additional international health law is also needed.

Conclusion: ITIIP law has potential risks, but need not, in principle, be inconsistent with health. Awareness among global health practitioners of ITIIP law implications is important, and identification of possible improvements law is required. New global law for global health should address such topics as alcohol and food, and health determinants.

GLOBAL TOBACCO CONTROL STRATEGIES: ARE THEY WORKING IN DEVELOPING COUNTRIES?

Prof Chris Bullen

University of Auckland.

Substantial progress in tobacco control has been made in recent few decades in much of the world. In New Zealand, for example, marked declines have occurred in youth smoking initiation, smoking prevalence and per capita consumption. These changes have resulted from sustained implementation of a set of strategies collectively known as the Framework Convention on Tobacco Control (FCTC): advertising and sponsorship bans, tobacco taxation,

smokefree environments, mass media campaigns and support for smokers to quit. However, the picture is not so positive for many parts of the world, where tobacco smoking remains a leading cause of lost years of healthy life and a source of health inequality, poverty and environmental damage. This is particularly true for low and middle-income countries, including many that are signatories to the FCTC. Weak legislation and corruption are enabling tobacco companies to market cheap tobacco with few restrictions; rapid population growth and changing social norms are driving an increase in the absolute numbers of smokers. In this lecture I argue that the FCTC is not working for all: a change in approach is needed if the premature tobacco-related deaths of hundreds of millions of people in low and middle income countries are to be prevented.

GETTING THE MESSAGE RIGHT: DEVELOPING A TEXT BASED TOBACCO CESSATION PROGRAMME IN SAMOA.

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Background: A text message smoking cessation tool is currently being adapted for use in Samoa. Samoa has a persistent high prevalence of tobacco use, few existing cessation support services, and high mobile connectivity.

Methods: Focus groups were conducted as part of a text message tobacco cessation initiative in Samoa. Groups of smokers were recruited to trial receiving text messages and report their experiences, preferences for message content, knowledge about quitting, and other issues deemed relevant to adapting the tool.

Results: Tobacco use is now a deeply entrenched social norm in Samoa; supported in part through easy and affordable access, previously relaxed smoking environments and minimal quitting support. Tobacco use is believed to make you 'strong', aid digestion and is entrenched in social life.

Mobile phones are ubiquitous and affordable in Samoa. Receiving cessation support messages via a mobile phone show promise. Text messages were considered salient, with smokers indicating a preference for hard-hitting, factual messages.

Conclusions: Mobile phones appear to be an acceptable and accessible mode of delivery for tobacco cessation, particularly in the absence of alternative support. However,

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adapting a text based programme in Samoa requires fastidious attention to nuances of culture, language and socio-political structures.

FEMALE EMPOWERMENT AND WELLBEING: EVIDENCE FROM AFRICA

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We use household survey data from Senegal to model the effects of empowerment within the home on married women's wellbeing. The estimated effects of empowerment are large, and of a similar magnitude to the effects of morbidity. The size of the empowerment effect is robust to alternative estimation techniques, including an Instrumental Variables estimator. Although the quality of women's informal social support networks has no significant direct effect on wellbeing, it does have a significant indirect effect through empowerment.

SPRAY-DRIED KANAMYCIN POWDER FOR INHALATION TO TREAT DRUG RESISTANT TUBERCULOSIS.

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Background: Kanamycin is used as an injectable agent for the treatment of drug resistant tuberculosis. It has adverse effects including hearing loss probably due to systemic exposure. Treatment of TB by inhaling kanamycin may be advantageous due to direct delivery to the lung, possibly reducing systemic side effects as it requires lower doses. This study aimed to develop inhalable kanamycin powders using aqueous and non-aqueous spray-drying techniques.

Methods: Kanamycin powders were produced by a Buchi Mini Spray-dryer. The powders were characterized for particle size, morphology, crystallinity and moisture content by laser diffraction, scanning electron microscopy, X-ray diffractometry and thermogravimetric analysis. A next generation impactor (NGI) was used to determine *in vitro* aerosolization.

Results: The powders of inhalable size range (1.6 -6.1 μm) were produced by both aqueous and non-aqueous spray-drying techniques. Powders were corrugated in shape, amorphous in nature and had low moisture content (~5.5

%). The powders produced by aqueous spray-drying aerosolised better (48.2 ± 0.9 % of the dose (20 mg) reached the 'lung' region of the NGI) than non-aqueous spray-drying (31.3 ± 1.8 %).

Conclusion: Kanamycin inhalable powder can be produced by spray-drying techniques. Deep lung delivery of these powders may be helpful for the effective treatment of drug resistant tuberculosis.

PHOSPHOLIPID-BASED PYRAZINAMIDE SPRAY-DRIED INHALABLE POWDERS FOR TREATING TUBERCULOSIS.

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Background: Sterilization of necrotic granulomas containing mycobacteria is difficult by oral and parenteral drug delivery of antibiotics. Pulmonary delivery of anti-tubercular drugs should increase the concentration of drug in the granulomas and thereby improve the sterilization. The current study aimed to develop spray-dried (SD) powders composed of pyrazinamide and 1,2-dipalmitoyl-sn-glycero-3-phosphatidylcholine (DPPC) to improve drug delivery to the deeper lung.

Methods: Pyrazinamide SD powders with varying amounts of DPPC (5, 15, and 15% w/w) were produced using a BUCHI B-290 Mini Spray-Dryer. The powders were characterized physicochemically (Karl Fischer titration, scanning electron microscopy, differential scanning calorimetry, hot-stage microscopy, thermogravimetric analysis, X-ray diffraction, Fourier transform infrared spectroscopy) and for their aerosol dispersion performance using a next generation impactor (NGI).

Results: All the SD powders had a narrow particle size distribution (1.29 to 4.26 μm) with low residual moisture (<2%). Solid state characterization confirmed that the α -polymorphic crystalline pyrazinamide transformed into the γ -polymorphic form during spray-drying. The SD powder with 25% w/w DPPC aerosolized best with a fine particle fraction of 73.2 ± 4.0 %.

Conclusion: Incorporating DPPC improved aerosolization of SD powders; however further evaluation of dissolution and alveolar macrophage uptake are necessary to determine the therapeutic potential of these powders for inhalation.

ANTIMICROBIAL RESISTANCE IN RECENT ENTEROBACTERIACEAE ISOLATES FROM SAMOA.

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Antimicrobial resistance is a global concern, with multi-resistant organisms causing difficulties in the management and treatment of severe infections. We investigated the prevalence of antibiotic resistance in 270 non-duplicate isolates of *Enterobacteriaceae* species collected from the Tupua Tamasese Mea'ole Hospital, July 2014–Jan 2015. Minimum inhibitory concentrations were determined using the Phoenix™ Automated Microbiology System and results interpreted using Clinical and Laboratory Standards Institute guidelines (2012).

Despite participating in External Quality Assessments, only 54% of all isolated collected were found to be correctly identified. Of the 125 isolates that were misidentified, 35% (n=94) had both genus and species incorrectly reported. Furthermore, antimicrobial susceptibility results were inconsistent, with multi-resistant organisms reported as "susceptible" or "no growth".

Non-susceptibility to third-generation cephalosporins was <20% (ceftriaxone 19%, ceftazidime 9%), with 18% and 16% of isolates non-susceptible to gentamicin and ciprofloxacin respectively. 6.7% and 8.1% of all isolates showed resistance to ertapenem and cefepime respectively, despite limited use of these agents locally. These resistance rates are higher than those reported by WHO (2014).

These results highlight the impact of the lack of qualified microbiology staff. Local processes and procedures need significant improvement, in order to determine the true prevalence of antimicrobial resistance in Samoa.

ESTIMATING THE BURDEN OF FUNGAL DISEASE IN VIETNAM: AN ACTUARIAL APPROACH TO DESCRIBE THE 2012 INCIDENCE AND PREVALENCE OF DISEASE BASED ON AVAILABLE RISK-FACTOR DATA.

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Background: There are limited epidemiological data on fungal infections in Vietnam, yet their incidence is likely to rise as healthcare developments create more iatrogenic risk factors. We estimated baseline incidence and prevalence of selected serious fungal infections for the year 2012.

Methods: We made these estimates using a previously described actuarial method, which takes incidence and prevalence of risk factors for fungal infections and applies multipliers. Wherever possible, risk factor data were local.

Results: We estimated 2,352,748 serious fungal infections occurred in Vietnam in 2012. Frequent conditions included recurrent vaginal candidiasis (3893 / 100,000 women annually), tinea capitis (457 / 100,000 annually), and chronic pulmonary aspergillosis (61 / 100,000 / five year period). We estimated 140 cases of cryptococcal meningitis, 206 of penicilliosis and 608 of *Pneumocystis jiroveci* pneumonia.

Conclusions: This is the first summary of Vietnamese fungal infections. The majority of severe disease is due to *Aspergillus* species, driven by the high prevalence of pulmonary tuberculosis. The AIDS epidemic highlights opportunistic infections, such as penicilliosis and cryptococcosis, which may complicate immunosuppressive treatments. These estimates provide a useful indication of disease prevalence to inform future research and resource allocation but should be verified by further epidemiological approaches.

NEGLECTED TROPICAL DISEASES IN PREHISTORY: SKELETAL EVIDENCE OF DIFFERENTIAL DIAGNOSIS FROM NORTHEAST THAILAND.

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Background: The prehistoric disease environment is an important component of the evolution of infectious disease and contributes to our understanding of the interaction of infectious pathogens with human cultural and biological adaptations. This paper aims to develop an understanding of the burden of infectious diseases in a large, well-preserved archaeological population from Northeast Thailand.

Methods: The sample ($N = 201$) from Ban Non Wat (1750–420 B.C.) lived during an important time in prehistory at the beginnings of agriculture with changing social complexities. The skeletal material was macroscopically examined for the presence of proliferative periosteal reactions, indicative of an inflammatory bony response. These lesions were subsequently quantified at both the individual and population level.

Results: The analysis indicates that 85 individuals (42%) have evidence of a systemic infection. A differential diagnosis carried out at the population level provides insight into the possible infectious microorganisms, such as *Burkholderia pseudomallei*, and *Opisthorchis viverrini*.

Conclusions: This paper enhances the limited scientific information on the prehistoric disease environment in tropical Northeast Thailand, and contributes to the global information on neglected infectious diseases.

MCAULEY ORATION

ANTIBIOTIC RESISTANCE IN THE GENOMIC ERA: COMBATING A MAJOR THREAT TO GLOBAL HEALTH.

Sharon Peacock

Director of the Bloomsbury Research Institute

The latest generation of DNA sequencing platforms can provide an accurate whole genome sequence for a broad range of bacteria in less than a day, and large reference genome datasets at low cost. These could be employed in diagnostic and public health microbiology to more effectively contain and treat the spread of multidrug resistant pathogens. This talk will describe the emergence and impact of antibiotic resistance, together with the opportunities that microbial genome sequencing presents for surveillance, the investigation of nosocomial outbreaks, and the identification of genetic determinants of antimicrobial resistance associated with a stratified medicine approach to patient care.

THE ECONOMICS OF MASS DEWORMING PROGRAMS.

Sarah Baird

Department of Global Health, Milken Institute School of Public Health, George Washington University

Although intestinal worm infections can be treated using safe, low-cost drugs, some have challenged the view that mass school-based deworming should be a policy priority. This debate has been exemplified in what has become popularly known as the "Worm Wars." My talk will focus on

the economics—both theory and evidence—on the policy choice around public subsidies for deworming.

DIETARY HABITS AND PHYSICAL ACTIVITY OF ASIAN IMMIGRANTS IN HOME AND HOST (NZ) COUNTRY: FINDINGS OF THE MIGRANT HEALTH PILOT STUDY.

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Background and Aims: Diet and physical activity are well established modifiable determinants of non-communicable diseases. However, little is known about the changes in these factors after migration among people of Chinese and Indian ethnicities, the two largest Asian subgroups in New Zealand. The aim of this pilot study was to investigate dietary habits and physical activity in their respective home countries and in New Zealand.

Methods: A two staged cross-sectional survey of first generation Chinese ($n = 51$) and Indian migrants ($n = 29$) was conducted and data on nutrition and physical activity in home and host country were collected via self-completed or interviewer administered questionnaires.

Results: About half of Chinese and Indian participants reported having increased fruit consumption, in contrast one in five reported eating less vegetables in New Zealand. Some shift in the patterns of consuming fast food, sugar drinks, mode of transportation, recreational and sedentary activities between home and host countries were also observed.

Conclusions: The results of this pilot study provide impetus to further investigate the changes in modifiable disease risk factors to better understand the trajectories of diet related disease prevalence among these Asian sub-groups both in the home and host country.

MODELLING CHOLERA AND MALARIA IN HISTORICAL PERSPECTIVE: DATABASE AND METHODS OF ANALYSIS.

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Identifying the drivers of temporal patterns in human diseases, such as malaria and cholera, are essential for disease control, but require fine scale, spatiotemporal data. Previous studies have discovered different climatological drivers appearing in different locations. Commonly studied

drivers of malaria, including temperature and rainfall, may significantly influence transmission, but lags between weather events and changes in malaria transmission may vary. Therefore, understanding infectious disease transmission requires modelling approaches that capture seasonal patterns at both small and large spatial scales. Here we present data on, and preliminary analyses, of spatially varying rainfall and temperature and fever and cholera mortality from three different climatic regions within British India. The data span a 38 year time period and are from a population of approximately 27 million people. Preliminary analyses suggest distinct disease patterns driven by strong, seasonally driven climatic changes."

WHY CITIZENS DON'T 'COMPLAIN' OR HAVE 'VOICE'? : A CASE STUDY FROM NEPAL'S RURAL PRIMARY HEALTH CARE SYSTEM.

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Background: In recent decades the Government of Nepal has introduced different voice mechanisms into its Primary Health Care system, but little is known about how Nepali citizens complain. The purpose of the study is to explore the mechanisms by which citizens complain about health care services, and to gauge the responsiveness to their complaints by health service providers.

Methods: Using interviewer-administered structured questionnaires, 400 interviews were conducted with service users, Health Facility Management Committee (HFMC) members and service providers from 22 public health facilities in the Dang District. In addition, qualitative interviews with 39 key informants, including citizens, were conducted to provide detailed and contextual insights. Quantitative data were analysed using IBM SPSS 22; qualitative interviews were transcribed and then analysed using QSR NVivo 10. Ethical approval was obtained from the Human Ethics Committee of Otago University and Nepal Health Research Council, and written consent was granted by all participants.

Results: Citizens had grievances/suggestions with the health system, but they didn't complain frequently. Of health facility patients, 9% reported making complaints about the health facility services. Complaints made were about availability and accessibility of medicines, health facility opening hours, staff behaviour and regularity. There were no explicit differences about the types of complaints made individually or collectively. Generally, complaints were made verbally to health providers either in-person or by phone.

Those who couldn't speak directly to health workers did make complaints indirectly such as via HFMC members, community health volunteers or friends. Use of formal channels such as suggestion boxes or written complaints were almost non-existent. More than two thirds of complainants (n=20) said that they either didn't have a response to their complaint or were dissatisfied with the response. There was no systematic way of managing complaints or of maintaining proper records for subsequent analysis. Reasons given for not complaining included: a lack of complaint channels; lack of knowledge regarding service entitlements and complaint channels; power asymmetry between health workers and citizens; health workers' attitudes; lack of exit options for citizens, and perceived lack of responsiveness to complaints.

Conclusions: Very few citizens made complaints to primary health care services in Nepal, and the responsiveness to complaints was perceived as poor. Several factors related to community and the health system were identified which hinder citizens voice and service provider responsiveness. There appears to be a need to increase awareness among citizens about service entitlements and voice mechanisms; and to increase service provider responsiveness to complaints lodged.

NONGOVERNMENT ORGANISATIONS AS HEALTHCARE PROVIDER IN WESTERN NEPAL: OUTCOMES, CHALLENGES AND SUSTAINABILITY.

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Access to healthcare and medicines is one of the major healthcare problems of Nepal, especially in rural areas. Nongovernment organisations (NGOs) have long been working directly and indirectly in the health sector to fill in this gap. As part of a case study on access to and use of medicines, we carried out a study on the contributions of NGOs in the health sector in Western Nepal. This involved interviews and observations of NGOs working in the health sector. The result showed that NGOs were running health posts, clinics and hospitals which were providing primary and secondary level healthcare. Some of them were charging a fee for health services and medicines while some were not. The NGO-run health facilities contained adequate medicines, better trained human resources and equipment compared to corresponding public health facilities. However, they had problems with health facility management, coordination with the government, working with the local community and sustainability. The study

showed that the NGO-run health facilities improved rural people's access to primary and secondary healthcare but they need to improve their management practice, coordination with the government and local community, and review their financing mechanism in view of the global funding crunch.

WHO PRESENTS AT EYE HEALTH OUTREACH CLINICS IN THE PACIFIC ISLANDS?

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Background: Anecdotal reports indicate a decreasing number of patients presenting for assessment, and in particular a reduction in the number of patients requiring cataract surgery in Pacific Island Countries (PIC)s. This study describes patient data from eye health outreach clinics in seven Pacific Islands.

Methods: Routine data collected at The Fred Hollows Foundation NZ eye health outreach clinics in Fiji, Kiribati, Papua New Guinea (PNG), Samoa, the Solomon Islands, Tonga and Vanuatu between 2009 and 2013 were analysed.

Results: Overall the number of patients treated per clinic fell in Fiji, Samoa and the Solomon Islands. Data from PNG show a higher mean number of patients per clinic and the numbers of patients presenting at PNG outreach clinics appears to be increasing. Cataract was identified in 40% - 70% of visits overall, but this range varied between 14% (PNG) and 94% (Fiji). Refractive error was the most common presenting complaint at PNG outreach clinics; diabetic retinopathy was most common in Tonga. Cases of trachoma or trichiasis were identified in all countries, excepting Kiribati, Samoa and Tonga.

Conclusion: Data from outreach eye health clinics show marked differences between Pacific island countries in the most common presenting conditions.

THE EVOLUTION OF AN EPIDEMIC: AN UNINTENTIONAL ETHNOGRAPHY OF EBOLA.

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The Ebola outbreak in West Africa was first reported in March 2014, and quickly became the deadliest occurrence of the disease since its discovery in 1976. By September 2015 there had been 15,232 confirmed cases of Ebola, with

11,306 resulting in death. During the early months of the outbreak, I was living in Sierra Leone, undertaking fieldwork on rural livelihoods in Kayima and Panguma, two small villages in the country's Eastern Province. Drawing on observations made in my fieldwork diary and blog entries, as well as more traditional techniques such as interviews and focus groups, this paper presents an unintentional ethnography of the Ebola outbreak. It will discuss the dissemination of, and local reaction to, information regarding the initial spread and threat of Ebola, and will contextualise this within the global response, highlighting how initial indifference at both the local and global scales helped facilitate the rapid spread of the disease. It will then discuss the implications of this outbreak in the context of my research, highlighting the impact that Ebola has had on already vulnerable livelihoods in rural Sierra Leone.

THE POTENTIAL FOR AN OTITIS MEDIA PUBLIC HEALTH PROGRAMME IN FIJI.

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Background: Chronic OM is a major public health problem in low- to middle- income countries and within certain high-risk populations in high-income settings, despite it being largely preventable. Although a high prevalence of the disease is estimated within Pacific Island populations, a paucity of accurate, country-specific data has contributed to poor awareness of the disease, and thus, a lack of investment to develop sustainable prevention and treatment strategies.

Methods: 1. A systematic review was conducted to understand the elements of an effective programme to ameliorate the consequences of OM.
2. Key informant interviews were conducted to contribute to a better contextual understanding of the potential for an OM programme in Fiji.

Data was analysed using Thematic Analysis methodologies.

Results & Conclusions: Despite significant challenges in service provision and resource availability, a sustainable OM programme is feasible, but will require long-term commitment, and close collaboration, between intersectoral partners. Any intervention will need to be structured as part of a broader public health programme, integrated into the local health, education and social system, have provision for funding and support health worker training. This study also highlights an urgent need for accurate country-based epidemiological data on OM in Pacific Island populations.

AN EVALUATION OF A WORLD VISION WATER, HYGIENE AND SANITATION (WASH) PROJECT ON TANNA ISLAND, VANUATU.

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Background: In 2013, World Vision implemented a three year Water, Hygiene and Sanitation (WASH) Project on the island of Tanna, Vanuatu. The overall goal of the project was to reduce child undernutrition, with a long-term outcome of healthier children and families. This research aimed to evaluate the Project on its expected outcomes after two years of implementation, including WASH facilities, knowledge, and practices; drinking water safety; and child health.

Methods: We used a mixed methods approach to data collection, including household surveys, household observations, and anthropometric measures. Drinking water safety was assessed both at the household and at the source water using compartment bag testing (Aquagenx, USA).

Results: We found that of 201 households studied, 191 (95.0%) had an *Escherichia coli* most probable number (MPN) of <1 per 100 mL. Of 303 children, 35 (11.6%) were reported to have had diarrhea in the two weeks preceding the survey. Of 297 children receiving anthropometric evaluation, 145 (48.8%) were stunted. Of 208 households, 202 (97.1%) had improved sanitation facilities and 106 (51.0%) had operational handwashing facilities. Of 208 caregivers, 190 (91.3%) could identify when to wash their hands for microbiologic safety, and 155 (74.5%) reported washing their hands the last 24 hours.

Conclusions: We found that the Project had achieved improvements in WASH and health knowledge, and WASH facilities. However, to achieve its long-term outcome of healthier children and families, knowledge improvements need to equate to behaviour changes. Most drinking water was microbiologically unsafe, a problem that will be addressed by increasing access to improved drinking water from protected sources.

EXPLORING THE IMPACT OF SOCIO-ECONOMIC FACTORS ON THE RISK OF PNEUMONIA IN CHILDREN LESS THAN 5-YEARS OLD IN BASSE, THE RURAL GAMBIA.

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Background: Pneumonia remains a leading cause of child mortality despite our improved understanding of the disease and existing interventions targeting traditional risk factors, such as malnutrition and indoor air pollution. Growing research supports a holistic approach to reducing child mortality that addresses socio-economic determinants of health. In The Gambia, research has linked factors such as caregivers' lack of assistance with domestic duties, education, or financial autonomy with increased risk of child mortality. Similarly, we investigated whether aforementioned socioeconomic factors also influenced the risk of childhood pneumonia.

Methods: We conducted a case-control study in Basse Health and Demographic Surveillance System (BHDSS) area, with ethical approval from Medical Research Council and The Gambian government. Fieldworkers administered questionnaires to consenting caregivers of cases ($n=228$) and controls ($n=448$) in local languages. Cases were aged 2 to 59-months, BHDSS resident, and enrolled in Pneumococcal Surveillance Program with radiological-confirmed pneumonia between May and August 2009. For each case, two age-matched controls were recruited from the BHDSS (+/-2 months). Univariate odds ratios were calculated for each variable. Change-in-estimate methodology was used to select confounders for multivariate analysis, with +/-10% change required for inclusion.

Findings: Univariate analysis showed odds of childhood pneumonia were significantly lower if caregivers had someone to help prepare meals (OR: 0.33; 95% confidence interval, CI: 0.12-0.93); had someone to give advice about health (OR: 0.44; CI: 0.23-0.85); or if they could decide how other's income was spent (OR: 0.29, CI: 0.09-0.94). Odds were higher if caregivers were not confident with reading (OR: 10.60, CI: 2.03-55.25); not confident they had someone to borrow money from for emergency (OR: 6.25, CI: 1.2-32.5); or if they did not prioritise avoiding illness (OR: 2.00, CI: 1.11-3.60). Traditional risk factors such as lack of

exclusive breast feeding or exposure to indoor smoking did not meet statistical significance.

Interpretation: Although interpretation is incomplete while multivariate analysis is underway, results suggest that social supports and autonomy afforded to caregivers, as well as their beliefs about health influence their children's risk of pneumonia. Understanding these socioeconomic influences may result in more holistic strategies for managing and preventing childhood pneumonia.

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KERNEL DENSITY-RATIO SURFACES FOR ESTIMATION OF GEOGRAPHICAL RELATIVE RISK, WITH AN APPLICATION TO PNEUMOCOCCAL DISEASE AND RADIOLOGICAL PNEUMONIA IN THE GAMBIA.

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The kernel estimator of the so-called 'density-ratio' or 'relative risk' surface is growing in popularity among epidemiologists and public health researchers, serving as an informative tool for exploring the spatial fluctuations in the continuous risk of disease contraction over some two-dimensional spatial region. In recent years the statistical methodology has expanded, with flexible improvements including spatially adaptive smoothing regimens and techniques for detecting statistically significant peaks and troughs appearing in the literature. In this talk, we provide an overview of the statistical methods involved, and show them in action as we compare distributions of vaccine-based subtype-specific cases of invasive pneumococcal disease and radiological pneumonia in The Gambia.

BARRIERS AND FACILITATORS TO GUIDELINE IMPLEMENTATION STRATEGIES TO IMPROVE OBSTETRIC CARE IN LOW AND MIDDLE INCOME COUNTRIES (LMIC): QUALITATIVE EVIDENCE SYNTHESIS

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Background: Clinical guidelines and their implementation strategies are seen as crucial to improving obstetric care in LMIC. For these strategies to be effective we need a better understanding why implementation works in some contexts, and not in others, and how sustainability of quality improvement can be achieved. We aimed to synthesise qualitative research on guideline implementation strategies for LMIC obstetric care to identify barriers and facilitators to successful implementation. The review was conducted in parallel with a quantitative effectiveness systematic review.

Methods: Systematic review using “best fit” framework synthesis. **Setting:** LMIC obstetric facilities; **Participants:** health professionals and paramedical professionals located in health facilities from tertiary to primary level, and those working in communities. **Guideline implementation strategies:** a) distribution of educational materials, b) educational meetings, c) Local consensus processes, d) Educational outreach visits, e) Local opinion leaders, f) Audit and feedback and g) Reminders.

Results: Nine studies were included. The majority (seven) evaluated implementation of audit. The synthesis utilised a “stages of change” conceptual framework to identify barriers and facilitators related to pre-implementation, implementation and institutionalisation of the guideline implementation strategies.

Conclusions: Our set of barriers and facilitators are likely to be transferable to guideline implementation in other LMIC clinical settings.

IMPACT OF PNEUMOCOCCAL CONJUGATE VACCINATION ON INVASIVE PNEUMOCOCCAL DISEASE IN THE GAMBIA

Grant A Mackenzie, Philip C Hill, David J Jeffries, Momodou Jasseh, Kim Mulholland, Martin Antonio, Sana Sambou, Maria Knoll, Orin S Levine, Stephen R Howie, Richard A Adegbola, Brian M Greenwood, Tumani Corrah and the Gambian PCV Evaluation Group

Background: Pneumococcal conjugate vaccines (PCV) have been introduced widely but there is little information on their impact in developing countries. We measured the impact of PCV on invasive pneumococcal disease (IPD) in The Gambia.

Methods: The 7-valent vaccine (PCV7) was introduced into routine use in August 2009, followed by PCV13 in May 2011. We conducted population-based surveillance for IPD among those aged 2 months and greater within a demographic surveillance area. Standardised criteria were used to identify

and investigate patients. We compared the incidence of IPD between baseline (May 12, 2008 – May 11, 2010) and PCV13 periods (January 1, 2013 – December 31, 2014), adjusting for changes in case ascertainment.

Findings: We investigated 14 650 patients and identified 320 cases of IPD. Compared with baseline, incidence of IPD decreased by 55% (95% CI 30%, 71%) in the 2–23 month age group, from 253 to 113 per 100 000 in 2013/14. This was due to an 82% (64%, 91%) reduction of serotypes covered by PCV13. Despite limited vaccine coverage in the 2–4 years age group, IPD decreased in this group by 56% (25%, 75%), from 113 to 49 per 100 000, with a 68% (39%, 83%) reduction in PCV13 serotypes. The incidence of non-PCV13 serotypes in children 2–59 months of age trended upwards from 28 to 41 per 100 000, with a broad range of serotypes responsible. The incidence of non-pneumococcal bacteraemia varied little over time.

Interpretation: The Gambian PCV programme reduced the incidence of IPD in young children by approximately 55%. Further surveillance is needed to determine the maximum impact in older children and adults, and to monitor serotype replacement.