Medicine and Global Health, Nuffield Department of Medicine, University of Oxford, Oxford, United Kingdom, [7]Infection and Immunity Division, Walter & Eliza Hall Institute, Melbourne, Australia, [8]Department of Parasitology, Medical Faculty, Universitas Indonesia, Jakarta, Indonesia

Asymptomatic gametocyte carriage at low densities may often drive malaria transmission in low to moderate endemic settings. We examined risk factors for gametocyte carriage employing RT-qPCR diagnostics among residents of hypo- to meso-endemic West Timor in eastern Indonesia. Two mass blood surveys were conducted in June and September 2013. 1,551 blood samples were collected from 875 residents. Light microscopy identified 47 *Plasmodium falciparum*- and 74 *P. vivax*-positives. Later, qPCR was utilised to examine for malaria positivity, and a total of 91 *P. falciparum* and 315 *P. vivax* positives were identified. RNA for gametocyte assay was available from 85 and 227 *P. falciparum*- and *P.vivax* -positive subjects, respectively. Assay for gametocytemia employed *pfs25* and *pvs25* RNA markers. Participant age, sex, microscopic malaria status, plasmodial parasite density, fever, and fever history were examined as potential risk factors for gametocyte carriage using bivariate and multivariate analyses. Among microscopically patent subjects, 23/47 *P. falciparum* positives also had patent gametocytemia, whereas 16/74 *P. vivax* positives did so. Gametocyte carriage was detected in 52% (44/85) and 37% (86/227) *P. falciparum* and *P. vivax* infections. Bivariate analyses suggested younger age (<=17 yrs), microscopic positivity, estimated parasite density, and history of fever were positively associated with gametocyte carriage in both *P. falciparum* and *P. vivax* ($p<0.05$). Gametocytemia for either species did not appear to be impacted by sex or fever. Multivariate analyses suggested age and history of fever were associated with *P. falciparum* ($p=0.015$ and $p=0.006$) gametocytemia, whereas parasite density was the sole predictor for gametocyte carriage in *P. vivax* ($p<0.001$). Most parasitemias in this community occurred below the limit of detection by expert microscopy, as did almost all gametocyte carriage. This study demonstrates sub-patent gametocyte carriage and its apparently species-specific risk factors in a low transmission setting. Gametocytemia in *P. vivax* indeed appears to emerge independently of febrile illness.

311

ASSESSING RELATIONSHIP BETWEEN HUMAN SETTLEMENT PATTERNS AND MALARIA RISK IN A RESIDUAL TRANSMISSION SETTING IN SOUTHEASTERN TANZANIA

Emmanuel W. Kaindoa[1], Arnold S. Mmbando[1], Gustav Mkandawile[1], Maureen Coetzee[2], Sherif Amer[3], Fredros O. Okumu[1]

[1]*Ifakara Health Institute, Morogoro, United Republic of Tanzania, [2]Wits Research Institute for Malaria and Wits/MRC Collaborating Centre for Multidisciplinary Research on Malaria, School of Pathology, Faculty of Health Sciences, University of the Witwatersrand, Johannesburg, South Africa, [3]Faculty of Geo-information Science and Earth Observation, University of Twente, Netherlands, Netherlands*

Spatial targeting of interventions is increasingly recognized as essential for malaria control, particularly in areas aiming for elimination. The associations between house characteristics and malaria transmission are known, but gaps remain on whether transmission is also influenced by factors such as distances between households or the degree to which houses are clustered. This study examined households densities and their distances influence malaria transmission in a set of rural Tanzanian communities. We performed indoor and outdoor mosquito collection from fixed as well as randomly selected households over 12 months period and assessed effects of spatial clustering of households on malaria transmission risks. The study found that high house densities increased *Anopheles* biting risk but mosquito density declined as distances between houses increased beyond 50m. Despite the recent scale-up of effective vector control interventions, such as LLINs, there are still major household and environmental characteristics contributing to persistent malaria transmission. Additional efforts such as house improvement programs targeted at village-level, could address the challenges by prioritizing high-risk household clusters. Such new efforts could be further improved by involving communities in the control strategies, and removing financial and access barriers associated with poor-housing.

312

PARADIGM SHIFT AND SEASONAL VARIATION IN MALARIA PREVALENCE AND ANAEMIA IN IJEDE, IKORODU LOCAL GOVERNMENT AREA, LAGOS STATE, NIGERIA

Oluwagbemiga Olanrewaju Aina[1], Adeola Yetunde Olukosi[1], Chimere Obiora Agomo[2], Bamidele Abiodun Bamidele Iwalokun[1], Olusola Ajibaye[1], Bassey A. Orok[1], Adeniyi K. Adeneye[1], Chinendum T. Oparaugo[1], Samuel K. Akindele[1], Olajumoke M. Akinyele[1], Samson T. Awolola[1]

[1]*Nigerian Institute of Medical Research, Lagos, Nigeria, [2]Department of Medical Laboratory Science, University of Lagos, Lagos, Nigeria*

Seasonal variation is the change that occurs as a result of climate change including rain fall, humidity and temperature. There are two main seasons in Nigeria wet season and dry season. The objective of this study is to compare the prevalence of malaria and anaemia in Ijede community in both the wet and dry seasons and to assess the malaria prevalence of children under-five and above five years old. This is a cross sectional study, the study participants were screened for malaria using mRDTs and microscopy. The anaemia status of the participants were defined using the WHO haematocrit cut-off for mild, moderate and severe anaemia based on age and sex. Participants with confirmed malaria parasite were treated with artemether-lumefantrine. Blood spots were made on filter paper for studies on antimalarial drug resistance. A total of 813 and 833 participants were screened in the dry and wet seasons respectively , majority of them were females 556 (68.4%) and 480 (57.6%) in both seasons, The mean age was 30.07 ± 20.5 years and 26.3 ± 20.6 years in dry and wet seasons respectively. Children under the age of 5 were 134 (16.5%) and 130 (15.6%) in dry and wet seasons respectively, while those above 5 years of age were 679 (83.5%) and 704 (84.4%) in dry and wet seasons respectively. The prevalence of aneamia was 100 (22.4%) and 206 (47.7%) in dry and wet seasons respectively. Malaria prevalence in Ijede community was 5.7% and 9.7% in dry and wet seasons respectively. Malaria prevalence was 122(3.2%) and 590 (6.2%) in Children under 5 years and above 5 years respectively in dry season while in wet season the malaria prevalence was 113 (13.1%) and 610 (13.4%) in Children under 5 years and above 5 years respectively. Malaria prevalence was higher in children above 5 years of age irrespective of methods of assessment ($P<0.05$) in both dry and wet seasons. There is a paradigm shift in high malaria prevalence from children under-fives to above five years in this study. Malaria control strategies should be also be targeted at Children above the age of 5 years mostly during the wet season.

313

A SYSTEMATIC REVIEW OF THE CHANGING MALARIA DISEASE BURDEN IN SUB-SAHARAN AFRICA SINCE 2000: COMPARING MODEL PREDICTIONS ANDEMPIRICAL OBSERVATION

Alice Kamau[1], Polycarp Mogeni[1], Emelda A. Okiro[1], Robert W. Snow[2], Philip Bejon[2]

[1]*KEMRI-Wellcome Trust Research Programme, Kilifi, Kenya, [2]Centre for Tropical Medicine and Global Health, Nuffield Department of Clinical Medicine, University of Oxford, Oxford, United Kingdom*

The changing burden of malaria in Africa has been modelled using sparse data on parasite prevalence, environmental covariates and intervention coverage which are linked to historical estimates of clinical incidence. Uncertainty remains regarding the spatial consistency of these modelled declines. We undertook a systematic review (PROSPERO International Prospective Register of systematic reviews; ID= CRD42019116834) to identify empirical data on the temporal changes in clinical malaria in Africa since 2000, where reports covered at least 5 continuous years. These data were then compared with time-space matched estimates of the predicted

changes in clinical burden using data from the Malaria Atlas Project (MAP). The magnitude of relative change and correlation between changes in empirical clinical malaria and modelled estimates of clinical burden was assessed. Sixty-six articles met our inclusion criteria representing 120 sites surveyed between 5-15 consecutive years since 2000 from 23 African countries. Forty-one (34%) site-specific data showed evidence of an increase in malaria over the surveyed period, 79 (66%) showed a decline. Comparisons between changes in empirical clinical malaria and modelled estimates of clinical burden showed a mixed pattern of concordance, depending of data types, location and period of observation. Models provide a broad picture of changing global disease burden but cannot replace empirical data. The paucity of high quality, temporal clinical data in Africa must be redressed, to avoid a continued dependence on models or to help train future models.

314

HIGHLY DYNAMIC CHANGES IN IRON STATUS DURING PREGNANCY AND POSTPARTUM AND ASSOCIATIONS WITH ADVERSE MATERNAL OUTCOMES IN A MALARIA ENDEMIC REGION OF PAPUA NEW GUINEA: A COHORT STUDY

Eliza Davidson[1], Michelle Scoullar[1], Herbert Opi[1], Elizabeth Peach[1], Chris Morgan[1], Pele Melepia[2], Ruth Fidelis[2], Willie Pomat[3], Philippe Boeuf[1], Ricardo Ataide[1], Julie Simpson[4], James Beeson[1], Freya Fowkes[1]

[1]*Burnet, Melbourne, Australia,* [2]*Burnet, Kokopo, Papua New Guinea,* [3]*Papua New Guinea Institute of Medical Research, Goroka, Papua New Guinea,* [4]*Melbourne School of Population and Global Health, University of Melbourne, Melbourne, Australia*

Iron deficiency is the most common nutrient deficiency worldwide and is the leading risk factor for anaemia; approximately half of all anaemia cases are attributed to iron deficiency. The highest prevalence of iron deficiency globally is observed in pregnant women, who are highly susceptible to both iron deficiency and anaemia; while postpartum susceptibility is less well known. However, iron is also an essential nutrient for a number of pathogens, and so a deficiency in host iron is hypothesized to reduce pathogen fitness and decrease infection susceptibility and/or severity. This interaction is of particular concern in malaria endemic countries. Here we determine temporal changes in iron deficiency during pregnancy and postpartum; and investigate associations with anaemia and *Plasmodium* species infection. This study utilized 700 samples and corresponding epidemiological data from women living in a malaria endemic region of Papua New Guinea, where the prevalence of iron deficiency and poor maternal outcomes are high. Iron deficiency, defined as ferritin<15μg/L, was highly prevalent at enrolment (80.6%) and delivery (84.9%); far less prevalent at 6 months (22.2%) and 12 months postpartum (28%). The prevalence of anaemia, defined as haemoglobin <11g/dL, was also very high at enrolment (82.3%) and delivery (57.6%), but less so at 6 (37.7%) and 12 (49.4%) months postpartum. Ferritin measures within women were highly dynamic over time, with huge fluctuations between enrolment and 12 months postpartum. Haemoglobin levels were more stable, gradually increasing from enrolment through to delivery and 6 months postpartum. Iron deficiency was significantly associated with lower haemoglobin levels at enrolment, delivery and 6 months postpartum ($p<0.05$), compared to iron replete women. Multivariate analyses quantified the relationship between *Plasmodium* species infection, iron status and anaemia. Findings highlight the high burden of deficiencies and disease in resource-poor settings and the complex interactions that exist between morbidities transitioning from pregnancy to postpartum.

315

COMPARISON OF *PLASMODIUM* INFECTION BETWEEN CHILDREN AND ADULTS IN KOMBEWA

Cornel Obonyo Arima, Jim Ray Managbanag, Cephas Aguko, Agneta Ogolo, Catherine Sumbi, Michael Ayaya, Everlyne Omondi, Victor Otieno, Vincent Akolo, Rose Adeny, Hoseah M. Akala, Bernhards Ogutu

[1]United States Medical Research Directorate - Africa/Kenya, [2]Kenya Medical Research Institute

Malaria remains one of the major causes of preventable illnesses and mortality in developing countries. In 2005, WHO estimated 214 million new malaria infected cases with 438,000 malaria associated mortalities. Malaria morbidity and mortality is higher in children under five years than adults. Studies have shown that recent up-scaled integrated vector control interventions have eased disease burden in Africa. Specifically, the world health organisation recommends that in endemic areas with intense malaria transmission, all infants at their first immunization and all pregnant women as early as possible in pregnancy should receive one long-lasting insecticidal net through immunization and antenatal care visits. As this guideline continues to be followed, it is essential to continue tracking the impact of these guidelines on disease burden across ages in the population. The aim of this study was to estimate the frequency of malaria in Kombewa by age group. A total of 1451 potential study subjects were screened in the blood collection protocol survey between 2007 and 2011 in Kombewa sub county, Kisumu. A total of 20μl of whole blood was drawn from each study subject. Each sample was tested by both RDT and confirmed by expert microscopy. Out of 1451, 940(64.8%) samples tested positive for *Plasmodium* species by microscopy. Of the 940 positive cases, children < 5 years were 400(43%), ages of 5-17years 385(26.6%) while adults above 18yrs were 150(10.5%) positive cases. Further, children ages <5 years had highest parasite counts than older children aged 7-17 years and adults based on expert microscopy confirmed read-outs ($P<0.005$). These findings show decreasing frequency of infection with increase in age suggesting sustained burden among children despite heightened intervention targeting this age group.

316

PARASITAEMIC PROFILES AND DISTRIBUTION OF HOST AND MATERNAL FACTORS AMONG INFANTS LIVING IN A HIGH MALARIA TRANSMISSION AREA OF GHANA

Akua Kyerewaa Botwe[1], Seth Owusu-Agyei[2], Ulf Hammar[3], Felix Boakye Oppong[1], Stephaney Gyaase[1], Gabriel Jakpa[1], George Adjei[4], Muhammad Asghar[5], Faith Osier[6], Anna Färnert[7], Kwaku Poku Asante[1]

[1]*Kintampo Health Research Centre, Kintampo, Ghana,* [2]*Institute of Health Research, University of Health and Allied Sciences, Ho, Ghana,* [3]*Unit of Biostatistics. Department of Epidemiology, Institute for Environmental Medicine, Karolinska Institutet, Stockholm, Sweden,* [4]*University of Cape Coast, Cape Coast, Ghana,* [5]*Division of Infectious Diseases, Department of Medicine Solna, Karolinska Institutet, Stockholm, Sweden,* [6]*Kenya Medical Research Institute, Kilifi, Kenya,* [7]*Department of Infectious Diseases. Karolinska University Hospital, Stockholm, Sweden*

Insight into determinants of asymptomatic and symptomatic infections in infants can contribute to our understanding of malaria immunity and guide control interventions. The aim of study was to identify infants immune to malaria based on their temporal profile of episodes in the first year of life and identify pre-disposing factors to susceptibility. A birth cohort in Kintampo, Ghana (N = 1855) was followed with monthly blood sampling and passive surveillance of malaria between 2008 and 2011. Malaria parasites were detected by light microscopy. Host, maternal, parasite and hematological parameters were collected from infants and their mothers. Profiles of infections and distribution of host and maternal factors among infants through their first year of life were examined. Analyses were based on 1264 infants that had at least eight monthly visits in twelve months. Infants were either parasite negative in all samples