

MEDLARS BIBLIOGRAPHY

PUBLICATIONS OF RELEVANCE TO PAPUA NEW GUINEA AND MELANESIA

Bibliographic Citation List generated from MEDLARS

- 1 **Australian Nursing Journal.**
Many Solomon Islands nurses disengaged with services.
Aust Nurs J 2013 Feb;20(7):36.
- 2 **Australian Nursing Journal.**
Manus Island policy fails asylum seekers.
Aust Nurs J 2013 Apr;20(9):50-51.
- 3 **Arnott A, Barnadas C, Senn N, Siba P, Mueller I, Reeder JC, Barry AE.**
High genetic diversity of *Plasmodium vivax* on the north coast of Papua New Guinea.
Am J Trop Med Hyg 2013 Jul;89(1):188-194. doi: 10.4269/ajtmh.12-0774. Epub 2013 May 20.
Despite having the highest *Plasmodium vivax* burden in the world, molecular epidemiological data from Papua New Guinea (PNG) for this parasite remain limited. To investigate the molecular epidemiology of *P. vivax* in PNG, 574 isolates collected from four catchment sites in East Sepik (N = 1) and Madang (N = 3) Provinces were genotyped using the markers MS16 and msp1F3. Genetic diversity and prevalence of *P. vivax* were determined for all sites. Despite a *P. vivax* infection prevalence in the East Sepik (15%) catchments less than one-half the prevalence of the Madang catchments (27-35%), genetic diversity was similarly high in all populations (He = 0.77-0.98). High genetic diversity, despite a marked difference in infection prevalence, suggests a large reservoir of diversity in *P. vivax* populations of PNG. Significant reductions in transmission intensity may, therefore, be required to reduce the diversity of parasite populations in highly endemic countries such as PNG.
- 4 **Arya SC, Agarwal N.**
Apropos "evaluation of serological diagnostic tests for typhoid fever in Papua New Guinea using a composite reference standard".
Clin Vaccine Immunol 2013 Feb;20(2):317. doi: 10.1128/CVI.00635-12.
- 5 **Atkins KE, Townsend JP, Medlock J, Galvani AP.**
Epidemiological mechanisms of genetic resistance to kuru.
J R Soc Interface 2013 Jun 5;10(85):20130331. doi: 10.1098/rsif.2013.0331. Print 2013 Aug 6.
Transmissible spongiform encephalopathies (TSEs), such as kuru, are invariably fatal neurodegenerative conditions caused by a malformation of the prion protein. Heterozygosity of codon 129 of the prion protein gene has been associated with increased host resistance to TSEs, although the mechanism by which this resistance is achieved has not been determined. To evaluate the epidemiological mechanism of human resistance to kuru, we developed a model that combines the dynamics of kuru transmission and the population genetics of human resistance. We fitted our model to kuru data from the epidemic that occurred in Papua New Guinea over the last hundred years. To elucidate the epidemiological mechanism of human resistance, we estimated the incubation period and transmission rate of kuru for codon 129 heterozygotes and homozygotes using kuru incidence data and human genotype frequency data from 1957 to 2004. Our results indicate that human resistance arises from a combination of both a longer incubation period and reduced susceptibility to infection. This work provides evidence for balancing selection acting on a human population and the mechanistic basis for the heterozygote resistance to kuru.
- 6 **Baker A, Mayo M, Owens L, Burgess G, Norton R, McBride WJ, Currie BJ, Warner J.**
Biogeography of *Burkholderia pseudomallei* in the Torres Strait islands of Northern Australia.
J Clin Microbiol 2013 Aug;51(8):2520-2525. doi: 10.1128/JCM.00418-13. Epub 2013 May 22.
It has been hypothesized that biogeographical boundaries are a feature of *Burkholderia pseudomallei* ecology, and they impact the epidemiology of melioidosis on a global scale. This study examined the relatedness of *B. pseudomallei* sourced from islands in the Torres Strait of Northern Australia to determine if the geography of isolated island communities is a determinant of the organisms' dispersal. Environmental sampling on Badu Island in the Near Western Island cluster recovered a single clone. An additional 32 clinical isolates from the region were sourced. Isolates were characterized using multilocus sequence typing and a multiplex PCR targeting the flagellum gene cluster. Gene cluster analysis determined that 69% of the isolates from the region encoded the ancestral *Burkholderia thailandensis*-like flagellum and chemotaxis gene cluster, a proportion significantly lower than that reported from mainland Australia and consistent with observations of isolates from southern Papua New Guinea. A goodness-of-fit test indicated that there was geographic localization of sequence types throughout the archipelago, with the exception of Thursday Island, the economic and cultural hub of the region. Sequence types common to mainland Australia and Papua New Guinea were identified. These findings demonstrate for the first time an environmental reservoir for *B. pseudomallei* in the Torres Strait, and multilocus sequence typing suggests that the organism is not randomly distributed throughout this region and that seawater may provide a barrier to dispersal of the organism. Moreover, these findings support an anthropogenic dispersal hypothesis for the spread of *B. pseudomallei* throughout this region.
- 7 **Barry AE, Schultz L, Senn N, Nale J, Kiniboro B, Siba PM, Mueller I, Reeder JC.**
High levels of genetic diversity of *Plasmodium falciparum* populations in Papua New Guinea despite variable infection prevalence.
Am J Trop Med Hyg 2013 Apr;88(4):718-725. doi: 10.4269/ajtmh.12-0056. Epub 2013 Feb 11.
High levels of genetic diversity in *Plasmodium*

- falciparum* populations are an obstacle to malaria control. Here, we investigate the relationship between local variation in malaria epidemiology and parasite genetic diversity in Papua New Guinea (PNG). Cross-sectional malaria surveys were performed in 14 villages spanning four distinct malaria-endemic areas on the north coast, including one area that was sampled during the dry season. High-resolution msp2 genotyping of 2,147 blood samples identified 761 *P. falciparum* infections containing a total of 1,392 clones whose genotypes were used to measure genetic diversity. Considerable variability in infection prevalence and mean multiplicity of infection was observed at all of the study sites, with the area sampled during the dry season showing particularly striking local variability. Genetic diversity was strongly associated with multiplicity of infection but not with infection prevalence. In highly endemic areas, differences in infection prevalence may not translate into a decrease in parasite population diversity.
- 8 **Beebe NW, Ambrose L, Hill LA, Davis JB, Hapgood G, Cooper RD, Russell RC, Ritchie SA, Reimer LJ, Lobo NF, Syafruddin D, van den Hurk AF.** Tracing the tiger: population genetics provides valuable insights into the *Aedes (Stegomyia) albopictus* invasion of the Australasian Region. *PLoS Negl Trop Dis* 2013 Aug 8;7(8):e2361. doi: 10.1371/journal.pntd.0002361. eCollection 2013.
- BACKGROUND: The range of the Asian tiger mosquito *Aedes albopictus* is expanding globally, raising the threat of emerging and re-emerging arbovirus transmission risks including dengue and chikungunya. Its detection in Papua New Guinea's (PNG's) southern Fly River coastal region in 1988 and 1992 placed it 150 km from mainland Australia. However, it was not until 12 years later that it appeared on the Torres Strait islands. We hypothesized that the extant PNG population expanded into the Torres Strait as an indirect effect of drought-proofing the southern Fly River coastal villages in response to El Niño-driven climate variability in the region (via the rollout of rainwater tanks and water storage containers).
 METHODOLOGY/PRINCIPAL FINDINGS: Examination of the mosquito's mitochondrial DNA cytochrome oxidase I (COI) sequences and 13 novel nuclear microsatellites revealed evidence of substantial intermixing between PNG's southern Fly region and Torres Strait island populations essentially compromising any island eradication attempts due to potential of reintroduction. However, two genetically distinct populations were identified in this region comprising the historically extant PNG populations and the exotic introduced population. Both COI sequence data and microsatellites showed the introduced population to have genetic affinities to populations from Timor Leste and Jakarta in the Indonesian region. CONCLUSIONS/SIGNIFICANCE: The *Ae. albopictus* invasion into the Australian region was not a range expansion out of PNG as suspected, but founded by other, genetically distinct population(s), with strong genetic affinities to populations sampled from the Indonesian region. We now suspect that the introduction of *Ae. albopictus* into the Australian region was driven by widespread illegal fishing activity originating from the Indonesian region during this period. Human sea traffic is apparently shuttling this mosquito between islands in the Torres Strait and the southern PNG mainland and this extensive movement may well compromise *Ae. albopictus* eradication attempts in this region.
- 9 **Boonthanom L.** Working in Papua New Guinea volunteer vacancy. *Aust Nurs J* 2013 Feb;20(7):20.
- 10 **Breed AC, Meers J, Sendow I, Bossart KN, Barr JA, Smith I, Wacharapluesadee S, Wang L, Field HE.** The distribution of henipaviruses in Southeast Asia and Australasia: is Wallace's Line a barrier to Nipah virus? *PLoS One* 2013 Apr 24;8(4):e61316. doi: 10.1371/journal.pone.0061316.
- Nipah virus (NiV) (Genus *Henipavirus*) is a recently emerged zoonotic virus that causes severe disease in humans and has been found in bats of the genus *Pteropus*. Whilst NiV has not been detected in Australia, evidence for NiV infection has been found in pteropid bats in some of Australia's closest neighbours. The aim of this study was to determine the occurrence of henipaviruses in fruit bat (Family Pteropodidae) populations to the north of Australia. In particular we tested the hypothesis that Nipah virus is restricted to west of Wallace's Line. Fruit bats from Australia, Papua New Guinea, East Timor and Indonesia were tested for the presence of antibodies to Hendra virus (HeV) and Nipah virus, and tested for the presence of HeV, NiV or henipavirus RNA by PCR. Evidence was found for the presence of Nipah virus in both *Pteropus vampyrus* and *Rousettus amplexicaudatus* populations from East Timor. Serology and PCR also suggested the presence of a henipavirus that was neither HeV nor NiV in *Pteropus alecto* and *Acerodon celebensis*. The results demonstrate the presence of NiV in the fruit bat populations on the eastern side of Wallace's Line and within 500 km of Australia. They indicate the presence of non-NiV, non-HeV henipaviruses in fruit bat populations of Sulawesi and Sumba and possibly in Papua New Guinea. It appears that NiV is present where *P. vampyrus* occurs, such as in the fruit bat populations of Timor, but where this bat species is absent other henipaviruses may be present, as on Sulawesi and Sumba. Evidence was obtained for the presence of henipaviruses in the non-Pteropid species *R. amplexicaudatus* and *A. celebensis*. The findings of this work fill some gaps in knowledge in geographical and species distribution of henipaviruses in Australasia which will contribute to planning of risk management and surveillance activities.
- 11 **Brown AM.** Nursing accounting competencies related to HIV in a Papua New Guinea context. *J Assoc Nurses AIDS Care* 2013 Sep-Oct;24(5):e25-34. doi: 10.1016/j.jana.2012.09.002. Epub 2012 Dec 17.
- Nursing administration is an important part of the campaign to eliminate HIV across Papua New Guinea (PNG). This paper considers the critical importance of developing nursing leadership in effective accounting competencies in relation to HIV projects in PNG. The results of the study's textual analysis of audit reports of the Auditor General of PNG revealed a failure on the part of PNG's main health agencies involved with its national HIV program to provide competent financial reporting. In light of these results, this study shows how improving accounting and other financial competencies among nursing leaders would benefit the implementation of the PNG HIV national strategy. The findings of this study have implications not only for the internal control of HIV nursing competencies

but also for nursing leadership related to HIV issues in a developing country context.

- 12 **Burkot TR, Russell TL, Reimer LJ, Bugoro H, Beebe NW, Cooper RD, Sukawati S, Collins FH, Lobo NF.**

Barrier screens: a method to sample blood-fed and host-seeking exophilic mosquitoes.

Malar J 2013 Feb 5;12:49. doi: 10.1186/1475-2875-12-49.

BACKGROUND: Determining the proportion of blood meals on humans by outdoor-feeding and resting mosquitoes is challenging. This is largely due to the difficulty of finding an adequate and unbiased sample of resting, engorged mosquitoes to enable the identification of host blood meal sources. This is particularly difficult in the south-west Pacific countries of Indonesia, the Solomon Islands and Papua New Guinea where thick vegetation constitutes the primary resting sites for the exophilic mosquitoes that are the primary malaria and filariasis vectors. **METHODS:** Barrier screens of shade-cloth netting attached to bamboo poles were constructed between villages and likely areas where mosquitoes might seek blood meals or rest. Flying mosquitoes, obstructed by the barrier screens, would temporarily stop and could then be captured by aspiration at hourly intervals throughout the night. **RESULTS:** In the three countries where this method was evaluated, blood-fed females of *Anopheles farauti*, *Anopheles bancroftii*, *Anopheles longirostris*, *Anopheles sudaicus*, *Anopheles vagus*, *Anopheles kochi*, *Anopheles annularis*, *Anopheles tessellatus*, *Culex vishnui*, *Culex quinquefasciatus* and *Mansonia* spp. were collected while resting on the barrier screens. In addition, female *Anopheles punctulatus* and *Armigeres* spp. as well as male *An. farauti*, *Cx. vishnui*, *Cx. quinquefasciatus* and *Aedes* species were similarly captured. **CONCLUSIONS:** Building barrier screens as temporary resting sites in areas where mosquitoes were likely to fly was an extremely time-effective method for collecting an unbiased representative sample of engorged mosquitoes for determining the human blood index.

- 13 **Butt L.**

Local biologies and HIV/AIDS in highlands Papua, Indonesia.

Cult Med Psychiatry 2013 Mar;37(1):179-194. doi: 10.1007/s11013-012-9299-2.

The province of Papua, Indonesia has one of the fastest growing rates of HIV infection in Asia. Within volatile political conditions, HIV has reached generalized epidemic status for indigenous Papuans. This article explores the merits of using the concept of local biologies as an analytic tool to assess the range of factors which affect a local pattern of untreated HIV and rapid onset of AIDS. A research team conducted 32 in-depth interviews with HIV-positive indigenous persons and 15 interviews with health care workers in urban and peri-urban sites in the central highlands region. The results show fear of gossip and stigmatization, regional political conditions and gaps in care interweave to create local biological conditions of evasion of care and rapid onset of AIDS. The normative emphasis in contemporary scholarship on stigma as shaping subjective responses to HIV needs to be complemented by a full assessment of the physiological impact of health services, and the ways political conditions trickle down and mediate local biological patterns. The concept of local biologies is highly effective for explaining the full scope of possible

factors affecting the intersection of social and physical realms for HIV-positive persons.

- 14 **Cassar O, Einsiedel L, Afonso PV, Gessain A.**

Human T-cell lymphotropic virus type 1 subtype C molecular variants among Indigenous Australians: new insights into the molecular epidemiology of HTLV-1 in Australo-Melanesia.

PLoS Negl Trop Dis 2013 Sep 26;7(9):e2418. doi: 10.1371/journal.pntd.0002418.

BACKGROUND: HTLV-1 infection is endemic among people of Melanesian descent in Papua New Guinea, the Solomon Islands and Vanuatu. Molecular studies reveal that these Melanesian strains belong to the highly divergent HTLV-1c subtype. In Australia, HTLV-1 is also endemic among the Indigenous people of central Australia; however, the molecular epidemiology of HTLV-1 infection in this population remains poorly documented. **FINDINGS:** Studying a series of 23 HTLV-1 strains from Indigenous residents of central Australia, we analyzed coding (gag, pol, env, tax) and non-coding (LTR) genomic proviral regions. Four complete HTLV-1 proviral sequences were also characterized. Phylogenetic analyses implemented with both Neighbor-Joining and Maximum Likelihood methods revealed that all proviral strains belong to the HTLV-1c subtype with a high genetic diversity, which varied with the geographic origin of the infected individuals. Two distinct Australian clades were found, the first including strains derived from most patients whose origins are in the North, and the second comprising a majority of those from the South of central Australia. Time divergence estimation suggests that the speciation of these two Australian clades probably occurred 9,120 years ago (38,000-4,500). **CONCLUSIONS:** The HTLV-1c subtype is endemic to central Australia where the Indigenous population is infected with diverse subtype c variants. At least two Australian clades exist, which cluster according to the geographic origin of the human hosts. These molecular variants are probably of very ancient origin. Further studies could provide new insights into the evolution and modes of dissemination of these retrovirus variants and the associated ancient migration events through which early human settlement of Australia and Melanesia was achieved.

- 15 **Curry C.**

Setting up an Emergency Medicine Training Program. *J Nepal Health Res Counc* 2013 Jan;11(23):76-79.

This article presents the foundations for building an emergency medicine training program, particularly in an environment with limited resources. It describes the history of the development of EM, what it is, how EM is practised in a typical hospital emergency department and who else is building EM training programs. The experience of establishing EM training in Papua New Guinea provides a model for development in other resource-limited environments. Strategies to establish training and to build the credibility and role of EM within the health system are described.

- 16 **Dancause KN, Vilar M, Wilson M, Soloway LE, DeHuff C, Chan C, Tarivonda L, Regenvanu R, Kaneko A, Lum JK, Garruto RM.**

Behavioral risk factors for obesity during health transition in Vanuatu, South Pacific.

Obesity (Silver Spring) 2013 Jan;21(1):E98-E104. doi: 10.1002/oby.20082.

The South Pacific archipelago of Vanuatu, like

- many developing countries, is currently experiencing a shift in disease burdens from infectious to chronic diseases with economic development. A rapid increase in obesity prevalence represents one component of this "health transition". OBJECTIVE: To identify behaviors associated with measures of obesity in Vanuatu. DESIGN AND METHODS: 534 adults from three islands varying in level of economic development were surveyed. Height, weight, waist and hip circumferences; triceps, subscapular and suprailliac skinfolds; and percent body fat (%BF) by bioelectrical impedance were measured. Diet through 24-h dietary recall and physical activity patterns using a survey were assessed. We analyzed prevalence of obesity and central obesity based on multiple indicators (body mass index, %BF, waist circumference, and waist-to-height ratio), and analyzed differences among islands and associations with behavioral patterns. RESULTS: Obesity prevalence was lowest among rural and highest among suburban participants. Prevalence of central obesity was particularly high among women (up to 73.9%), even in rural areas (ranging from 14.7 to 41.2% depending on the measure used). Heavier reliance on animal protein and incorporation of Western foods in the diet – specifically, tinned fish and instant noodles – was significantly associated with increased obesity risk. CONCLUSIONS: Even in rural areas where diets and lifestyles remain largely traditional, modest incorporation of Western foods in the diet can contribute to increased risk of obesity. Early prevention efforts are thus particularly important during health transition. Where public health resources are limited, education about dietary change could be the best target for prevention.
- 17 **Datta SS, Barnabas R, Sittler A, Guarenti L, Toikilik S, Kariwiga G, Sui GP.** Three cases of neonatal tetanus in Papua New Guinea lead to development of national action plan for maternal and neonatal tetanus elimination. *Western Pac Surveill Response J* 2013 Jun 26;4(2):40-43. doi: 10.5365/WPSAR.2013.4.1.008.
Maternal or neonatal tetanus causes deaths primarily in Asia and Africa and is usually the result of poor hygiene during delivery. In 2011, three neonatal tetanus cases were investigated in Papua New Guinea, and all three cases were delivered at home by untrained assistants. The babies were normal at birth but subsequently developed spasms. A neonatal tetanus case must be viewed as a sentinel event indicating a failure of public health services including immunization, antenatal care and delivery care. The confirmation of these cases led to the drafting of the Papua New Guinea National Action Plan for Maternal and Neonatal Tetanus Elimination. This included three rounds of a tetanus toxoid supplementary immunization campaign targeting women of childbearing age (WBCA) and strengthening of other clean delivery practices. The first immunization round was conducted in April and May 2012, targeting 1.6 million WBCA and achieved coverage of 77%. The government of Papua New Guinea should ensure detailed investigation of all neonatal tetanus cases reported in the health information system and perform subprovincial analysis of tetanus toxoid coverage following completion of all three immunization rounds. Efforts also should be made to strengthen clean delivery practices to help eliminate maternal and neonatal tetanus in Papua New Guinea.
- 18 **Douglas NM, Simpson JA, Phyo AP, Siswantoro H, Hasugian AR, Kenangalem E, Poespoprodjo JR, Singhasivanon P, Anstey NM, White NJ, Tjitra E, Nosten F, Price RN.** Gametocyte dynamics and the role of drugs in reducing the transmission potential of *Plasmodium vivax*. *J Infect Dis* 2013 Sep 1;208(5):801-812. doi: 10.1093/infdis/jit261. Epub 2013 Jun 12.
BACKGROUND: Designing interventions that will reduce transmission of vivax malaria requires knowledge of *Plasmodium vivax* gametocyte dynamics. METHODS: We analyzed data from a randomized controlled trial in northwestern Thailand and 2 trials in Papua, Indonesia, to identify and compare risk factors for vivax gametocytemia at enrollment and following treatment. RESULTS: A total of 492 patients with *P. vivax* infections from Thailand and 476 patients (162 with concurrent falciparum parasitemia) from Indonesia were evaluable. Also, 84.3% (415/492) and 66.6% (209/314) of patients with mono-infection were gametocytemic at enrollment, respectively. The ratio of gametocytemia to asexual parasitemia did not differ between acute and recurrent infections ($p = 0.48$ in Thailand, $p = 0.08$ in Indonesia). High asexual parasitemia was associated with an increased risk of gametocytemia during follow-up in both locations. In Thailand, the cumulative incidence of gametocytemia between day 7 and day 42 following dihydroartemisinin + piperaquine (DHA + PIP) was 6.92% vs 29.1% following chloroquine ($p < 0.001$). In Indonesia, the incidence of gametocytemia was 33.6% following artesunate + amodiaquine (AS + AQ), 7.42% following artemether + mefloquine, and 6.80% following DHA + PIP ($p < 0.001$ for DHA + PIP vs AS + AQ). CONCLUSIONS: *P. vivax* gametocyte carriage mirrors asexual-stage infection. Prevention of relapses, particularly in those with high asexual parasitemia, is likely to be the most important strategy for interrupting *P. vivax* transmission.
- 19 **Duggan AT, Stoneking M.** A highly unstable recent mutation in human mtDNA. *Am J Hum Genet* 2013 Feb 7;92(2):279-284. doi: 10.1016/j.ajhg.2012.12.004. Epub 2013 Jan 10.
An A-to-G transition at position 16247 in the human mtDNA genome denotes haplogroup B4a1a1a and its sublineages. Informally known as the "Polynesian motif", this haplogroup has been widely used as a marker in Oceania of genetic affiliation with the Austronesian expansion. The 16247G allele has arisen only once in the human mtDNA phylogeny, about 7000 years ago, and is nearly fixed in Remote Oceania. We analyzed 536 complete mtDNA genome sequences from the Solomon Islands from haplogroup B4a1a1a and associated subhaplogroups and found multiple independent back-mutations from 16247G to 16247A. We also find elevated levels of heteroplasmy at this position in samples with the 16247G allele, suggesting the ongoing occurrence of somatic back-mutations and/or transmission of heteroplasmy. Moreover, the G allele is predicted to introduce a novel stem-loop structure in the DNA sequence that may be structurally unfavorable, thereby accounting for the remarkable number of back-mutations observed at the 16247G allele in this short evolutionary time span. More generally, haplogroup-calling scripts result in inaccurate haplogroup calls involving the back-mutation and need to be supplemented with other types of analyses; this may be true for other mtDNA lineages because no other lineage has been

investigated to the same extent (over 500 complete mtDNA sequences).

- 20 **Einsiedel L, Cassar O, Gordon L, Gessain A.** Human T-lymphotropic virus type 1 infective dermatitis in central Australia.

J Clin Virol 2013 Aug;57(4):370-373. doi: 10.1016/j.jcv.2013.04.022. Epub 2013 May 23.

The human T-lymphotropic virus type 1 (HTLV-1) is a single-stranded RNA retrovirus that preferentially infects CD4+ T cells. The spectrum of diseases that are associated with the most frequent genotype, the HTLV-1 cosmopolitan subtype A, has been well described. In contrast, very few cases of HTLV-1 related diseases have been reported for the HTLV-1 subtype C variant, which is endemic to Australia and the nearby islands of Melanesia. Here we describe the first case of infective dermatitis associated with the HTLV-1 Australo-Melanesian subtype C. This was complicated by repeated episodes of invasive infection with *Staphylococcus aureus* and illustrates the life-threatening nature of infective dermatitis among HTLV-1 carriers who live in conditions of social disadvantage.

- 21 **Ekeroma AJ, Pollock T, Kenealy T, Shulruf B, Sopoaga F, Montorzi G, McCowan LM, Hill A.**

Pacific island publications in the reproductive health literature 2000-2011: with New Zealand as a reference.

Aust NZ J Obstet Gynaecol 2013 Apr;53(2):197-202. doi: 10.1111/ajo.12039. Epub 2013 Feb 1.

BACKGROUND: There is a keen interest to develop research systems and increase research output in the 14 Pacific Island Forum Countries (PIFC) to support development of policies and practice based on locally relevant research evidence. **AIMS:** To assess the quantity and characteristics of reproductive health research output by each country (14 PIFC) from 2000 to 2011 using New Zealand's reproductive research outputs as the reference. **METHODS:** A systematic search of the literature using a broad definition of reproductive health. **RESULTS:** There were 174 papers published in the PIFC from 2000 to 2011 compared with 628 papers published in New Zealand (NZ). Most (57%) of the PIFC papers were from Papua New Guinea (PNG), although Samoa had the most papers by population (10/100,000). Five of the countries did not have a single publication. The majority of papers from both the PIFC and NZ were observational studies (72 vs 36%). Authors from Australia were responsible for 34% of PIFC publications followed by 25% from PNG. Sixty-three per cent of papers by PIFC sole and first authors were published in local journals, whereas 86% of non-PIFC authors published in international journals. **CONCLUSION:** There is a need for reproductive research in PIFC. PNG had the most publications on the back of a well-funded dedicated research institute and a significant collaboration with Australian researchers. The large number of papers in PIFC countries without PIFC authors raises the question about the need to require non-PIFC researchers to enter into genuine research partnerships in order to build research capacity in the PIFC.

- 22 **Erickson SM, Thomsen EK, Keven JB, Vincent N, Koimbu G, Siba PM, Christensen BM, Reimer LJ.**

Mosquito-parasite interactions can shape filariasis transmission dynamics and impact elimination programs.

PLoS Negl Trop Dis 2013 Sep 12;7(9):e2433. doi: 10.1371/journal.pntd.0002433.

The relationship between mosquito vectors and lymphatic filariasis (LF) parasites can result in a range of transmission outcomes. Anophelines are generally characterized as poor vectors due to an inability to support development at low densities. However, it is important to understand the potential for transmission in natural vectors to maximize the success of elimination efforts. Primary vectors in Papua New Guinea (n=1209) were dissected following exposure to microfilaremic blood (range 8-233 mf/20 µl). We examined density-dependent and species-specific parasite prevalence, intensity and yield, barriers to parasite development as well as impacts on mosquito survival. We observed strikingly different parasite prevalence and yield among closely related species. Prevalence of infective stage larvae (L3s) ranged from 4.2% to 23.7% in *An. punctulatus*, 24.5% to 68.6% in *An. farauti* s.s. and 61.9% to 100% in *An. hinesorum* at low and high density exposures, respectively. Injection experiments revealed the greatest barrier to parasite development involved passage from the midgut into the hemocoel. The ratio of L3 to ingested mf at low densities was higher in *An. hinesorum* (yield=1.0) and *An. farauti* s.s. (yield=0.5) than has been reported in other anopheline vectors. There was a negative relationship between mosquito survival and bloodmeal mf density. In *An. farauti* s.s., increased parasite yield and survival at low densities suggest greater competence at low microfilaremias. In Papua New Guinea the likelihood of transmission will be strongly influenced by vector composition and changes in the mf reservoir as a result of elimination efforts. Global elimination efforts will be strengthened by the knowledge of transmission potential in the context of current control measures.

- 23 **Eutsey RA, Hiller NL, Earl JP, Janto BA, Dahlgren ME, Ahmed A, Powell E, Schultz MP, Gilsdorf JR, Zhang L, Smith A, Murphy TF, Sethi S, Shen K, Post JC, Hu FZ, Ehrlich GD.**

Design and validation of a supragenome array for determination of the genomic content of *Haemophilus influenzae* isolates.

BMC Genomics 2013 Jul 17;14:484. doi: 10.1186/1471-2164-14-484.

BACKGROUND: *Haemophilus influenzae* colonizes the human nasopharynx as a commensal, and is etiologically associated with numerous opportunistic infections of the airway; it is also less commonly associated with invasive disease. Clinical isolates of *H. influenzae* display extensive genomic diversity and plasticity. The development of strategies to successfully prevent, diagnose and treat *H. influenzae* infections depends on tools to ascertain the gene content of individual isolates. **RESULTS:** We describe and validate a *Haemophilus influenzae* supragenome hybridization (SGH) array that can be used to characterize the full genic complement of any strain within the species, as well as strains from several highly related species. The array contains 31,307 probes that collectively cover essentially all alleles of the 2890 gene clusters identified from the whole genome sequencing of 24 clinical *H. influenzae* strains. The finite supragenome model predicts that these data include greater than 85% of all non-rare genes (where rare genes are defined as those present in less than 10% of sequenced strains). The veracity of the array was tested by comparing the whole genome sequences of eight strains with their

hybridization data obtained using the supragenome array. The array predictions were correct and reproducible for ~98% of the gene content of all of the sequenced strains. This technology was then applied to an investigation of the gene content of 193 geographically and clinically diverse *H. influenzae* clinical strains. These strains came from multiple locations from five different continents and Papua New Guinea and include isolates from: the middle ears of persons with otitis media and otorrhea; lung aspirates and sputum samples from pneumonia and COPD patients; blood specimens from patients with sepsis; cerebrospinal fluid from patients with meningitis; as well as from pharyngeal specimens from healthy persons. **CONCLUSIONS:** These analyses provided the most comprehensive and detailed genomic/phylogenetic look at this species to date, and identified a subset of highly divergent strains that form a separate lineage within the species. This array provides a cost-effective and high-throughput tool to determine the gene content of any *H. influenzae* isolate or lineage. Furthermore, the method for probe selection can be applied to any species, given a group of available whole genome sequences.

- 24 **Field H, de Jong CE, Halpin K, Smith CS.** Henipaviruses and fruit bats, Papua New Guinea. *Emerg Infect Dis* 2013 Apr;19(4):670-671. doi: 10.3201/eid1904.111912.
- 25 **Furusawa T, Naka I, Yamauchi T, Natsuhara K, Eddie R, Kimura R, Nakazawa M, Ishida T, Inaoka T, Matsumura Y, Ataka Y, Ohtsuka R, Ohashi J.** Hypertension-susceptibility gene prevalence in the Pacific islands and associations with hypertension in Melanesia. *J Hum Genet* 2013 Mar;58(3):142-149. doi: 10.1038/jhg.2012.147. Epub 2013 Jan 17.
- Human essential hypertension is partly caused by genetic factors. Angiotensinogen (AGT), G-protein β 3-subunit (GNB3) and cytochrome P450 3A5 (CYP3A5) are candidate hypertension susceptibility genes and risk alleles at these loci have been thought to arise owing to human adaptation to climatic changes following the migration out-of-Africa. This study aimed to reveal the frequencies of hypertension-susceptibility genotypes in Pacific island populations and associations of these single-nucleotide polymorphisms (SNPs) to hypertension. Genotyping was conducted for 804 individuals from Melanesian, Micronesian and Polynesian populations at SNPs in the genes encoding AGT (rs699, rs5049 and rs5051), GNB3 (rs5443) and CYP3A5*1/*3 (rs776746). Associations between these SNPs and hypertension were tested for 383 Melanesian Solomon Islanders. We found that the A/A genotype at rs5049 was a risk factor for hypertension ($p = 0.025$) in the Melanesian Solomon Islanders; three SNPs for AGT were in linkage disequilibrium. The ancestral alleles of rs699, rs5051 and rs776746, and the derived allele of rs5443 were as frequent in the populations surveyed here as in other equatorial populations. Although other polymorphisms associated with hypertension and additional populations remain to be studied, these findings suggest that the Pacific Islanders' susceptibility to hypertension arose because of human migration and adaptation.
- 26 **Graves PM, Makita L, Susapu M, Brady MA, Melrose W, Capuano C, Zhang Z, Dapeng L, Ozaki**

M, Reeve D, Ichimori K, Kazadi WM, Michna F, Bockarie MJ, Kelly-Hope LA.

Lymphatic filariasis in Papua New Guinea: distribution at district level and impact of mass drug administration, 1980 to 2011.

Parasit Vectors 2013 Jan 11;6:7. doi: 10.1186/1756-3305-6-7.

BACKGROUND: Lymphatic filariasis (LF) caused by *Wuchereria bancrofti* is present at high prevalence in some parts of Papua New Guinea. However, there has been no rigorous data-based representative assessment of nationwide prevalence of LF. The LF programme has been daunted by the scope of the problem, and progress on mass drug administration (MDA) has been slow and lacking in resources. **METHODS:** A systematic literature review identified LF surveys in Papua New Guinea between 1980 and 2011. Results were extracted by location, time period and test used (blood slide, immunochromatographic test (ICT) or Og4C3 ELISA) and combined by district. Three criteria schemes based on the Global Programme to Eliminate Lymphatic Filariasis guidelines, with modifications, were developed to classify and prioritize districts by prevalence level. Results of repeated surveys in the same sites were used to investigate the impact of MDA on LF prevalence over the time period. **RESULTS:** There were 312 distinct survey sites identified in 80 of the 89 districts over the 31-year period. The overall LF prevalence in the sites tested was estimated at 18.5 to 27.5% by blood slide for microfilariae (Mf), 10.1% to 12.9% by ICT and 45.4% to 48.8% by Og4C3. Biases in site selection towards areas with LF, and change in type of assay used, affected the prevalence estimates, but overall decline in prevalence over the time period was observed. Depending on the criteria used, 34 to 36 districts (population 2.7 to 2.9 million) were classed as high endemic ($\geq 5\%$ prevalence), 15 to 25 districts (1.7 to 1.9 million) as low endemic ($< 5\%$) and 20 to 31 (1.3 to 2.2 million) as non-endemic. Nine districts (0.7 million) had no information. The strong impact of MDA, especially on microfilaria (Mf) prevalence, was noted in sites with repeat surveys. **CONCLUSIONS:** This analytical review of past surveys of LF in Papua New Guinea enables better estimation of the national burden, identifies gaps in knowledge, quantifies and locates the population at risk, and can be used to predict the likely impact of MDA and/or vector control. Better targeting of districts by level of prevalence will strengthen the control programme, facilitate monitoring of the disease trend and increase the likelihood of reaching the target of LF elimination by 2020.

- 27 **Gray N, Azzopardi P, Kennedy E, Willersdorf E, Creati M.**

Improving adolescent reproductive health in Asia and the Pacific: do we have the data? A review of DHS and MICS surveys in nine countries.

Asia Pac J Public Health 2013 Mar;25(2):134-144. doi: 10.1177/1010539511417423. Epub 2011 Jul 31.

Data on adolescent reproductive health (ARH) are required to inform evidence-based policies and programs. The reports of national-level household surveys such as the Demographic and Health Survey (DHS) and Multiple Indicator Cluster Survey (MICS) are important sources of such data in developing countries. The aim of this study was to map data on ARH from DHS and MICS reports from selected countries in the Asia and Pacific regions. The DHS and MICS reports for Bangladesh, Cambodia, Indonesia,

Papua New Guinea, Philippines, Solomon Islands, Timor-Leste, Vanuatu, and Vietnam were reviewed. Data on 128 indicators, including ARH outcomes, outcomes for babies of adolescent mothers, and adolescents' access to health information and services, were mapped. Available data are limited because of the omission of cohorts such as young adolescents (10-14 years old) and, in many surveys, unmarried women; the omission of important indicators; and failure to report data disaggregated by age. DHS and MICS reports have limited capacity to inform policy and programs to improve ARH. A review of DHS and MICS sampling strategies and reporting templates, and a consideration of alternative data collection strategies, are warranted.

28 **Greenhill A, Siba V, Horwood P.**

Reply to 'apropos "evaluation of serological diagnostic tests for typhoid fever in Papua New Guinea using a composite reference standard"'.
Clin Vaccine Immunol 2013 Feb;20(2):318. doi: 10.1128/CVI.00724-12.

29 **Hamura NN, Bolnga JW, Wangnapi R, Horne AW, Rogerson SJ, Unger HW.**

The impact of tubal ectopic pregnancy in Papua New Guinea – a retrospective case review.
BMC Pregnancy Childbirth 2013 Apr 4;13:86. doi: 10.1186/1471-2393-13-86.

BACKGROUND: Ectopic pregnancy (EP) is an important cause of morbidity and mortality amongst women of reproductive age. Tubal EP is well described in industrialised countries, but less is known about its impact in low-resource countries, in particular in the South Pacific Region. **METHODS:** We undertook a retrospective review of women with tubal EP treated at a provincial referral hospital in coastal Papua New Guinea over a period of 56 months. Demographic and clinical variables were obtained from patients' medical records and analysed. The institutional rate of tubal EP was calculated, and diagnosis and management reviewed. Potential risk factors for tubal EP were identified, and delays contributing to increased morbidity described. **RESULTS:** A total of 73 women had tubal EP. The institutional rate of tubal EP over the study period was 6.3 per 1,000 deliveries. There were no maternal deaths due to EP. The mean age of women was 31.5±5.7 years, 85% were parous, 67% were rural dwellers and 62% had a history of sub-fertility. The most commonly used diagnostic aid was culdocentesis. One-third of women had clinical evidence of shock on arrival. All women with tubal EP were managed by open salpingectomy. Tubal rupture was confirmed for 48% of patients and was more common amongst rural dwellers. 43% of women had macroscopic evidence of pelvic infection. Two-thirds of patients received blood transfusions, and post-operative recovery lasted six days on average. Late presentation, lack of clinical suspicion, and delays with receiving appropriate treatments were observed. **CONCLUSIONS:** Tubal EP is a common gynaecological emergency in a referral hospital in coastal PNG, and causes significant morbidity, in particular amongst women residing in rural areas. Sexually transmitted infections are likely to represent the most important risk factor for tubal EP in PNG. Interventions to reduce the morbidity due to tubal EP include the prevention, detection and treatment of sexually transmitted infections, identification and reduction of barriers to prompt presentation, increasing health workers' awareness of ectopic

pregnancy, providing pregnancy test kits to rural health centres, and strengthening hospital blood transfusion services, including facilities for autotransfusion.

30 **Harrington H, Asugeni R, MacLaren D.**

Comment: Inter-island referrals in Solomon Islands: a remote hospital perspective.
Rural Remote Health 2013 Apr-Jun;13(2):2415. Epub 2013 Apr 22.

31 **Harrison GL, Pryor J, Malani J, Supuri M, Masta A, Teriboriki B, Toatu T, Penny D, Allain JP, Barnes E, Pybus OG, Klenerman P.**

Infection frequency of hepatitis C virus and IL28B haplotypes in Papua New Guinea, Fiji, and Kiribati.
PLoS One 2013 Aug 20;8(8):e66749. doi: 10.1371/journal.pone.0066749.

It has been estimated that there are more than 60 million hepatitis C virus (HCV) carriers in the World Health Organization's Western Pacific region (WHO-WPR), where liver cancer is among the top three causes of cancer death. WHO and the US Centers for Disease Control and Prevention report the prevalence of HCV in the South Pacific islands (countries within the WHO-WPR) to be high (5-10% and >2% respectively). However, since HCV is not tested for in many of these countries, there is sparse data available to support this assertion. We screened ~2000 apparently healthy individuals from Papua New Guinea, Fiji and Kiribati and found a sero-prevalence of 2.0%, 0.1% and 0%, respectively. All sero-positive samples tested negative for HCV RNA. Curious as to why all the sero-positive individuals were negative for HCV-RNA, we also screened them for the HCV protective IL28B SNP markers rs12979860 and rs8099917. All antibody-positive participants bar one had HCV protective haplotypes. Our results suggest that HCV is present in these Pacific island countries, albeit at a prevalence lower than previous estimates. As none of our participants had undergone antiviral treatment, and therefore must have cleared infection naturally, we hypothesise that genotypes 1 and/or 4 are circulating in South Pacific island people and that these peoples are genetically predisposed to be more likely to spontaneously resolve HCV infection than to become chronic carriers.

32 **Hase R, Uwamino Y, Muranaka K, Tochtani K, Sogi M, Kitazono H, Hosokawa N.**

[*Plasmodium malariae* malaria with more than a 4-month incubation period: difficult to distinguish from a relapse of *Plasmodium vivax* malaria]. [Japanese] *Kansenshogaku Zasshi* 2013 Jul;87(4):446-450.

We report herein on a case of *Plasmodium malariae* malaria with more than a 4-month incubation period. A 35-year-old Japanese man who first presented to our clinic with fever and history of travel to Papua New Guinea was suspected of having *Plasmodium vivax* malaria based on peripheral smear results. We admitted him and initiated treatment with mefloquine. After two days of therapy, he became afebrile. We discharged him, and *P. vivax* was later confirmed with PCR. We started mefloquine prophylaxis for a planned trip to Papua New Guinea. After his return, a standard dose of primaquine (15 mg x 14 days) was prescribed for a radical cure of *P. vivax*. About 4 months after his last visit to Papua New Guinea, he returned to our clinic with fever. We suspected a relapse of *P. vivax* malaria and admitted him for a second time. After two days of mefloquine therapy, his symptoms improved. We discharged him and restarted a higher dose of

- primaquine (30 mg x 14 days) therapy for a radical cure of *P. vivax*. Subsequently, the PCR test revealed the parasite was *P. malariae* and not *P. vivax*. Only 13 cases of *Plasmodium malariae* malaria have been reported in Japan during the past 10 years. Blood-stage schizonticides such as mefloquine are not active against the liver stage. Therefore the use of these drugs for prophylaxis will not be effective for prevention of malaria if its liver stage is longer than the duration of effective chemoprophylaxis. Although the incubation period of *P. malariae* is typically 13 to 28 days, it occasionally lasts for months or even years. Careful attention should be given to the possibility that *P. malariae* occasionally has a long incubation period even in the absence of the hypnozoite stage.
- 33 **Hill DL, Eriksson EM, Li Wai Suen CS, Chiu CY, Ryg-Cornejo V, Robinson LJ, Siba PM, Mueller I, Hansen DS, Schofield L.** Oponising antibodies to *P. falciparum* merozoites associated with immunity to clinical malaria. *PLoS One* 2013 Sep 9;8(9):e74627. doi: 10.1371/journal.pone.0074627.
- Naturally acquired humoral immunity to the malarial parasite *Plasmodium falciparum* can protect against disease, although the precise mechanisms remain unclear. Although antibody levels can be measured by ELISA, few studies have investigated functional antibody assays in relation to clinical outcomes. In this study we applied a recently developed functional assay of antibody-mediated opsonisation of merozoites to plasma samples from a longitudinal cohort study conducted in a malaria-endemic region of Papua New Guinea (PNG). Phagocytic activity was quantified by flow cytometry using a standardized and high-throughput protocol, and was subsequently evaluated for association with protection from clinical malaria and high-density parasitemia. Oponising antibody responses were found to: i) increase with age, ii) be enhanced by concurrent infection, and iii) correlate with protection from clinical episodes and high-density parasitemia. Stronger protective associations were observed in individuals with no detectable parasitemia at baseline. This study presents the first evidence for merozoite phagocytosis as a correlate of acquired immunity and clinical protection against *P. falciparum* malaria.
- 34 **Honjo K, Chaves LF, Satake A, Kaneko A, Minakawa N.** When they don't bite, we smell money: understanding malaria bednet misuse. *Parasitology* 2013 Apr;140(5):580-586. doi: 10.1017/S0031182012002077. Epub 2013 Jan 24.
- Insecticide-treated nets (ITNs) are a major tool to control malaria. Over recent years increased ITN coverage has been associated with decreased malaria transmission. However, ITN 'misuse' has been increasingly reported and whether this emergent behaviour poses a threat to successful malaria control and elimination is an open question. Here, we use a game theory mathematical model to understand the possible roles of poverty and malaria infection protection by individual and emerging 'community effects' on the 'misuse' of malaria bednets. We compare model predictions with data from our studies in Lake Victoria Islands (LVI), Kenya and Aneityum, Vanuatu. Our model shows that alternative ITN use is likely to emerge in impoverished populations and could be exacerbated if ITNs become ineffective or when large 'community effects' emerge. Our model predicted patterns of ITN use similar to that observed in LVI, where 'misuse' is common, and the high ITN use in Aneityum, more than 20 years after malaria elimination in 1990. We think that observed differences in ITN use may be shaped by different degrees of economic and social development, and educational components of the Aneityum elimination, where traditional cooperative attitudes were strengthened with the malaria elimination intervention and post-elimination surveillance.
- 35 **Horwood P, Bande G, Dagina R, Guillaumot L, Aaskov J, Pavlin B.** The threat of chikungunya in Oceania. *Western Pac Surveill Response J* 2013 Jun 4;4(2):8-10. doi: 10.5365/WPSAR.2013.4.2.003.
- 36 **Horwood PF, Reimer LJ, Dagina R, Susapu M, Bande G, Katusele M, Koimbu G, Jimmy S, Ropa B, Siba PM, Pavlin BI.** Outbreak of chikungunya virus infection, Vanimo, Papua New Guinea. *Emerg Infect Dis* 2013 Sep;19(9):1535-1538. doi: 10.3201/eid1909.130130.
- In June 2012, health authorities in Papua New Guinea detected an increase in febrile illnesses in Vanimo. Chikungunya virus of the Eastern/Central/Southern African genotype harboring the E1:A226V mutation was identified. This ongoing outbreak has spread to ≥8 other provinces and has had a harmful effect on public health.
- 37 **Jimenez Soto E, La Vincente S, Clark A, Firth S, Morgan A, Detrick Z, Dayal P, Aldaba BM, Kosen S, Kraft AD, Panicker R, Prasai Y, Trisnantoro L, Varghese B, Widiati Y; Investment Case Team for India, Indonesia, Nepal, Papua New Guinea and the Philippines.** Investment case for improving maternal and child health: results from four countries. *BMC Public Health* 2013 Jun 21;13:601. doi: 10.1186/1471-2458-13-601.
- BACKGROUND:** Without addressing the constraints specific to disadvantaged populations, national health policies such as universal health coverage risk increasing equity gaps. Health system constraints often have the greatest impact on disadvantaged populations, resulting in poor access to quality health services among vulnerable groups. **METHODS:** The Investment Cases in Indonesia, Nepal, Philippines, and the state of Orissa in India were implemented to support evidence-based sub-national planning and budgeting for equitable scale-up of quality MNCH services. The Investment Case framework combines the basic setup of strategic problem solving with a decision-support model. The analysis and identification of strategies to scale-up priority MNCH interventions is conducted by in-country planners and policymakers with facilitation from local and international research partners. **RESULTS:** Significant variation in scaling-up constraints, strategies, and associated costs were identified between countries and across urban and rural typologies. Community-based strategies have been considered for rural populations served predominantly by public providers, but this analysis suggests that the scaling-up of maternal, newborn, and child health services requires health system interventions focused on 'getting the basics right'. These include upgrading or building facilities, training and redistribution of staff, better supervision, and strengthening the

procurement of essential commodities. Some of these strategies involve substantial early capital expenditure in remote and sparsely populated districts. These supply-side strategies are not only the 'best buys', but also the 'required buys' to ensure the quality of health services as coverage increases. By contrast, such public supply strategies may not be the 'best buys' in densely populated urbanised settings, served by a mix of public and private providers. Instead, robust regulatory and supervisory mechanisms are required to improve the accessibility and quality of services delivered by the private sector. They can lead to important maternal mortality reductions at relatively low costs. **CONCLUSIONS:** National strategies that do not take into consideration the special circumstances of disadvantaged areas risk disempowering local managers and may lead to a "business-as-usual" acceptance of unreachable goals. To effectively guide health service delivery at a local level, national plans should adopt typologies that reflect the different problems and strategies to scale up key MNCH interventions.

38 Johnston LG, Prybylski D, Raymond HF, Mirzazadeh A, Manopaiboon C, McFarland W.

Incorporating the service multiplier method in respondent-driven sampling surveys to estimate the size of hidden and hard-to-reach populations: case studies from around the world.

Sex Transm Dis 2013 Apr;40(4):304-310. doi: 10.1097/OLQ.0b013e31827fd650.

BACKGROUND: Estimating the sizes of populations at highest risk for HIV is essential for developing and monitoring effective HIV prevention and treatment programs. We provide several country examples of how service multiplier methods have been used in respondent-driven sampling surveys and provide guidance on how to maximize this method's use. **METHODS:** Population size estimates were conducted in 4 countries (Mauritius – intravenous drug users [IDU] and female sex workers [FSW]; Papua New Guinea – FSW and men who have sex with men [MSM]; Thailand – IDU; United States – IDU) using adjusted proportions of population members reporting attending a service, project or study listed in a respondent-driven sampling survey, and the estimated total number of population members who visited one of the listed services, projects, or studies collected from the providers. **RESULTS:** The median population size estimates were 8866 for IDU and 667 for FSW in Mauritius. Median point estimates for FSW were 4190 in Port Moresby and 8712 in Goroka, Papua New Guinea, and 2126 for MSM in Port Moresby and 4200 for IDU in Bangkok, Thailand. Median estimates for IDU were 1050 in Chiang Mai, Thailand, and 15,789 in 2005 and 15,554 in 2009 in San Francisco. **CONCLUSION:** Our estimates for almost all groups in each country fall within the range of other regional and national estimates, indicating that the service multiplier method, assuming all assumptions are met, can produce informative estimates. We suggest using multiple multipliers whenever possible, garnering program data from the widest possible range of services, projects, and studies. A median of several estimates is likely to be more robust to potential biases than a single estimate.

39 Kelly A, Kupul M, Aeno H, Shih P, Naketrumb R, Neo J, Fitzgerald L, Kaldor JM, Siba PM, Vallely A.

Why women object to male circumcision to prevent HIV in a moderate-prevalence setting.

Qual Health Res 2013 Feb;23(2):180-193. doi: 10.1177/1049732312467234. Epub 2012 Nov 27.

Adult male circumcision has been shown to reduce the transmission of HIV. Women's acceptability of male circumcision is important in Papua New Guinea's preparedness to introduce male circumcision, and in ethical considerations of its use as a biomedical technology for HIV prevention. We conducted 21 focus group discussions and 18 in-depth interviews with women in all four regions of Papua New Guinea. The majority of women objected to the introduction of male circumcision for three main reasons: circumcision would result in sexual risk compensation; circumcision goes against Christian faith; and circumcision is a new practice that is culturally inappropriate. A minority of women accepted male circumcision for the prevention of HIV and other sexually transmitted infections, and for the benefit of penile hygiene and health. Women's objections to circumcision as a biomedical method of preventing HIV reemphasize the importance of sociocultural and behavioral interventions in Papua New Guinea.

40 Kelly GC, Hale E, Donald W, Batarii W, Bugoro H, Nausien J, Smale J, Palmer K, Bobogare A, Taleo G, Vallely A, Tanner M, Vestergaard LS, Clements AC.

A high-resolution geospatial surveillance-response system for malaria elimination in Solomon Islands and Vanuatu.

Malar J 2013 Mar 21;12:108. doi: 10.1186/1475-2875-12-108.

BACKGROUND: A high-resolution surveillance-response system has been developed within a geographic information system (GIS) to support malaria elimination in the Pacific. This paper examines the application of a GIS-based spatial decision support system (SDSS) to automatically locate and map the distribution of confirmed malaria cases, rapidly classify active transmission foci, and guide targeted responses in elimination zones. **METHODS:** Customized SDSS-based surveillance-response systems were developed in the three elimination provinces of Isabel and Temotu, Solomon Islands and Tafea, Vanuatu. Confirmed malaria cases were reported to provincial malaria offices upon diagnosis and updated into the respective SDSS as part of routine operations throughout 2011. Cases were automatically mapped by household within the SDSS using existing geographical reconnaissance (GR) data. GIS queries were integrated into the SDSS-framework to automatically classify and map transmission foci based on the spatiotemporal distribution of cases, highlight current areas of interest (AOI) regions to conduct foci-specific targeted response, and extract supporting household and population data. GIS simulations were run to detect AOIs triggered throughout 2011 in each elimination province and conduct a sensitivity analysis to calculate the proportion of positive cases, households and population highlighted in AOI regions of a varying geographic radius. **RESULTS:** A total of 183 confirmed cases were reported and mapped using the SDSS throughout 2011 and used to describe transmission within a target population of 90,354. Automatic AOI regions were also generated within each provincial SDSS identifying geographic areas to conduct response. 82.5% of confirmed cases were automatically geo-referenced and mapped at the household level, with 100% of remaining cases

geo-referenced at a village level. Data from the AOI analysis indicated different stages of progress in each province, highlighting operational implications with regard to strategies for implementing surveillance-response in consideration of the spatiotemporal nature of cases as well as logistical and financial constraints of the respective programmes. **CONCLUSIONS:** Geospatial systems developed to guide Pacific island malaria elimination demonstrate the application of a high-resolution SDSS-based approach to support key elements of surveillance-response including understanding epidemiological variation within target areas, implementing appropriate foci-specific targeted response, and consideration of logistical constraints and costs.

41 **Kenangalem E, Waramori G, Pontororing GJ, Sandjaja, Tjitra E, Maguire G, Kelly PM, Anstey NM, Ralph AP.**

Tuberculosis outcomes in Papua, Indonesia: the relationship with different body mass index characteristics between Papuan and non-Papuan ethnic groups.

PLoS One 2013 Sep 27;8(9):e76077. doi: 10.1371/journal.pone.0076077.

Weight gain achieved during pulmonary tuberculosis (PTB) treatment is associated with the likelihood of bacteriological treatment success. It is recognised that weight and body mass index (BMI) characteristics differ between ethnic groups in health and illness states. However, there has been no prior investigation of how ethnic differences in BMI might influence tuberculosis treatment outcome. Our aim was to investigate predictors of microbiological response to PTB treatment at the Tuberculosis Clinic in Timika, Papua Province, Indonesia and, specifically, to determine the contribution of ethnicity. The population comprises two distinct ethnic groups - Asian (non-Papuan) and Melanesian (Papuan). We conducted a prospective study of adults with smear-positive PTB. Treatment outcomes were 1- and 2-month sputum culture and time to microscopy conversion. Clinical measures included weight, BMI, chest radiograph, pulmonary function including forced expiratory volume in 1 second (FEV1) and haemoglobin. 186 participants (83 Papuan, 103 non-Papuan Indonesians) were enrolled. At baseline, Papuans had higher mean weight and BMI than non-Papuans (50.0 kg versus 46.9 kg, $p = 0.006$ and 20.0 kg/m² versus 18.7 kg/m², $p = 0.001$ respectively). This was despite having lower mean haemoglobin (11.3 vs 13.1 g/dL, $p < 0.0001$), higher smoking and HIV rates (37% vs 21%, $p = 0.02$ and 20% vs 5%, $p = 0.01$ respectively) and longer median illness duration (3 vs 2 months, $p = 0.04$), but similar radiological severity (proportion with cavities 55% vs 57%, $p = 0.7$), sputum smear grade ($p = 0.3$) and mean % predicted FEV1 (63% vs 64%, $p = 0.7$). By 2 months, Papuans had gained still more weight (mean 5.9 vs 4.2 kg, $p = 0.02$), and were more likely to have negative sputum culture (49/56 vs 45/67, $p = 0.02$), in univariable and multivariable analyses controlling for other likely determinants of culture conversion. In conclusion, Papuans had better early microbiological outcome from PTB treatment, which may relate to better preservation of weight and greater early weight gain.

42 **Kennedy EC, Mackesy-Buckley S, Subramaniam S, Demmke A, Latu R, Robertson AS, Tiban K, Tokon A, Luchters S.**

The case for investing in family planning in the Pacific: costs and benefits of reducing unmet need for contraception in Vanuatu and the Solomon Islands.

Reprod Health 2013 Jun 10;10:30. doi: 10.1186/1742-4755-10-30.

BACKGROUND: Unmet need for family planning in the Pacific is among the highest in the world. Better understanding of required investments and associated benefits of increased access to family planning in the Pacific may assist prioritization and funding. **METHODS:** We modelled the costs and associated health, demographic and economic impacts of reducing unmet need for family planning between 2010 and 2025 in Vanuatu and the Solomon Islands. Baseline data were obtained from census reports, Demographic and Health Surveys, and UN agency reports. Using a demographic modelling program we compared a scenario of "no change in unmet need" with two distinct scenarios: 1) all family planning needs met by 2020; and 2) all needs met by 2050. **RESULTS:** Meeting family planning needs by 2020 would increase prevalence of modern contraception in 2025 from 36.8 to 65.5% in Vanuatu and 28.5 to 37.6% in the Solomon Islands. Between 2010 and 2025 the average annual number of unintended pregnancies would decline by 68% in Vanuatu and 50% in the Solomon Islands, and high-risk births would fall by more than 20%, averting 2573 maternal and infant deaths. Total fertility rates would fall from 4.1 to 2.2 in Vanuatu and 3.5 in the Solomon Islands, contributing to slowed population growth and lower dependency ratios. The direct cost of reducing unmet need by 2020 was estimated to be \$5.19 million for Vanuatu and \$3.36 million for the Solomon Islands between 2010 and 2025. Preventing unintended pregnancies would save \$112 million in health and education expenditure. **CONCLUSIONS:** In small island developing states such as Vanuatu and the Solomon Islands, increasing investment in family planning would contribute to improved maternal and infant outcomes and substantial public sector savings.

43 **Kinaston RL, Buckley HR, Gray A.**

Diet and social status on Taumako, a Polynesian outlier in the Southeastern Solomon Islands.

Am J Phys Anthropol 2013 Aug;151(4):589-603. doi: 10.1002/ajpa.22314.

Stable isotopes ($\delta^{13}\text{C}$, $\delta^{15}\text{N}$ and $\delta^{34}\text{S}$) are used to characterize the diet of the adult individuals ($n = 99$) interred in the Namu burial ground located on the Polynesian outlier of Taumako (~300-750 BP). Polynesian outliers are islands on the fringe of Remote Oceania that were inhabited by a back migration of populations from Polynesia during prehistory. As a result of admixture with nearby island communities, little is known about the social structure and social diversity of the prehistoric inhabitants of Taumako. The distribution of prestige grave goods within the Namu cemetery has been used as evidence to support the premise that Taumakoan social structure was stratified like Polynesian societies. Here we test the hypothesis that "wealthy" individuals and males will display isotopic ratios indicative of the consumption of "high status" foods in the Pacific islands such as pork, chicken, sea turtle, and pelagic fish. The isotope results suggest the $\delta^{34}\text{S}$ values were diagenetically altered, possibly an effect of volcanism. The carbon and nitrogen stable isotope ratios indicate that the diet of all the individuals included a mixture of C3 terrestrial plant foods (like starchy staples such as yam, taro, and breadfruit, in addition to nuts) and a variety of

marine resources, including reef and pelagic fish. The stable isotope results indicate that wealthy individuals and males were eating more foods from higher trophic levels, interpreted as being high status animal foods. The socially differentiated food consumption patterns are discussed within a Pacific island context.

44 King EJ, Maman S, Wyckoff SC, Pierce MW, Groves AK.

HIV testing for pregnant women: a rights-based analysis of national policies.

Glob Public Health 2013;8(3):326-341. doi: 10.1080/17441692.2012.745010. Epub 2012 Nov 26.

Ethical and human rights concerns have been expressed regarding the global shift in policies on HIV testing of pregnant women. The main purpose of this research was to conduct a policy analysis using a human rights-based approach of national policies for HIV testing of pregnant women. We collected HIV testing policies from 19 countries including: Cambodia, China, Guyana, Haiti, India, Jamaica, Kenya, Moldova, Papua New Guinea, Russian Federation, South Africa, Sudan, Swaziland, Tanzania, Ukraine, United States, Uzbekistan, Zambia and Zimbabwe. We analysed the HIV testing policies using a standardised framework that focused on government obligations to respect, protect and fulfil. Our results highlight the need for more attention to issues of pregnant women's autonomy in consenting to HIV testing, confidentiality in antenatal care settings and provision of counselling and care services. We conclude with a discussion about potential implications of the current testing policies and provide recommendations for ways that HIV testing policies can more effectively uphold the human rights of pregnant women.

45 Kline K, McCarthy JS, Pearson M, Loukas A, Hotez PJ.

Neglected tropical diseases of Oceania: review of their prevalence, distribution, and opportunities for control.

PLoS Negl Trop Dis 2013;7(1):e1755. doi: 10.1371/journal.pntd.0001755. Epub 2013 Jan 31.

Among Oceania's population of 35 million people, the greatest number living in poverty currently live in Papua New Guinea (PNG), Fiji, Vanuatu, and the Solomon Islands. These impoverished populations are at high risk for selected NTDs, including *Necator americanus* hookworm infection, strongyloidiasis, lymphatic filariasis (LF), balantidiasis, yaws, trachoma, leprosy, and scabies, in addition to outbreaks of dengue and other arboviral infections including Japanese encephalitis virus infection. PNG stands out for having the largest number of cases and highest prevalence for most of these NTDs. However, Australia's Aboriginal population also suffers from a range of significant NTDs. Through the Pacific Programme to Eliminate Lymphatic Filariasis, enormous strides have been made in eliminating LF in Oceania through programs of mass drug administration (MDA), although LF remains widespread in PNG. There are opportunities to scale up MDA for PNG's major NTDs, which could be accomplished through an integrated package that combines albendazole, ivermectin, diethylcarbamazine, and azithromycin, in a program of national control. Australia's Aboriginal population may benefit from appropriately integrated MDA into primary health care systems. Several emerging viral NTDs remain important threats to the region.

46 Koepfli C, Colborn KL, Kiniboro B, Lin E, Speed TP, Siba PM, Felger I, Mueller I.

A high force of *Plasmodium vivax* blood-stage infection drives the rapid acquisition of immunity in Papua New Guinean children.

PLoS Negl Trop Dis 2013 Sep 5;7(9):e2403. doi: 10.1371/journal.pntd.0002403.

BACKGROUND: When both parasite species are co-endemic, *Plasmodium vivax* incidence peaks in younger children compared to *P. falciparum*. To identify differences in the number of blood stage infections of these species and its potential link to acquisition of immunity, we have estimated the molecular force of blood-stage infection of *P. vivax* ((mol)FOB, ie, the number of genetically distinct blood-stage infections over time), and compared it to previously reported values for *P. falciparum*. **METHODS:** *P. vivax* (mol) FOB was estimated by high resolution genotyping parasites in samples collected over 16 months in a cohort of 264 Papua New Guinean children living in an area highly endemic for *P. falciparum* and *P. vivax*. In this cohort, *P. vivax* episodes decreased three-fold over the age range of 1-4.5 years. **RESULTS:** On average, children acquired 14.0 new *P. vivax* blood-stage clones/child/year-at-risk. While the incidence of clinical *P. vivax* illness was strongly associated with (mol)FOB (incidence rate ratio (IRR)=1.99, 95% confidence interval (CI95) [1.80-2.19]), (mol)FOB did not change with age. The incidence of *P. vivax* showed a faster decrease with age in children with high (IRR=0.49, CI95 [0.38-0.64] $p < 0.001$) compared to those with low exposure (IRR = 0.63, CI95[0.43-0.93] $p = 0.02$). **CONCLUSION:** *P. vivax* (mol)FOB is considerably higher than *P. falciparum* (mol)FOB (5.5 clones/child/year-at-risk). The high number of *P. vivax* clones that infect children in early childhood contribute to the rapid acquisition of immunity against clinical *P. vivax* malaria.

47 Koepfli C, Timinao L, Antao T, Barry AE, Siba P, Mueller I, Felger I.

A large *Plasmodium vivax* reservoir and little population structure in the South Pacific.

PLoS One 2013 Jun 18;8(6):e66041. Print 2013.

INTRODUCTION: The importance of *Plasmodium vivax* in malaria elimination is increasingly being recognized, yet little is known about its population size and population genetic structure in the South Pacific, an area that is the focus of intensified malaria control. **METHODS:** We have genotyped 13 microsatellite markers in 295 *P. vivax* isolates from four geographically distinct sites in Papua New Guinea (PNG) and one site from Solomon Islands, representing different transmission intensities. **RESULTS:** Diversity was very high with expected heterozygosity values ranging from 0.62 to 0.98 for the different markers. Effective population size was high (12,872 to 19,533 per site). In PNG population structuring was limited with moderate levels of genetic differentiation. F_{ST} values (adjusted for high diversity of markers) were 0.14-0.15. Slightly higher levels were observed between PNG populations and Solomon Islands (F_{ST}=0.16). **CONCLUSIONS:** Low levels of population structure despite geographical barriers to transmission are in sharp contrast to results from regions of low *P. vivax* endemicity. Prior to intensification of malaria control programs in the study area, parasite diversity and effective population size remained high.

48 Koinari M, Karl S, Elliot A, Ryan U, Lymbery AJ.

Identification of *Anisakis* species (Nematoda: Anisakidae) in marine fish hosts from Papua New Guinea.

Vet Parasitol 2013 Mar 31;193(1-3):126-133. doi: 10.1016/j.vetpar.2012.12.008. Epub 2012 Dec 20.

The third-stage larvae of several genera of anisakid nematodes are important etiological agents for zoonotic human anisakiasis. The present study investigated the prevalence of potentially zoonotic anisakid larvae in fish collected on the coastal shelves off Madang and Rabaul in Papua New Guinea (PNG) where fish represents a major component of the diet. Nematodes were found in seven fish species including *Decapterus macarellus*, *Gerres oblongus*, *Pinjalo lewisi*, *Pinjalo pinjalo*, *Selar crumenophthalmus*, *Scomberomorus maculatus* and *Thunnus albacares*. They were identified by both light and scanning electron microscopy as *Anisakis* Type I larvae. Sequencing and phylogenetic analysis of the ribosomal internal transcribed spacer (ITS) and the mitochondrial cytochrome C oxidase subunit II (cox2) gene identified all nematodes as *Anisakis typica*. This study represents the first in-depth characterisation of *Anisakis* larvae from seven new fish hosts in PNG. The overall prevalence of larvae was low (7.6%) and no recognized zoonotic *Anisakis* species were identified, suggesting a very low threat of anisakiasis in PNG.

49 Kool JL, Pavlin BI, Musto J, Dawainavesi A.

Influenza surveillance in the Pacific island countries and territories during the 2009 pandemic: an observational study.

BMC Infect Dis 2013 Jan 7;13:6. doi: 10.1186/1471-2334-13-6.

BACKGROUND: Historically, Pacific island countries and territories (PICTs) have been more severely affected by influenza pandemics than any other part of the world. We herein describe the emergence and epidemiologic characteristics of pandemic influenza H1N1 in PICTs from 2009 to 2010. **METHODS:** The World Health Organization gathered reports of influenza-like illness and laboratory-confirmed pandemic H1N1 cases from all 23 Pacific island countries and territories, from April 2009 through August 2010. Data were gathered through weekly email reports from Pacific island countries and territories and through email or telephone follow-up. **RESULTS:** Pacific island countries and territories started detecting pandemic H1N1 cases in June 2009, firstly in French Polynesia, with the last new detection occurring in August 2009 in Tuvalu. Nineteen Pacific island countries and territories reported 1,972 confirmed cases, peaking in August 2009. No confirmed pandemic H1N1 cases were identified in Niue, Pitcairn and Tokelau; the latter instituted strict maritime quarantine. Influenza-like-illness surveillance showed trends similar to surveillance of confirmed cases. Seven Pacific island countries and territories reported 21 deaths of confirmed pandemic H1N1. Case-patients died of acute respiratory distress syndrome or multi-organ failure, or both. The most reported pre-existing conditions were obesity, lung disease, heart disease, and pregnancy. Pacific island countries and territories instituted a variety of mitigation measures, including arrival health screening. Multiple partners facilitated influenza preparedness planning and outbreak response. **CONCLUSIONS:** Pandemic influenza spread rapidly throughout the Pacific despite enormous distances and relative isolation. Tokelau and Pitcairn may be

the only jurisdictions to have remained pandemic-free. Despite being well-prepared, Pacific island countries and territories experienced significant morbidity and mortality, consistent with other indigenous and low-resource settings. For the first time, regional influenza-like-illness surveillance was conducted in the Pacific, allowing health authorities to monitor the pandemic's spread and severity in real-time. Future regional outbreak responses will likely benefit from the lessons learned during this outbreak.

50 Laman M, Pomat W, Siba P, Betuela I.

Ethical challenges in integrating patient-care with clinical research in a resource-limited setting: perspectives from Papua New Guinea.

BMC Med Ethics 2013 Jul 26;14:29. doi: 10.1186/1472-6939-14-29.

BACKGROUND: In resource-limited settings where healthcare services are limited and poverty is common, it is difficult to ethically conduct clinical research without providing patient-care. Therefore, integration of patient-care with clinical research appears as an attractive way of conducting research while providing patient-care. In this article, we discuss the ethical implications of such approach with perspectives from Papua New Guinea. **DISCUSSION:** Considering the difficulties of providing basic healthcare services in developing countries, it may be argued that integration of clinical research with patient-care is an effective, rational and ethical way of conducting research. However, blending patient-care with clinical research may increase the risk of subordinating patient-care in favour of scientific gains; therapeutic misconception and inappropriate inducement; and the risk of causing health system failures due to limited capacity in developing countries to sustain the level of healthcare services sponsored by the research. Nevertheless, these ethical and administrative implications can be minimised if patient-care takes precedence over research; the input of local ethics committees and institutions are considered; and funding agencies acknowledge their ethical obligation when sponsoring research in resource-limited settings. **SUMMARY:** Although integration of patient-care with clinical research in developing countries appears as an attractive way of conducting research when resources are limited, careful planning and consideration on the ethical implications of such an approach must be considered.

51 Laman M, Ripa P, Vince J, Tefuarani N.

Head nodding predicts mortality in young hypoxaemic Papua New Guinean children with acute lower respiratory tract infection.

J Trop Pediatr 2013 Feb;59(1):75-76. doi: 10.1093/tropej/fms048. Epub 2012 Oct 15.

52 Lee Y, Wakabayashi M.

Key informant interview on antimicrobial resistance (AMR) in some countries in the Western Pacific region.

Global Health 2013 Jul 26;9:34. doi: 10.1186/1744-8603-9-34.

BACKGROUND: The World Health Organization (WHO) selected antimicrobial resistance (AMR) as the theme for World Health Day 2011. The slogan was "Combat Drug Resistance - no action today, no cure tomorrow". A six-point policy package was launched as a core product for World Health Day. It aimed to stimulate extensive and coherent action to overcome the many challenges presented by antimicrobial

resistance. **METHODS:** As a preparation for World Health Day, interviews were conducted with a series of key informants, mainly senior government staff, to assess their awareness of the topic and the interventions proposed in the policy package. Since the key informant interview methodology was used with a small number of interviewees, it may be difficult to demonstrate the validity of the findings. **RESULTS:** Key informants from twelve out of fifteen countries responded, which included Fiji (n = 5), Kiribati (n = 1), Lao PDR (n = 2), Malaysia (n = 6), Micronesia (n = 3), Mongolia (n = 5), the Philippines (n = 5), Vietnam (n = 6), Vanuatu (n = 1), Solomon Islands (n = 3), Cambodia (n = 5) and Brunei (n = 1). There was a total of forty-three respondents (n = 43). AMR was widely recognized as a problem. Lack of a coherent, comprehensive and national plan or strategy was noted. Surveillance was often seen as weak and fragmented even where presented. Laboratory capacity was felt to be insufficient across all countries interviewed. The majority of respondents stressed the need for national and local plans to combat AMR including reliable estimates of the financial cost of combating and managing AMR, the need for legislation to control inappropriate use of antimicrobials in food animals and more serious efforts to promote Standard Treatment Guidelines (STGs) and Rational Prescription. Also, importance was highlighted of the need to include infection prevention and control (IPC) as a part of accreditation and registration of health institutions and programs to promote IPC to the general population. **CONCLUSION:** A coalition of interested parties at the local, national and international levels need to generate and sustain the political will to organize a more comprehensive, sustainable, and coherent approach to AMR.

53 **Levinson SC, Majid A.**

The island of time: Yélf Dnye, the language of Rossel Island.

Front Psychol 2013 Feb 18;4:61. doi: 10.3389/fpsyg.2013.00061. eCollection 2013.

This paper describes the linguistic description of time, the accompanying gestural system, and the "mental time lines" found in the speakers of Yélf Dnye, an isolate language spoken offshore from Papua New Guinea. Like many indigenous languages, Yélf Dnye has no fixed anchoring of time and thus no calendrical time. Instead, time in Yélf Dnye linguistic description is primarily anchored to the time of speaking, with six diurnal tenses and special nominals for n days from coding time; this is supplemented with special constructions for overlapping events. Consequently there is relatively little cross-over or metaphor from space to time. The gesture system, on the other hand, uses pointing to sun position to indicate time of day and may make use of systematic time lines. Experimental evidence fails to show a single robust axis used for mapping time to space. This suggests that there may not be a strong, universal tendency for systematic space-time mappings.

54 **Logue K, Chan ER, Phipps T, Small ST, Reimer L, Henry-Halldin C, Sattabongkot J, Siba PM, Zimmerman PA, Serre D.**

Mitochondrial genome sequences reveal deep divergences among *Anopheles punctulatus* sibling species in Papua New Guinea.

Malar J 2013 Feb 14;12:64. doi: 10.1186/1475-2875-12-64.

BACKGROUND: Members of the *Anopheles*

punctulatus group (AP group) are the primary vectors of human malaria in Papua New Guinea. The AP group includes 13 sibling species, most of them morphologically indistinguishable. Understanding why only certain species are able to transmit malaria requires a better comprehension of their evolutionary history. In particular, understanding relationships and divergence times among *Anopheles* species may enable assessing how malaria-related traits (eg, blood feeding behaviours, vector competence) have evolved. **METHODS:** DNA sequences of 14 mitochondrial (mt) genomes from five AP sibling species and two species of the *Anopheles dirus* complex of Southeast Asia were sequenced. DNA sequences from all concatenated protein coding genes (10,770 bp) were then analysed using a Bayesian approach to reconstruct phylogenetic relationships and date the divergence of the AP sibling species. **RESULTS:** Phylogenetic reconstruction using the concatenated DNA sequence of all mitochondrial protein coding genes indicates that the ancestors of the AP group arrived in Papua New Guinea 25 to 54 million years ago and rapidly diverged to form the current sibling species. **CONCLUSION:** Through evaluation of newly described mt genome sequences, this study has revealed a divergence among members of the AP group in Papua New Guinea that would significantly predate the arrival of humans in this region, 50 thousand years ago. The divergence observed among the mtDNA sequences studied here may have resulted from reproductive isolation during historical changes in sea-level through glacial minima and maxima. This leads to a hypothesis that the AP sibling species have evolved independently for potentially thousands of generations. This suggests that the evolution of many phenotypes, such as insecticide resistance, will arise independently in each of the AP sibling species studied here.

55 **Man WY, Kelly A, Worth H, Frankland A, Shih P, Kupul M, Lwin T, Mek A, Kepa B, Emori R, Akuani F, Cangah B, Walizopa L, Pirpir L, Nosi S, Siba PM.**

Sexual risk behaviour, marriage and ART: a study of HIV-positive people in Papua New Guinea.

AIDS Res Ther 2013 Jun 27;10(1):17. doi: 10.1186/1742-6405-10-17.

BACKGROUND: The prevention of intimate partner transmission of HIV remains an important component of comprehensive HIV prevention strategies. In this paper we examine the sexual practices of people living with HIV on antiretroviral therapy (ART) in Papua New Guinea (PNG). **METHOD:** In 2008, a total of 374 HIV-positive people over the age of 16 and on ART for more than two weeks were recruited using a non-probability, convenience sampling methodology. This accounted for around 18% of adults on ART at the time. A further 36 people participated in semi-structured interviews. All interviews were thematically analysed using NVivo qualitative data analysis software. **RESULTS:** Less than forty per cent (38%) of participants reported having had sexual intercourse in the six months prior to the survey. Marital status was by far the most important factor in determining sexual activity, but consistent condom use during vaginal intercourse with a regular partner was low. Only 46% reported consistent condom use during vaginal intercourse with a regular partner in the last six months, despite 77% of all participants reporting that consistent condom use can prevent HIV transmission. Consistent condom use was lowest amongst married couples and those

in seroconcordant relationships. The vast majority (91.8%) of all participants with a regular heterosexual partner had disclosed their status to their partner. Qualitative data reinforced low rates of sexual activity and provided important insights into sexual abstinence and condom use. **CONCLUSIONS:** Considering the importance of intimate partner transmission of HIV, these results on the sexual practices of people with HIV on ART in PNG suggest that one-dimensional HIV prevention messages focussing solely on condom use fail to account for the current practices and needs of HIV-positive people, especially those who are married and know their partner's HIV status.

- 56 **Massey PD, Asugeni R, Wakageni J, Kekeubata E, Maena'aadi J, Laete'esafi J, Waneagea J, Harrington H, Fangaria G, MacLaren D, Speare R.** Progress towards TB control in East Kwaio, Solomon Islands.

Rural Remote Health 2013 Apr-Jun;13(2):2555. Epub 2013 Jun 3.

- 57 **May FJ, Clark DC, Pham K, Diviney SM, Williams DT, Field EJ, Kuno G, Chang GJ, Cheah WY, Setoh YX, Prow NA, Hobson-Peters J, Hall RA.**

Genetic divergence among members of the Kokobera group of flaviviruses supports their separation into distinct species.

J Gen Virol 2013 Jul;94(Pt 7):1462-1467. doi: 10.1099/vir.0.049940-0. Epub 2013 Feb 20.

The Kokobera virus group comprises mosquito-borne flaviviruses that cluster together phylogenetically. These viruses are unique to Australia and Papua New Guinea, and have been associated with a mild polyarticular disease in humans. Recent isolation of genetically diverse viruses within this group has prompted analysis of their genetic and phenotypic relationships. Phylogenetic analysis based on complete ORF, the envelope gene or the NS5/3' untranslated region supported the separation of the group into distinct species: Kokobera virus (KOKV), Stratford virus, New Mapoon virus, MK7979 and TS5273. Virulence studies in 3-week-old mice also provided the first evidence that a member of the KOKV group (MK7979) was neuroinvasive after intraperitoneal inoculation. In this context, our recent detection of KOKV group-specific antibodies in horses in the field suggests that these viruses should be considered in the epidemiology of flavivirus encephalitis in Australia.

- 58 **McCool J, McKenzie J, Lyman A, Allen M.**

Supporting Pacific island countries to strengthen their resistance to tobacco industry interference in tobacco control: a case study of Papua New Guinea and Solomon Islands.

Int J Environ Res Public Health 2013 Aug 6;10(8):3424-3434. doi: 10.3390/ijerph10083424.

Tobacco use is the biggest single preventable cause of non-communicable diseases (NCDs) in the Western Pacific region. Currently, 14 Pacific island countries have ratified the WHO Framework Convention on Tobacco Control (FCTC) and, in having done so, are committed to implementing tobacco control measures aligned with the FCTC. Progressing strong and effective tobacco control legislation is essential to achieving long term gains in public health in small island countries. However, survey evidence suggests that pervasive tobacco industry interference serves to undermine tobacco control and public policy in several Pacific countries.

An initiative was developed to provide dedicated, in-country technical support for developing legislation and policy to support implementation of Article 5.3 of the FCTC in the Solomon Islands and Papua New Guinea. This paper examines the factors that have assisted the two Pacific countries to make progress in implementing Article 5.3 and what this might mean for supporting progress in other Pacific settings. A document analysis was undertaken to identify the process and outcome of the intervention. Two significant outputs from the project included having identified and documented specific examples of TII and the development of draft legislation for Article 5.3 and other key resources for public servants both within and outside the health sector. Key determinants of progress included a motivated and engaged Ministry of Health, active civil society group or champion and access to media to prepare tobacco-industry-related material to stimulate public and policy sector debate.

- 59 **Milne GJ, Baskaran P, Halder N, Karl S, Kelso J.**

Pandemic influenza in Papua New Guinea: a modelling study comparison with pandemic spread in a developed country.

BMJ Open 2013 Mar 26;3(3). pii: e002518. doi: 10.1136/bmjopen-2012-002518. Print 2013.

OBJECTIVES: The possible occurrence of a highly pathogenic influenza strain is of concern to health authorities worldwide. It is known that during past influenza pandemics developing countries have experienced considerably higher death rates compared with developed countries. Furthermore, many developing countries lack appropriate pandemic preparedness plans. Mathematical modelling studies to guide the development of such plans are largely focused on predicting pandemic influenza spread in developed nations. However, intervention strategies shown by modelling studies to be highly effective for developed countries give limited guidance as to the impact which an influenza pandemic may have on low-income countries given different demographics and resource constraints. To address this, an individual-based model of a Papua New Guinean (PNG) community was created and used to simulate the spread of a novel influenza strain. The results were compared with those obtained from a comparable Australian model. **DESIGN:** A modelling study. **SETTING:** The towns of Madang in PNG (population ~35 000) and Albany (population ~30 000) in Australia. **OUTCOME MEASURES:** Daily and cumulative illness attack rates in both models following introduction of a novel influenza strain into a naive population, for an unmitigated scenario and two social distancing intervention scenarios. **RESULTS:** The unmitigated scenario indicated an approximately 50% higher attack rate in PNG compared with the Australian model. The two social distancing-based intervention strategies were 60-70% less effective in a PNG setting compared with an Australian setting. **CONCLUSIONS:** This study provides further evidence that an influenza pandemic occurring in a low-income country such as PNG may have a greater impact than one occurring in a developed country, and that PNG-feasible interventions may be substantially less effective. The larger average household size in PNG, the larger proportion of the population under 18 and greater community-wide contact all contribute to this feature.

- 60 **Mitjà O, Paru R, Selve B, Betuela I, Siba P, De Lazzari E, Bassat Q.**

Malaria epidemiology in Lihir Island, Papua New Guinea.

Malar J 2013 Mar 15;12:98. doi: 10.1186/1475-2875-12-98.

BACKGROUND: *Plasmodium vivax* and *Plasmodium falciparum* malaria remain highly endemic in the Pacific islands including Lihir Island, Papua New Guinea. Lihir Gold Limited is conducting mining activities and funded an integrated vector control intervention within the villages surrounding the mine. The aim of this study was to assess the impact of this programme by comparing the epidemiological trends of malaria in different parts of the island. **METHODS:** Two cross-sectional surveys were conducted before and after the intervention (2006-2010) to determine malaria prevalence in mine-impact (MI) and non-MI areas. Incidence of malaria was estimated for the Lihir Medical Centre catchment area using island population denominators and a health-centre passive case detection ongoing from 2006 to 2011. **RESULTS:** A total of 2,264 and 1,653 children <15 were surveyed in the cross-sectional studies. The prevalence of any malaria parasitaemia initially was 31.5% in MI areas and 34.9% in non-MI (POR 1.17; 95 CI 0.97-1.39). After four years there was a significant reduction in prevalence in the MI areas (5.8%; POR 0.13, 95 CI 0.09-0.20), but reduction was less marked in non-MI areas (26.9%; POR 0.69, 95 CI 0.58-0.81). 28,747 patients were included in the evaluation of incidence trends and overall malaria in the local Lihirian population in MI areas declined over time, while it remained at similar high levels among migrants. The age-incidence analysis showed that for each higher age range the malaria incidence declines compared to that of the previous stratum. **CONCLUSIONS:** There was a substantial reduction in prevalence and incidence rates of both *P. vivax* and *P. falciparum* in the mining area following implementation of a malaria control intervention, which was not seen in the area outside the mining activities.

- 61 **Naka I, Hikami K, Nakayama K, Koga M, Nishida N, Kimura R, Furusawa T, Natsuhara K, Yamauchi T, Nakazawa M, Ataka Y, Ishida T, Inaoka T, Iwamoto S, Matsumura Y, Ohtsuka R, Tsuchiya N, Ohashi J.** A functional SNP upstream of the beta-2 adrenergic receptor gene (*ADRB2*) is associated with obesity in Oceanic populations.

Int J Obes (Lond) 2013 Sep;37(9):1204-1210. doi: 10.1038/ijo.2012.206. Epub 2012 Dec 11.

OBJECTIVE: Obesity is a growing health concern in the Oceanic populations. To investigate the genetic factors associated with adult obesity in the Oceanic populations, the association of single nucleotide polymorphisms (SNPs) of the beta-2 adrenergic receptor gene (*ADRB2*) with obesity was examined in 694 adults living in Tonga and Solomon Islands. **RESULTS:** A screening for variation in 16 Oceanic subjects detected 17 SNPs in the entire region of *ADRB2*, of which nine SNPs including two non-synonymous ones, rs1042713 (Arg16Gly) and rs1042714 (Gln27Glu), were further genotyped for all subjects. The rs34623097-A allele, at a SNP located upstream of *ADRB2*, showed the strongest association with risk for obesity in a logistic regression analysis adjusted for age, sex, and population ($p = 5.6 \times 10^{-4}$, odds ratio [OR] = 2.5, 95% confidence interval [CI] = 1.5-4.2). The 27Glu was also significantly associated with obesity in the single-point association analysis ($p = 0.013$, OR = 2.0, 95%CI = 1.2-3.4); however, this association was no longer significant

after adjustment for rs34623097 since these SNPs were in linkage disequilibrium with each other. A copy of the obesity-risk allele, rs34623097-A, led to a 1.6 kg/m² increase in body mass index (BMI; defined as weight in kilograms divided by height in meters squared) ($p = 0.0019$). A luciferase reporter assay indicated that rs34623097-A reduced the transcriptional activity of the luciferase reporter gene by approximately 10% compared with rs34623097-G. An electrophoretic mobility shift assay demonstrated that rs34623097 modulated the binding affinity with nuclear factors. An evolutionary analysis implies that a G>A mutation at rs34623097 occurred in the Neandertal genome and then the rs34623097-A allele flowed into the ancestors of present-day humans. **CONCLUSION:** The present results suggest that rs34623097-A, which would lead to lower expression of *ADRB2*, contributes to the onset of obesity in the Oceanic populations.

- 62 **Ome M, Wangnapi R, Hamura N, Umbers AJ, Siba P, Laman M, Bolnga J, Rogerson S, Unger HW.**

A case of ultrasound-guided prenatal diagnosis of prune belly syndrome in Papua New Guinea – implications for management.

BMC Pediatr 2013 May 7;13:70. doi: 10.1186/1471-2431-13-70.

BACKGROUND: Prune belly syndrome is a rare congenital malformation of unknown aetiology and is characterised by abnormalities of the urinary tract, a deficiency of abdominal musculature and bilateral cryptorchidism in males. We report a case of prune belly syndrome from Papua New Guinea, which was suspected on pregnancy ultrasound scan and confirmed upon delivery. **CASE PRESENTATION:** A 26-year-old married woman, Gravida 3 Para 2, presented to antenatal clinic in Madang, Papua New Guinea, at 21(+5) weeks' gestation by dates. She was well with no past medical or family history of note. She gave consent to participate in a clinical trial on prevention of malaria in pregnancy and underwent repeated ultrasound examinations which revealed a live fetus with persistent megacystis and anhydramnios. Both mother and clinicians agreed on conservative management of the congenital abnormality. The mother spontaneously delivered a male fetus weighing 2010 grams at 34 weeks' gestation with grossly abnormal genitalia including cryptorchidism, penile aplasia and an absent urethral meatus, absent abdominal muscles and hypoplastic lungs. The infant passed away two hours after delivery. This report discusses the implications of prenatal detection of severe congenital abnormalities in PNG. **CONCLUSION:** This first formally reported case of prune belly syndrome from a resource-limited setting in the Oceania region highlights the importance of identifying and documenting congenital abnormalities. Women undergoing antenatal ultrasound examinations must be carefully counseled on the purpose and the limitations of the scan. The increasing use of obstetric ultrasound in PNG will inevitably result in a rise in prenatal detection of congenital abnormalities. This will need to be met with adequate training, referral mechanisms and better knowledge of women's attitudes and beliefs on birth defects and ultrasound. National medicolegal guidance regarding induced abortion and resuscitation of a fetus with severe congenital abnormalities may be required.

- 63 **Pomat WS, van den Biggelaar AH, Phanukoannon**

S, Francis J, Jacoby P, Siba PM, Alpers MP, Reeder JC, Holt PG, Richmond PC, Lehmann D; Neonatal Pneumococcal Conjugate Vaccine Trial Study Team.

Safety and immunogenicity of neonatal pneumococcal conjugate vaccination in Papua New Guinean children: a randomised controlled trial.

PLoS One 2013;8(2):e56698. doi: 10.1371/journal.pone.0056698. Epub 2013 Feb 22.

BACKGROUND: Approximately 826,000 children, mostly young infants, die annually from invasive pneumococcal disease. A 6-10-14-week schedule of pneumococcal conjugate vaccine (PCV) is efficacious but neonatal PCV may provide earlier protection and better coverage. We conducted an open randomized controlled trial in Papua New Guinea to compare safety, immunogenicity and priming for memory of 7-valent PCV (PCV7) given in a 0-1-2-month (neonatal) schedule with that of the routine 1-2-3-month (infant) schedule. **METHODS:** We randomized 318 infants at birth to receive PCV7 in the neonatal or infant schedule or no PCV7. All infants received 23-valent pneumococcal polysaccharide vaccine (PPV) at age 9 months. Serotype-specific serum IgG for PCV7 (VT) serotypes and non-VT serotypes 2, 5 and 7F were measured at birth and 2, 3, 4, 9, 10 and 18 months of age. Primary outcomes were geometric mean concentrations (GMCs) and proportions with concentration ≥ 0.35 $\mu\text{g/ml}$ of VT serotype-specific pneumococcal IgG at age 2 months and one month post-PPV. **RESULTS:** We enrolled 101, 105 and 106 infants, respectively, into neonatal, infant and control groups. Despite high background levels of maternally derived antibody, both PCV7 groups had higher GMCs than controls at age 2 months for serotypes 4 ($p < 0.001$) and 9V ($p < 0.05$) and at age 3 months for all VTs except 6B. GMCs for serotypes 4, 9V, 18C and 19F were significantly higher ($p < 0.001$) at age 2 months in the neonatal (one month post-dose2 PCV7) than in the infant group (one month post-dose1 PCV7). PPV induced significantly higher VT antibody responses in PCV7-primed than unprimed infants, with neonatal and infant groups equivalent. High VT and non-VT antibody concentrations generally persisted to age 18 months. **CONCLUSIONS:** PCV7 is well-tolerated and immunogenic in PNG neonates and young infants and induces immunologic memory to PPV booster at age 9 months with antibody levels maintained to age 18 months.

64 Pugach I, Delfin F, Gunnarsdóttir E, Kayser M, Stoneking M.

Genome-wide data substantiate Holocene gene flow from India to Australia.

Proc Natl Acad Sci USA 2013 Jan 29;110(5):1803-1808. doi: 10.1073/pnas.1211927110. Epub 2013 Jan 14.

The Australian continent holds some of the earliest archaeological evidence for the expansion of modern humans out of Africa, with initial occupation at least 40,000 years ago. It is commonly assumed that Australia remained largely isolated following initial colonization, but the genetic history of Australians has not been explored in detail to address this issue. Here, we analyze large-scale genotyping data from Aboriginal Australians, New Guineans, island Southeast Asians and Indians. We find an ancient association between Australia, New Guinea and the Mamanwa (a Negrito group from the Philippines), with divergence times for these groups estimated at 36,000 y ago, and supporting the view that these populations

represent the descendants of an early "southern route" migration out of Africa, whereas other populations in the region arrived later by a separate dispersal. We also detect a signal indicative of substantial gene flow between the Indian populations and Australia well before European contact, contrary to the prevailing view that there was no contact between Australia and the rest of the world. We estimate this gene flow to have occurred during the Holocene, 4,230 years ago. This is also approximately when changes in tool technology, food processing, and the dingo appear in the Australian archaeological record, suggesting that these may be related to the migration from India.

65 Ralph AP, Yeo TW, Salome CM, Waramori G, Pontororing GJ, Kenangalem E, Sandjaja, Tjitra E, Lumb R, Maguire GP, Price RN, Chatfield MD, Kelly PM, Anstey NM.

Impaired pulmonary nitric oxide bioavailability in pulmonary tuberculosis: association with disease severity and delayed mycobacterial clearance with treatment.

J Infect Dis 2013 Aug 15;208(4):616-626. doi: 10.1093/infdis/jit248. Epub 2013 Jun 3.

BACKGROUND: Nitric oxide (NO), a key macrophage antimycobacterial mediator that ameliorates immunopathology, is measurable in exhaled breath in individuals with pulmonary tuberculosis. We investigated relationships between fractional exhale NO (FENO) and initial pulmonary tuberculosis severity, change during treatment, and relationship with conversion of sputum culture to negative at 2 months. **METHODS:** In Papua, we measured FENO in patients with pulmonary tuberculosis at baseline and serially over 6 months and once in healthy controls. Treatment outcomes were conversion of sputum culture results at 2 months and time to conversion of sputum microscopy results. **RESULTS:** Among 200 patients with pulmonary tuberculosis and 88 controls, FENO was lower for patients with pulmonary tuberculosis at diagnosis (geometric mean FENO, 12.7 parts per billion [ppb]; 95% confidence interval [CI], 11.6-13.8) than for controls (geometric mean FENO, 16.6 ppb; 95% CI, 14.2-19.5; $p = 0.002$), fell further after treatment initiation (nadir at 1 week), and then recovered by 6 months ($p = 0.03$). Lower FENO was associated with more severe tuberculosis disease, with FENO directly proportional to weight ($p < 0.001$) and forced vital capacity ($p = 0.001$) and inversely proportional to radiological score ($p = 0.03$). People whose FENO increased or remained unchanged by 2 months were 2.7-fold more likely to achieve conversion of sputum culture than those whose FENO decreased (odds ratio, 2.72; 95% CI, 1.05-7.12; $p = 0.04$). **CONCLUSIONS:** Among patients with pulmonary tuberculosis, impaired pulmonary NO bioavailability is associated with more severe disease and delayed mycobacterial clearance. Measures to increase pulmonary NO warrant investigation as adjunctive tuberculosis treatments.

66 Redman-MacLaren ML, Mills J, Tommbe R, MacLaren DJ, Speare R, McBride WJ.

Women and HIV in a moderate prevalence setting: an integrative review.

BMC Public Health 2013 Jun 6;13:552. doi: 10.1186/1471-2458-13-552.

BACKGROUND: Almost 32,000 people are living with human immunodeficiency virus (HIV) in Papua New Guinea (PNG). The primary route of transmission

in this moderate prevalence setting is through heterosexual sex. Thus a gendered understanding of HIV is required to inform HIV prevention, treatment and care options. The aim of this review is to investigate understandings specifically about women and HIV in PNG and to identify gaps in the literature to inform future HIV research. **METHODS:** An integrative review of literature about women, HIV and PNG was conducted using a systematic search of online databases, including book chapters and grey literature. Prior to inclusion, literature was assessed using inclusion and exclusion criteria, and the Critical Appraisal Skills Programme (CASP) appraisal tool. Selected articles, book chapters and reports were coded and a constant comparative method of analysis used to construct a series of themes. **RESULTS:** The 26 articles, book chapters and reports included in the review were predominantly descriptive, original research (23/26 pieces of literature). Six themes were identified in the literature: economic, social and cultural factors (including mobility); gender issues (including violence against women); knowledge about HIV (including perception of risk of HIV); religious beliefs about HIV; women perceived as responsible for HIV transmission; and prevention of HIV. Literature about women and HIV in PNG is predominantly focussed upon women who sell sex, women as mothers or young women. Women are usually represented as either victims of HIV or responsible for transmitting HIV. Anthropological and social research has described the economic, social and cultural context along with the lived experience of HIV in PNG, but there is limited operations research or implementation research available. **CONCLUSIONS:** The literature reviewed has highlighted the importance of a gendered analysis of HIV prevention, care and treatment in PNG. There is an opportunity for operations, implementation and health systems research about HIV in PNG to shift research from description to action.

- 67 **Rees S, Silove DM, Tay K, Kareth M.** Human rights trauma and the mental health of West Papuan refugees resettled in Australia. *Med J Aust* 2013 Aug 19;199(4):280-283.

OBJECTIVES: To document the extent and nature of human rights violations and other traumatic events reported by West Papuan refugees resettled in Australia and to assess trauma-related psychological disorders, distress and disability. **DESIGN AND SETTING:** Australian-based sample, mixed-methods design with 44 participants, conducted in Australia between October 2007 and November 2010 in communities in North Queensland and Melbourne. **PARTICIPANTS:** West Papuan refugees aged 18 years and over (88% response rate). **MAIN OUTCOME MEASURES:** Post-traumatic stress disorder (PTSD) symptoms (Harvard Trauma Questionnaire) and premigration potentially traumatic events (PTEs), psychological distress (Kessler Psychological Distress Scale [K10]), post-migration living difficulties, days out of role. **RESULTS:** Of the 44 West Papuan refugees, 40 reported one or more PTE, including inability to access medical care for family (40), lack of food and water (39) and lack of access to medical treatment (38). The most frequent postmigration stressors were separation from and worries about family members remaining in West Papua (43) and being unable to return home in an emergency because of ongoing conflict (41). Twenty-six participants reached a lower threshold for PTSD symptoms of 2.0, and 13 reached

the clinical threshold of 2.5. Fourteen reported severe psychological distress. **CONCLUSIONS:** West Papuan refugees resettled in Australia report a wide range of premigration PTEs including human rights violations, as well as symptoms of PTSD and distress. The data add to concerns about the state of human rights and mental health among West Papuans.

- 68 **Reimer LJ, Thomsen EK, Tisch DJ, Henry-Halldin CN, Zimmerman PA, Baea ME, Dagoro H, Susapu M, Hetzel MW, Bockarie MJ, Michael E, Siba PM, Kazura JW.**

Insecticidal bed nets and filariasis transmission in Papua New Guinea.

N Engl J Med 2013 Aug 22;369(8):745-753. doi: 10.1056/NEJMoa1207594.

BACKGROUND: Global efforts to eliminate lymphatic filariasis are based on the annual mass administration of antifilarial drugs to reduce the microfilaria reservoir available to the mosquito vector. Insecticide-treated bed nets are being widely used in areas in which filariasis and malaria are coendemic. **METHODS:** We studied five villages in which five annual mass administrations of antifilarial drugs, which were completed in 1998, reduced the transmission of *Wuchereria bancrofti*, one of the nematodes that cause lymphatic filariasis. A total of 21,899 anopheles mosquitoes were collected for 26 months before and 11 to 36 months after bed nets treated with long-lasting insecticide were distributed in 2009. We evaluated the status of filarial infection and the presence of *W. bancrofti* DNA in anopheline mosquitoes before and after the introduction of insecticide-treated bed nets. We then used a model of population dynamics to estimate the probabilities of transmission cessation. **RESULTS:** Village-specific rates of bites from anopheline mosquitoes ranged from 6.4 to 61.3 bites per person per day before the bed-net distribution and from 1.1 to 9.4 bites for 11 months after distribution ($p < 0.001$). During the same period, the rate of detection of *W. bancrofti* in anopheline mosquitoes decreased from 1.8% to 0.4% ($p = 0.005$), and the rate of detection of filarial DNA decreased from 19.4% to 14.9% ($p = 0.13$). The annual transmission potential was 5 to 325 infective larvae inoculated per person per year before the bed-net distribution and 0 after the distribution. Among all five villages with a prevalence of microfilariae of 2 to 38%, the probability of transmission cessation increased from less than 1.0% before the bed-net distribution to a range of 4.9 to 95% in the 11 months after distribution. **CONCLUSIONS:** Vector control with insecticide-treated bed nets is a valuable tool for *W. bancrofti* elimination in areas in which anopheline mosquitoes transmit the parasite. (Funded by the U.S. Public Health Service and the National Institutes of Health.)

- 69 **Richards JS, Arumugam TU, Reiling L, Healer J, Hodder AN, Fowkes FJ, Cross N, Langer C, Takeo S, Uboldi AD, Thompson JK, Gilson PR, Coppel RL, Siba PM, King CL, Torii M, Chitnis CE, Narum DL, Mueller I, Crabb BS, Cowman AF, Tsuboi T, Beeson JG.**

Identification and prioritization of merozoite antigens as targets of protective human immunity to *Plasmodium falciparum* malaria for vaccine and biomarker development.

J Immunol 2013 Jul 15;191(2):795-809. doi: 10.4049/jimmunol.1300778. Epub 2013 Jun 17.

The development of effective malaria vaccines

and immune biomarkers of malaria is a high priority for malaria control and elimination. Ags expressed by merozoites of *Plasmodium falciparum* are likely to be important targets of human immunity and are promising vaccine candidates, but very few Ags have been studied. We developed an approach to assess Ab responses to a comprehensive repertoire of merozoite proteins and investigate whether they are targets of protective Abs. We expressed 91 recombinant proteins, located on the merozoite surface or within invasion organelles, and screened them for quality and reactivity to human Abs. Subsequently, Abs to 46 proteins were studied in a longitudinal cohort of 206 Papua New Guinean children to define Ab acquisition and associations with protective immunity. Ab responses were higher among older children and those with active parasitemia. High-level Ab responses to rhoptry and microneme proteins that function in erythrocyte invasion were identified as being most strongly associated with protective immunity compared with other Ags. Additionally, Abs to new or understudied Ags were more strongly associated with protection than were Abs to current vaccine candidates that have progressed to phase 1 or 2 vaccine trials. Combinations of Ab responses were identified that were more strongly associated with protective immunity than responses to their single-Ag components. This study identifies Ags that are likely to be key targets of protective human immunity and facilitates the prioritization of Ags for further evaluation as vaccine candidates and/or for use as biomarkers of immunity in malaria surveillance and control.

70 Rosewell A, Clark G, Mabong P, Ropa B, Posanai E, Man NW, Dutta SR, Wickramasinghe W, Qi L, Ng JC, Mola G, Zwi AB, MacIntyre CR.

Concurrent outbreaks of cholera and peripheral neuropathy associated with high mortality among persons internally displaced by a volcanic eruption. *PLoS One* 2013 Sep 2;8(9):e72566. doi: 10.1371/journal.pone.0072566.

BACKGROUND: In October 2004, Manam Island volcano in Papua New Guinea erupted, causing over 10 000 villagers to flee to internally displaced person (IDP) camps, including 550 from Dugulaba village. Following violence over land access in March 2010, the IDPs fled the camps, and four months later concurrent outbreaks of acute watery diarrhea and unusual neurological complaints were reported in this population. **MATERIALS AND METHODS:** A retrospective case-control study was conducted to identify the risk factors for peripheral neuropathy. Rectal swabs were collected from cases of acute watery diarrhea. Hair and serum metals and metalloids were analyzed by Inductively Coupled Plasma-Mass Spectrometry (ICP-MS). **RESULTS:** There were 17 deaths among the 550 village inhabitants during the outbreak period at a crude mortality rate 21-fold that of a humanitarian crisis. *Vibrio cholerae* O1 El Tor Ogawa was confirmed among the population. Access to community-level rehydration was crucial to mortality. Peripheral neuropathy was diagnosed among cases with neurological symptoms. A balanced diet was significantly protective against neuropathy. A dose-response relationship was seen between peripheral neuropathy and a decreasing number of micronutrient-rich foods in the diet. Deficiencies in copper, iron, selenium and zinc were identified among the cases of peripheral neuropathy. **CONCLUSIONS:** Cholera likely caused the mostly preventable excess mortality.

Peripheral neuropathy was not caused by cholera, but cholera may worsen existing nutritional deficiencies. The peripheral neuropathy was likely to have been caused by complex micronutrient deficiencies linked to non-diversified diets that potentially increased the vulnerability of this population; however, a new zinc-associated neuropathy could not be ruled out. Reoccurrence can be prevented by addressing the root cause of displacement and ensuring access to arable land and timely resettlement.

71 Schaafsma SM, Geuze RH, Lust JM, Schiefenhövel W, Groothuis TG.

The relation between handedness indices and reproductive success in a non-industrial society. *PLoS One* 2013 May 21;8(5):e63114. doi: 10.1371/journal.pone.0063114. Print 2013.

The evolution of handedness in human populations has intrigued scientists for decades. However, whether handedness really affects Darwinian fitness is unclear and not yet studied in a non-industrial society where selection pressures on health and handedness are likely to be similar to the situation in which handedness has evolved. We measured both hand preference and asymmetry of hand skill (speed of fine motor control, measured by a pegboard task, and accuracy of throwing), as they measure different aspects of handedness. We investigated the associations between both the direction (left versus right) and strength (the degree to which a certain preference or asymmetry in skill is manifested, independent of the direction) of handedness. We analyzed to what extent these measures predict the number of offspring and self-reported illness in a non-industrial society in Papua, Indonesia. As it is known that body height and fitness are correlated, data on body height was also collected. Due to low numbers of left-handers we could not investigate the associations between direction of hand preference and measures of Darwinian fitness. We found a positive association between strength of asymmetry of hand skill (pegboard) and the number of children men sired. We also found a positive association for men between strength of hand preference and number of children who died within the first three years of life. For women we found no such effects. Our results may indicate that strength of handedness, independent of direction, has fitness implications and that the persistence of the polymorphism in handedness may be ascribed to either balancing selection on strength of asymmetry of hand skill versus strength of hand preference, or sexual antagonistic selection. No relationships between health and handedness were found, perhaps due to disease-related selective disappearance of subjects with a specific handedness.

72 Seah IM, Ambrose L, Cooper RD, Beebe NW.

Multilocus population genetic analysis of the Southwest Pacific malaria vector *Anopheles punctulatus*.

Int J Parasitol 2013 Sep;43(10):825-835. doi: 10.1016/j.ijpara.2013.05.004. Epub 2013 Jun 7.

The population structure and history of the cryptic malaria vector species, *Anopheles punctulatus* (Doenitz), was investigated throughout Papua New Guinea and the Solomon Islands with the aim of detailing genetic subdivisions and the potential for movement through this biogeographically complex region. We obtained larval collections from over 80 sites and utilised a diverse array of molecular

markers that evolve through different processes. Individuals were initially identified to species and genotyped using the ribosomal DNA second internal transcribed spacer. DNA sequencing of a single copy nuclear ribosomal protein S9 and the mitochondrial cytochrome oxidase I loci were then investigated and 12 nuclear microsatellite markers were developed and analysed. Our data revealed three genetically distinct populations – one in Papua New Guinea, the second on Buka Island (Bougainville Province, Papua New Guinea), and the third on Guadalcanal Island (Solomon Islands). Genetic differentiation within Papua New Guinea was much lower than that found in studies of other closely related species in the region. The data do suggest that *A. punctulatus* has undergone a population bottleneck followed by a recent population and range expansion in Papua New Guinea. Humans and regional economic growth may be facilitating this population expansion, as *A. punctulatus* is able to rapidly occupy human modified landscapes and traverse unsealed roads. We therefore anticipate extensive movement of this species through New Guinea – particularly into the highlands, with a potential increase in malaria frequency in a warming climate – as well as relatively unrestricted gene flow of advantageous alleles that may confound vector control efforts.

73 Senn N, Rarau P, Manong D, Salib M, Siba P, Reeder JC, Rogerson SJ, Genton B, Mueller I.

Effectiveness of artemether/lumefantrine for the treatment of uncomplicated *Plasmodium vivax* and *P. falciparum* malaria in young children in Papua New Guinea.

Clin Infect Dis 2013 May;56(10):1413-1420. doi: 10.1093/cid/cit068. Epub 2013 Feb 12.

BACKGROUND: Artemisinin combination therapy is recommended as treatment for uncomplicated *Plasmodium falciparum* (Pf) malaria, whereas chloroquine is still widely used for non-Pf infections. A common treatment for both vivax and falciparum malaria would be welcome. **METHODS:** A longitudinal prospective effectiveness study of 1682 children aged 3-27 months in outpatient clinics in Papua New Guinea. The main outcome was clinical treatment failure rate following treatment with artemether/lumefantrine (AL). **RESULTS:** Among 5670 febrile episodes, 1682 (28%) had positive rapid diagnostic test (RDT) results and were treated with AL. A total of 1261 (22%) had an infection confirmed by blood slide examination. Of these, 594 Pv and 332 Pf clinical malaria cases were included in the primary effectiveness analysis. Clinical treatment failure rates at 7, 28, and 42 days were 0.2%, 2.2%, and 12.0%, respectively, for Pv and 0.3%, 1.2%, and 3.6%, respectively, for Pf. A single malaria-unrelated death occurred within 42 days following treatment with AL, in a child who was aparasitemic by blood slide at reattendance. **CONCLUSIONS:** AL provides a rapid clinical response against both Pf and Pv malaria, but is associated with a high rate of Pv recurrent clinical episodes between days 28 and 42. In order to prevent relapsing infections from long-lasting hypnozoites, AL should ideally be complemented with a course of primaquine. In the absence of better treatment and diagnostic options, the use of AL in young children in routine practice is an acceptable, interim option in endemic areas where Pv is resistant to chloroquine and specific treatment for Pv hypnozoites not feasible.

74 Shinoda N, Sullivan KM, Tripp K, Erhardt JG,

Haynes BM, Temple VJ, Woodruff B.

Relationship between markers of inflammation and anaemia in children of Papua New Guinea.

Public Health Nutr 2013 Feb;16(2):289-295. doi: 10.1017/S1368980012001267. Epub 2012 May 21.

OBJECTIVE: To assess the association of the acute-phase protein biomarkers, C-reactive protein (CRP) and α 1-acid glycoprotein (AGP), with anaemia in children aged 6-59.9 months in Papua New Guinea. **DESIGN:** A nationally representative household-based cross-sectional survey of children aged 6-59.9 months was used to assess the relationships between various combinations of elevated CRP (>5 mg/l) and AGP (>1.2 g/l) with anaemia. Logistic regression was used to determine if other factors, such as age, sex, measures of anthropometry, region, urban/rural residence and household size, modified or confounded the acute-phase protein-anaemia association. **SETTING:** Papua New Guinea. **SUBJECTS:** A total of 870 children aged 6-59.9 months from the 2005 Papua New Guinea National Micronutrient Survey were assessed. **RESULTS:** The following prevalence estimates were found: anaemia 48%; elevated CRP 32%; and elevated AGP 33%. Children with elevated CRP had a prevalence of anaemia of 66% compared with children with normal CRP, who had a prevalence of 40%. Corresponding estimates for AGP were 61% and 42%, respectively. Similar results were found with combinations of elevated CRP and AGP. The higher prevalence of anaemia in children with elevated CRP and/or AGP was still present after controlling for confounders. **CONCLUSIONS:** Elevated levels of CRP and AGP were significantly associated with a higher prevalence of anaemia in the children surveyed. There are no expert group recommendations on whether to or how to account for markers of inflammation in presenting results on anaemia prevalence. Additional research would be helpful to clarify this issue.

75 Singh BK, Bockarie MJ, Gambhir M, Siba PM, Tisch DJ, Kazura J, Michael E.

Sequential modelling of the effects of mass drug treatments on anopheline-mediated lymphatic filariasis infection in Papua New Guinea.

PLoS One 2013 Jun 24;8(6):e67004. doi: 10.1371/journal.pone.0067004. Print 2013.

BACKGROUND: Lymphatic filariasis (LF) has been targeted by the WHO for global eradication leading to the implementation of large scale intervention programs based on annual mass drug administration (MDA) worldwide. Recent work has indicated that locality-specific bio-ecological complexities affecting parasite transmission may complicate the prediction of LF extinction endpoints, casting uncertainty on the achievement of this initiative. One source of difficulty is the limited quantity and quality of data used to parameterize models of parasite transmission, implying the important need to update initially derived parameter values. Sequential analysis of longitudinal data following annual MDAs will also be important to gaining new understanding of the persistence dynamics of LF. Here, we apply a Bayesian statistical-dynamical modelling framework that enables assimilation of information in human infection data recorded from communities in Papua New Guinea that underwent annual MDAs into our previously developed model of parasite transmission, in order to examine these questions in LF ecology and control. **RESULTS:** Biological parameters underlying transmission obtained by fitting the model to

longitudinal data remained stable throughout the study period. This enabled us to reliably reconstruct the observed baseline data in each community. Endpoint estimates also showed little variation. However, the updating procedure showed a shift towards higher and less variable values for worm kill but not for any other drug-related parameters. An intriguing finding is that the stability in key biological parameters could be disrupted by a significant reduction in the vector biting rate prevailing in a locality. **CONCLUSIONS:** Temporal invariance of biological parameters in the face of intervention perturbations indicates a robust adaptation of LF transmission to local ecological conditions. The results imply that understanding the mechanisms that underlie locally adapted transmission dynamics will be integral to identifying points of system fragility, and thus countermeasures to reliably facilitate LF extinction both locally and globally.

- 76 **Small ST, Ramesh A, Bun K, Reimer L, Thomsen E, Baea M, Bockarie MJ, Siba P, Kazura JW, Tisch DJ, Zimmerman PA.**

Population genetics of the filarial worm *Wuchereria bancrofti* in a post-treatment region of Papua New Guinea: insights into diversity and life history. *PLoS Negl Trop Dis* 2013 Jul 11;7(7):e2308. doi: 10.1371/journal.pntd.0002308. Print 2013 Jul.

BACKGROUND: *Wuchereria bancrofti* (Wb) is the primary causative agent of lymphatic filariasis (LF). Our studies of LF in Papua New Guinea (PNG) have shown that it is possible to reduce the prevalence of Wb in humans and mosquitoes through mass drug administration (MDA; diethylcarbamazine with/without ivermectin). While MDAs in the Dreikikir region through 1998 significantly reduced prevalence of Wb infection, parasites continue to be transmitted in the area. **METHODS:** We sequenced the Wb mitochondrial cytochrome oxidase 1 (CO1) gene from 16 people infected with Wb. Patients were selected from 7 villages encompassing both high and moderate annual transmission potentials (ATP). We collected genetic data with the objectives to (i) document contemporary levels of genetic diversity and (ii) distinguish between populations of parasites and hosts across the study area. **PRINCIPAL FINDINGS:** We discovered 109 unique haplotypes currently segregating in the Wb parasite population, with one common haplotype present in 15 out of 16 infections. We found that parasite diversity was similar among people residing within the same village and clustered within transmission zones. For example, in the high transmission area, diversity tended to be more similar between neighboring villages, while in the moderate transmission area, diversity tended to be less similar. **CONCLUSIONS:** In the Dreikikir region of PNG there are currently high levels of genetic diversity in populations of Wb. High levels of genetic diversity may complicate future MDAs in this region and the presence of dominant haplotypes will require adjustments to current elimination strategies.

- 77 **Sorokowski P, Sorokowska A, Danel DP.** Why pigs are important in Papua? Wealth, height and reproductive success among the Yali tribe of West Papua. *Econ Hum Biol* 2013 Jul;11(3):382-390. doi: 10.1016/j.ehb.2012.02.008. Epub 2012 Mar 7.

Many studies have investigated how different variables influence the reproductive success (RS) in the populations of natural birth control. Here,

we tested hypotheses about positive relationship between wealth, height and several measures of RS in an indigenous, traditional society from West Papua. The study was conducted among the Yali tribe in a few small, isolated mountain villages. In this tribe, a man's wealth is measured by the number of pigs he possesses. We found that wealth was related to fertility and number of living children, but not to child mortality in both men and women. Additionally, child mortality increased with the number of children in a family. Finally, we did not observe any relationship between height and reproductive success measures or wealth. We provide several possible explanations of our results and also put forward hypothetical background for further studies of indigenous populations.

- 78 **Spickett JT, Katscherian D, McIver L.** Health impacts of climate change in Vanuatu: an assessment and adaptation action plan. *Glob J Health Sci* 2013 Jan 30;5(3):42-53. doi: 10.5539/gjhs.v5n3p42.

Climate change is one of the greatest global challenges and Pacific island countries are particularly vulnerable due to, among other factors, their geography, demography and level of economic development. A Health Impact Assessment (HIA) framework was used as a basis for the consideration of the potential health impacts of changes in the climate on the population of Vanuatu, to assess the risks and propose a range of potential adaptive responses appropriate for Vanuatu. The HIA process involved the participation of a broad range of stakeholders including expert sector representatives in the areas of bio-physical, socio-economic, infrastructure, environmental diseases and food, who provided informed comment and input into the understanding of the potential health impacts and development of adaptation strategies. The risk associated with each of these impacts was assessed with the application of a qualitative process that considered both the consequences and the likelihood of each of the potential health impacts occurring. Potential adaptation strategies and actions were developed which could be used to mitigate the identified health impacts and provide responses which could be used by the various sectors in Vanuatu to contribute to future decision making processes associated with the health impacts of climate change.

- 79 **Sutanto I, Tjahjono B, Basri H, Taylor WR, Putri FA, Meilia RA, Setiabudy R, Nurleila S, Ekawati LL, Elyazar I, Farrar J, Sudoyo H, Baird JK.** Randomized, open-label trial of primaquine against vivax malaria relapse in Indonesia. *Antimicrob Agents Chemother* 2013 Mar;57(3):1128-1135. doi: 10.1128/AAC.01879-12. Epub 2012 Dec 17.

Radical cure of *Plasmodium vivax* infection applies blood schizontocidal therapy against the acute attack and hypnozoitocidal therapy against later relapse. Chloroquine and primaquine have been used for 60 years in this manner. Resistance to chloroquine by the parasite now requires partnering other blood schizontocides with primaquine. However, the safety and efficacy of primaquine against relapse when combined with other drugs have not been demonstrated. This randomized, open-label, and relapse-controlled trial estimated the efficacy of primaquine against relapse when administered with quinine or dihydroartemisinin-piperaquine

for treatment of the acute infection. Among 650 soldiers who had returned to their malaria-free base in Java, Indonesia, after 12 months in malarious Papua, Indonesia, 143 with acute *P. vivax* malaria were eligible for study. 116 enrolled subjects were randomized to these treatments: artesunate (200 mg dose followed by 100 mg/day for 6 days), quinine (1.8 g/day for 7 days) plus concurrent primaquine (30 mg/day for 14 days), or dihydroartemisinin (120 mg) plus piperazine (960 mg) daily for 3 days followed 25 days later by primaquine (30 mg/day for 14 days). Follow-up was for 12 months. 113 subjects were analyzable. Relapse occurred in 32 of 41 (78%) subjects administered artesunate alone (2.71 attacks/person-year), 7 of 36 (19%) administered quinine plus primaquine (0.23 attack/person-year), and 2 of 36 (6%) administered dihydroartemisinin-piperazine plus primaquine (0.06 attack/person-year). The efficacy of primaquine against relapse was 92% (95% confidence interval [CI] = 81% to 96%) for quinine plus primaquine and 98% (95% CI = 91% to 99%) for dihydroartemisinin-piperazine plus primaquine. Antirelapse therapy with primaquine begun a month after treatment of the acute attack with dihydroartemisinin-piperazine proved safe and highly efficacious against relapse by *P. vivax* acquired in Papua, Indonesia.

80 Taylor WR, Widjaja H, Basri H, Tjitra E, Ohrt C, Taufik T, Baso S, Hoffman SL, Richie TL.

Haemoglobin dynamics in Papuan and non-Papuan adults in northeast Papua, Indonesia, with acute, uncomplicated vivax or falciparum malaria. *Malar J* 2013 Jun 19;12:209. doi: 10.1186/1475-2875-12-209.

BACKGROUND: Haemoglobin (Hb) recovers slowly in malaria and may be influenced by naturally acquired immunity. Hb recovery was compared in malaria immune, indigenous Papuan and non-Papuan adults with limited malaria exposure. **METHODS:** Hb concentrations were measured on days (D) 0, 3, 7, and 28 in 57 Papuans and 105 non-Papuans treated with chloroquine, doxycycline or both drugs for acute, uncomplicated *Plasmodium vivax* (n = 64) or *Plasmodium falciparum* (n = 98). **RESULTS:** Mean (SD, range) D0 Hb was 12.7 (2.2, 7–21.3) g/dL and was similar in *P. falciparum*-infected Papuans and non-Papuans: 12.2 vs. 12.8 g/dL (p = 0.15) but significantly lower in: (i) *P. vivax*-infected Papuans vs. *P. vivax*-infected non-Papuans: 11.4 vs. 13.47 g/dL [Δ = -2.07 (95% CI: -3.3 – -0.8), p = 0.0018], (ii) all patients with splenomegaly (vs. those without splenomegaly): 12.16 vs. 13.01 g/dL [Δ = -0.85 (-1.6– -0.085), p = 0.029], and (iii) all females vs. all males: 10.18 vs. 13.01 g/dL [Δ = -2.82 (-3.97 – -1.67), p < 0.0001]. Multiple regression identified female sex (p = 0.000), longer illness duration (p = 0.015) (*P. falciparum* patients) and Papuan ethnicity (p = 0.017) (*P. vivax* patients) as significant factors for a lower D0 Hb. Mean D28 Hb increased to 13.6 g/dL [Δ = 1.01 (0.5-1.5) vs. D0 Hb, p = 0.0001]. It was: (i) positively correlated with the D0 Hb (adjusted r^2 = 0.24, p = 0.000), and was significantly lower in *P. vivax*-infected Papuans vs. non-Papuans: 12.71 vs. 14.46 g/dL [Δ = -1.7 (-2.95 – -0.5, p = 0.006). **CONCLUSIONS:** Haemoglobin recovery was related to baseline Hb. Vivax-infected malaria immune Papuans had persistently lower Hb concentrations compared to non-Papuans with limited malaria exposure. This haematological disadvantage remains unexplained.

81 Ting PL, Norton R.

Central nervous system tuberculosis: a disease from Papua New Guinea in North Queensland. *J Paediatr Child Health* 2013 Mar;49(3):E193-8. doi: 10.1111/jpc.12107.

AIM: To describe cases of confirmed central nervous system (CNS) tuberculosis seen at the major tertiary referral centre of North Queensland over a 10-year period. **METHODS:** This is a retrospective case series-based study of all cases of proven *Mycobacterium tuberculosis* infection of the CNS presenting to a major tertiary referral centre of North Queensland between 2000 and 2010. **RESULTS:** Five cases of confirmed CNS tuberculosis were identified over the 10-year period with two deaths. All were from Papua New Guinea with a mean age of 7 years. Imaging and early microbiological diagnosis was critical in making the diagnosis. HIV infection was not a contributing factor. Multidrug resistance was inferred or confirmed in two cases. **CONCLUSIONS:** CNS tuberculosis is a disease being increasingly seen in North Queensland among children from Papua New Guinea. Anticipation of multidrug resistance is important in the immediate management of suspected cases.

82 Tousignant B, Brian G, Venn BJ, Gould C, McKay R, Williams S.

Optic neuropathy among a prison population in Papua New Guinea. *Ophthalmic Epidemiol* 2013;20(1):4-12. doi: 10.3109/09286586.2012.742552.

PURPOSE: To estimate the prevalence of optic neuropathy (ON) among prisoners in a provincial prison in Papua New Guinea, and to explore risk factors for this condition among this population. **METHODS:** Cross-sectional observation study of 148 male prisoners aged ≥ 18 years using an interview-based questionnaire, assessment of visual and nervous system function, ocular examination, and blood analysis (α -tocopherol, β -carotene, lutein, folate, homocysteine, holotranscobalamin II, riboflavin, selenium, thiamin, and vitamins A, B(12) and C). Likelihood of the presence of ON was based on ordered groups determined by weighted combination of optic nerve head appearance and visual dysfunction (acuity, field, color perception). Main outcome measures were prevalence and associations of ON. **RESULTS:** Sample prevalence of clinical ON was 10.4% (95% confidence interval [CI], 6.2-16.8). No cases were found of unexplained non-visual nervous system dysfunction, including peripheral neuropathy. Increasing age (p=0.001), length of current (p=0.002) and lifetime (p=0.03) incarceration, and duration of smoking by current smokers (p=0.001) were associated with increased ON likelihood. However, when age-controlled, the smoking duration association was not maintained (p=0.6). Prisoners were folate deficient. Adjusting for age and duration of current incarceration, whole blood (p=0.02) and red blood cell (p=0.04) folate concentrations were inversely associated with ON likelihood. No association was found for any other assessed demographic, lifestyle or biochemical measure. **CONCLUSIONS:** A cluster of ON associated with folate deficiency has been identified. Recommendations for dietary change and micronutrient supplementation have been made.

83 Tynan A, Vallely A, Kelly A, Kupul M, Neo J, Naketrumb R, Aeno H, Law G, Milan J, Siba P,

Kaldor J, Hill PS; Male Circumcision Acceptability and Impact Study, PNG.

Sociocultural and individual determinants for motivation of sexual and reproductive health workers in Papua New Guinea and their implications for male circumcision as an HIV prevention strategy.

Hum Resour Health 2013 Feb 19;11(1):7. doi: 10.1186/1478-4491-11-7.

BACKGROUND: The motivation of health workers (HWs) to deliver services in developing countries has been described as a critical factor in the success of health systems in implementing programmes. How the sociocultural context of Papua New Guinea (PNG) affects the values, motivation and actions of HWs involved in sexual and reproductive health services is important for policy development and programme planning. With interest in male circumcision (MC) as an HIV prevention option in PNG, this study explored the perceptions and motivations of HWs involved in sexual and reproductive health services in PNG, examining their implications for the possible future roll out of a national MC programme. **METHODS:** A multi-method qualitative study was conducted with HWs across a range of health care professions working in sexual health facilities. A total of 29 in-depth interviews and one focus group discussion were completed. Qualitative thematic analysis of the transcripts and field notes was undertaken using a social constructivist approach and complemented by documentary organizational, programme and policy analysis. **RESULTS AND DISCUSSIONS:** Introduction of new health programmes, such as a MC programme for HIV prevention, are likely to impact upon one or more of the many motivational determinants. Social-cultural and individual factors influencing HW motivation to be involved in sexual and reproductive health services in PNG included community expectation and concern, sense of accomplishment and religious conviction. Strong links to community responsibility outweighed organizational ties. Faced with an often dysfunctional work environment, HWs perceived themselves as responsible to compensate for the failed health system. The impact of community influence and expectation needs to be considered when introducing a MC programme, particularly to communities in PNG where penile foreskin cutting is a common and accepted practice. **CONCLUSIONS:** The potential contribution to the success of a MC programme that HWs may have means that taking into account the differing needs of communities as well as the motivational influences on HWs that exist within the sociocultural environment is important. These findings will assist not only in programme planning for MC, but also in the expansion of other existing sexual and reproductive health services.

84 Tynan A, Hill PS, Kelly A, Kupul M, Aeno H, Naketrumb R, Siba P, Kaldor J, Vallely A; Male Circumcision Acceptability and Impact Study (MCAIS) team.

Listening to diverse community voices: the tensions of responding to community expectations in developing a male circumcision program for HIV prevention in Papua New Guinea.

BMC Public Health 2013 Aug 13;13:749. doi: 10.1186/1471-2458-13-749.

BACKGROUND: The success of health programs is influenced not only by their acceptability but also their ability to meet and respond to community expectations of service delivery. The World

Health Organization (WHO) and the Joint United Nations Programme on HIV/AIDS (UNAIDS) have recommended medical male circumcision (MC) as an essential component of comprehensive HIV prevention programs in high burden settings. This study investigated community-level perceptions of MC for HIV prevention in Papua New Guinea (PNG), a setting where diverse traditional and contemporary forms of penile foreskin cutting practices have been described. **METHODS:** A multi-method qualitative study was undertaken in four provinces in two stages from 2009 to 2011. A total of 82 in-depth interviews, and 45 focus group discussions were completed during Stage 1. Stage 2 incorporated eight participatory workshops that were an integral part of the research dissemination process to communities. The workshops also provided opportunity to review key themes and consolidate earlier findings as part of the research process. Qualitative data analysis used a grounded theory approach and was facilitated using qualitative data management software. **RESULTS:** A number of diverse considerations for the delivery of MC for HIV prevention in PNG were described, with conflicting views both between and within communities. Key issues included: location of the service, service provider, age eligibility, type of cut, community awareness and potential shame amongst youth. Key to developing appropriate health service delivery models was an appreciation of the differences in expectations and traditions of unique cultural groups in PNG. Establishing strong community coalitions, raising awareness and building trust were seen as integral to success. **CONCLUSIONS:** Difficulties exist in the implementation of new programs in a pluralistic society such as PNG, particularly if tensions arise between biomedical knowledge and medico-legal requirements, compared to existing socio-cultural interests. Community participatory approaches offer important opportunities to explore and design culturally safe, specific and accessible programs.

85 Uliaszek SJ, Henneberg M, Henry CJ.

One reason why waist-to-height ratio is usually better related to chronic disease risk and outcome than body mass index.

Int J Food Sci Nutr 2013 May;64(3):269-273. doi: 10.3109/09637486.2012.734291. Epub 2012 Oct 16.

The waist-to-height ratio (wtHR) has been proposed as an alternative to body mass index (BMI) as a simple anthropometric measure of body fatness. Both measures retain residual correlations with height, which causes them to over- or under-adjust for height (and thus misestimate nutritional state) when relating these measures to chronic disease risk, morbidity or mortality. The possibility that BMI has greater misadjustment than wtHR relative to waist/height (p) and weight/height (p) (where p is the optimal exponent for each population and sex group) is examined here. Analysis of anthropometric data for groups in Thailand, Papua New Guinea and Australia shows that this is the case, especially over-adjustment. This may contribute to the weaker relationships of chronic disease markers and outcomes with BMI than with wtHR.

86 Uluk T, Allison WE, Vince J, Wand H, Tefuarani N, Causser LM, Ripa P, Kariko M, Kaminiel O, Cunningham P, Graham SM, Kaldor JM.

Evaluation of an interferon-gamma release assay in children with suspected tuberculosis in Papua New Guinea.

Pediatr Infect Dis J 2013 Feb;32(2):187-189. doi: 10.1097/INF.0b013e31827412fc.

There are few data from tuberculosis (TB) endemic settings of the performance and outcome predictors of the QuantiFERON-TB Gold in Tube assay (QFT) in children with suspected TB. A prospective cross-sectional study was conducted in Papua New Guinea children with suspected TB evaluated at Port Moresby General Hospital (Port Moresby, Papua New Guinea). 216 children were enrolled including 106 probable TB, 87 possible TB and 23 without TB. Concordance between QFT and tuberculin skin test results was 86% ($p < 0.001$, $\kappa = 0.70$). QFT was significantly more likely to be positive than tuberculin skin test, overall and within the probable or possible TB categories, with no difference in prevalence of positivity between these 2 categories. The role of QFT in supporting the clinical diagnosis of TB in endemic settings, where resources are limited, remains uncertain especially as cost and technical requirements remain considerable.

- 87 **Umbers AJ, Stanisic DI, Ome M, Wangnapi R, Hanieh S, Unger HW, Robinson LJ, Lufele E, Baiwog F, Siba PM, King CL, Beeson JG, Mueller I, Aplin JD, Glazier JD, Rogerson SJ.**

Does malaria affect placental development? Evidence from in vitro models.

PLoS One 2013;8(1):e55269. doi: 10.1371/journal.pone.0055269. Epub 2013 Jan 31.

BACKGROUND: Malaria in early pregnancy is difficult to study but has recently been associated with fetal growth restriction (FGR). The pathogenic mechanisms underlying malarial FGR are poorly characterized, but may include impaired placental development. We used in vitro methods that model migration and invasion of placental trophoblast into the uterine wall to investigate whether soluble factors released into maternal blood in malaria infection might impair placental development. Because trophoblast invasion is enhanced by a number of hormones and chemokines, and is inhibited by pro-inflammatory cytokines, many of which are dysregulated in malaria in pregnancy, we further compared concentrations of these factors in blood between malaria-infected and uninfected pregnancies. **METHODOLOGY/PRINCIPAL FINDINGS:** We measured trophoblast invasion, migration and viability in response to treatment with serum or plasma from two independent cohorts of Papua New Guinean women infected with *Plasmodium falciparum* or *Plasmodium vivax* in early pregnancy. Compared to uninfected women, serum and plasma from women with *P. falciparum* reduced trophoblast invasion ($p = 0.06$) and migration ($p = 0.004$). *P. vivax* infection did not alter trophoblast migration ($p = 0.64$). The *P. falciparum*-specific negative effect on placental development was independent of trophoblast viability, but associated with high-density infections. Serum from *P. falciparum* infected women tended to have lower levels of trophoblast invasion-promoting hormones and factors and higher levels of invasion-inhibitory inflammatory factors. **CONCLUSION/SIGNIFICANCE:** We demonstrate that in vitro models of placental development can be adapted to indirectly study the impact of malaria in early pregnancy. These infections could result in impaired trophoblast invasion with reduced transformation of maternal spiral arteries due to maternal hormonal and inflammatory disturbances, which may contribute to FGR by limiting the delivery of maternal blood to the placenta. Future prevention strategies for malaria in pregnancy should include

protection in the first half of pregnancy.

- 88 **Vallely LM, Kelly A, Kupul M, Neo R, Fiya V, Kaldor JM, Mola GD, Worth H.**

Infant feeding in the context of HIV: a qualitative study of health care workers' knowledge of recommended infant feeding options in Papua New Guinea.

Int Breastfeed J 2013 Jun 7;8(1):6. doi: 10.1186/1746-4358-8-6.

BACKGROUND: Interventions to prevent mother to child transmission of human immunodeficiency virus (HIV) during childbirth and breastfeeding can reduce HIV infections in infants to less than 5% in low and middle income countries. The World Health Organization (WHO) recommends all mothers, regardless of their HIV status, practice exclusive breastfeeding for the first six months of an infant's life. In line with these recommendations and to protect, promote and support breastfeeding, in 2009 the PNG National Department of Health revised their National HIV infant feeding guidelines, reinforcing the WHO recommendation of exclusive breastfeeding for the first six months followed by the introduction of other food and fluids, while continuing breastfeeding. The overall aim of this paper is to explore health care workers' knowledge regarding infant feeding options in PNG, specifically as they relate to HIV exposed infants. **METHODS:** As part of a study investigating women's and men's experiences of prevention of mother to child transmission (PMTCT) services in two sites in PNG, 28 key informant interviews were undertaken. This paper addresses one theme that emerged from thematic data analysis: health care workers' knowledge regarding infant feeding options, specifically how this knowledge reflects the Papua New Guinea National HIV Care and Treatment Guidelines on HIV and infant feeding (2009). **RESULTS:** Most informants mentioned exclusive breastfeeding, the majority of whom reflected the most up-to-date National Guidelines of exclusive breastfeeding for six months. The importance of breastfeeding continuing beyond this time, along with the introduction of food and fluids, was less well understood. The most senior people involved in PMTCT were the informants who most accurately reflected the national guidelines of continuing breastfeeding after six months. **CONCLUSION:** Providing advice on optimal infant feeding in resource poor settings is problematic, especially in relation to HIV transmission. Findings from our study reflect those found elsewhere in identifying that key health care workers are not aware of up-to-date information relating to infant feeding, especially within the context of HIV. Greater emphasis needs to be placed on ensuring the most recent feeding guidelines are disseminated and implemented in clinical practice in PNG.

- 89 **Widmer A.**

Diversity as valued and troubled: social identities and demographic categories in understandings of rapid urban growth in Vanuatu.

Anthropol Med 2013;20(2):142-159. doi: 10.1080/13648470.2013.805299.

This paper deals with the simultaneous mainstreaming and diversification of ni-Vanuatu social categories associated with the ways in which population growth is understood as a possible crisis in both demographic knowledge and everyday ni-Vanuatu knowledge. The author is interested in understanding the downplaying but primarily the

amplification of difference with respect to place, generation and gender identities. The relationship between reproduction, social reproduction and the multiple meanings of modernity is at issue. In the expert knowledge of demography that proffers advice for the ni-Vanuatu state, it is the lack of modern development – in the form of adequate biomedical birth control, western education, and the equality of women – that is the implicit cause of population growth. Yet, many ni-Vanuatu see population growth as tied to the troubles that arise from the dilution of traditional social forms: there is too much modernity. In both demographic and ni-Vanuatu everyday narrations of the potential population crisis, diversification and mainstreaming take place and vulnerabilities are produced.

90 **Win Tin ST, Gadabu E, Iro G, Tasserei J, Colagiuri R.**

Diabetes-related amputations in Pacific islands countries: a root cause analysis of precipitating events.

Diabetes Res Clin Pract 2013 May;100(2):230-234. doi: 10.1016/j.diabres.2013.03.012. Epub 2013 Mar 22.

AIM: To identify precipitating events and factors preceding diabetes-related amputations in Pacific islands countries (PICs). METHODS: Using a root cause analysis approach, a questionnaire seeking information on events leading up to amputation was administered to a convenience sample of 85 people with diabetes in three PICs (Solomon Islands, Nauru and Vanuatu) who had a lower limb amputation in the previous five years. RESULTS: There were 85 participants (36% females) with a mean age of 54.1 years and a mean diabetes duration of 10.5 years prior to amputation. The first event was trauma and an infected wound in 55% and a blister in another 41%. Half (51%) did not take any action soon after the initial trigger event. The major reasons leading to the amputation included delaying treatment (42%), use of traditional treatments (18%) and insufficient knowledge about foot care (11%). 36% of participants had not received foot care information prior to the amputation and 19% did not attend anywhere for regular treatment. CONCLUSIONS: This study identified key precipitating events and underlying factors which contribute to diabetes-related amputations and which, if addressed successfully, have the potential to reduce amputation rates.

91 **Yeo TW, Lampah DA, Kenangalem E, Tjitra E, Price RN, Anstey NM.**

Impaired skeletal muscle microvascular function and increased skeletal muscle oxygen consumption in severe falciparum malaria.

J Infect Dis 2013 Feb 1;207(3):528-536. doi: 10.1093/infdis/jis692. Epub 2012 Nov 16.

BACKGROUND: Organ dysfunction and tissue hypoxia in severe falciparum malaria result from an imbalance between oxygen delivery and demand. In severe malaria, microvascular obstruction from parasite sequestration decreases oxygen delivery. However, host microvascular function (defined as the capacity to increase oxygen delivery in response to ischemia) and oxygen consumption have not been assessed. METHODS: We used near-infrared resonance spectroscopy to measure thenar muscle

microvascular function (StO₂recov) and oxygen consumption (VO₂) in 36 adults in Papua, Indonesia, with severe malaria, 33 with moderately severe malaria (MSM), 24 with severe sepsis, and 36 healthy controls. RESULTS: In the severe malaria group, the StO₂recov of 2.7%/second was 16% and 22% lower than that in the MSM group (3.1%/second) and control group (3.5%/second), respectively (p <0.001), and comparable to that in the severe sepsis group (2.5%/second). In the severe malaria group, StO₂recov was inversely correlated with lactate level (r = -0.63; p <0.001) and predicted death (area under the receiver operating characteristic curve, 0.71 [95% confidence interval {CI}, 0.51-0.92]), with each percentage decrease associated with an increased odds of mortality (odds ratio, 2.49 [95% CI, 1.05-6.2]). Conversely, VO₂ increased in the severe malaria group by 18%, compared with levels in the control and severe sepsis groups (p <0.001), and was associated with parasite biomass (r = 0.49; p = 0.04). CONCLUSIONS: Impaired microvascular function is associated with increased mortality among individuals with severe malaria, while oxygen consumption is increased. Tissue hypoxia may result not only from microvascular obstruction, but also from impaired ability of the microvasculature to match oxygen delivery to increased oxygen demand.

92 **Zimmerman PA, Ferreira MU, Howes RE, Mercereau-Puijalon O.**

Red blood cell polymorphism and susceptibility to *Plasmodium vivax*.

Adv Parasitol 2013;81:27-76. doi: 10.1016/B978-0-12-407826-0.00002-3.

Resistance to *Plasmodium vivax* blood-stage infection has been widely recognized to result from absence of the Duffy (Fy) blood group from the surface of red blood cells (RBCs) in individuals of African descent. Interestingly, recent studies from different malaria-endemic regions have begun to reveal new perspectives on the association between Duffy gene polymorphism and *P. vivax* malaria. In Papua New Guinea and the Americas, heterozygous carriers of a Duffy-negative allele are less susceptible to *P. vivax* infection than Duffy-positive homozygotes. In Brazil, studies show that the Fy(a) antigen, compared to Fy(b), is associated with lower binding to the *P. vivax* Duffy-binding protein and reduced susceptibility to vivax malaria. Additionally, it is interesting that numerous studies have now shown that *P. vivax* can infect RBCs and cause clinical disease in Duffy-negative people. This suggests that the relationship between *P. vivax* and the Duffy antigen is more complex than customarily described. Evidence of *P. vivax* Duffy-independent red cell invasion indicates that the parasite must be evolving alternative red cell invasion pathways. In this chapter, we review the evidence for *P. vivax* Duffy-dependent and Duffy-independent red cell invasion. We also consider the influence of further host gene polymorphism associated with malaria endemicity on susceptibility to vivax malaria. The interaction between the parasite and the RBC has significant potential to influence the effectiveness of *P. vivax*-specific vaccines and drug treatments. Ultimately, the relationships between red cell polymorphisms and *P. vivax* blood-stage infection will influence our estimates on the population at risk and efforts to eliminate vivax malaria.