

## CUGH 2019 / ORAL ABSTRACT PRESENTATIONS

CS02.001

Free Facilities or False Promises: A Mixed Method Study to Understand the Effects of Accredited Social Health Activists' Home Visits on Maternal and Newborn Health Equity in Uttar Pradesh, India

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**Background:** The state of Uttar Pradesh has among the highest neonatal mortality rates in India (45 per 1000 live births), with substantially more deaths among the poorest. To address this, India's National Health Mission has trained community-based incentivized volunteers called Accredited Social Health Activists (ASHAs) to visit all pregnant women at home and support them to deliver in public facilities. Contextual processes greatly shape community-based efforts to reduce health inequities, yet few studies have examined these dynamics. We undertook a mixed-method study to understand the extent to which, how and in what circumstances ASHAs' home visits reduce socio-economic inequities in institutional delivery in Uttar Pradesh.

**Methods:** We conducted generalized linear modeling using a cross-sectional survey among a representative random sample of 57,778 women who gave birth within the last two months in 25 districts in 2014-2015. We conducted qualitative social mapping and focus group discussions in four villages that were more and less remote in two districts, with purposively selected ASHAs, and mothers from higher and lower socio-economic groups (n=134). We used thematic framework analysis. Ethics approval was obtained from Sigma Institutional Review Board and University College London Research Ethics Committee.

**Findings:** Institutional delivery rates were 7 and 12 percentage points more equal between highest and lowest caste (RR:1.09, 95% CI:1.04-1.14 vs. RR:1.25, 95% CI:1.17-1.33) and education groups (RR:1.29, 95% CI:1.26-1.31 vs. RR:1.66, 95% CI: 1.61-1.70) respectively among women who received any third trimester home visits from ASHAs compared to none. The qualitative data showed that ASHAs' promotion of incentives and free care influenced families of lower socio-economic position to deliver in public community health centers. Yet many lost faith in them when they experienced indirect costs, lack of medicines or transport, and poor treatment, particularly in the remote villages. This also led complicated deliveries to be referred to higher-level, often private, hospitals, and wealthier families to opt directly for private care.

**Interpretation:** This study provides guidance for adapting implementation strategies within their socio-economic and health system contexts so as to improve provision of affordable, accessible and quality care. This would help alleviate poorer families' widespread reliance on emergency and expensive treatment, and reinforce ASHAs' role in improving maternal and newborn health equity.

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CS02.002

How have People's Knowledge and Attitude on HIV/AIDS Changed Over the Past Three Decades in Sub-Saharan African Countries?

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**Background:** People's knowledge and attitude on HIV/AIDS are key determinants of HIV/AIDS epidemics and are crucial contributors to the success of HIV/AIDS interventions. However, evidence on country-level HIV/AIDS knowledge and attitude is still scarce across SSA countries. To fill in the gap, this study gathers all available evidence to estimate national trends of HIV/AIDS knowledge and attitude from 1990 to 2017 across 42 SSA countries.

**Methods:** National surveys that have indicators of HIV/AIDS knowledge and attitude are retrieved from GHDx. There are 10 knowledge indicators covering knowledge of HIV transmission and risk reduction and 4 attitude indicators reflecting people's attitude towards PLWHs.

Individual level data on knowledge and attitude are extracted in a systematic and consistent way and are collapsed into country level estimates. Multi-level multiple imputation is used to impute missing indicators on country level and spatial-temporal Gaussian process regression (ST-GPR) is used to estimate the trend of each indicator for each country.

**Findings:** In the end, 246 national surveys are included in the study. From 1990 to 2017, most of the knowledge indicators slightly increased across all countries. However, the trends of knowledge of condom use reducing risk of HIV vary across countries with the overall trend slightly decreasing. Regarding attitude, willing to frequent HIV+ vendor, willing to take care of HIV+ family members in the house and believing HIV+ teacher should

continue to work all increased across countries. However, people are becoming more reluctant to reveal family members' positive status, suggesting that discrimination against PLWHs is still persistent if not becoming worse. In addition, our results indicate that men are slightly more knowledgeable about HIV/AIDS than women are, suggesting gender inequality regarding HIV/AIDS knowledge and attitude in SSA countries.

Interpretation: In SSA countries, people's knowledge of HIV/AIDS has increased slightly over the past three decades and people have become more accepting of HIV/AIDS patients in general. However, knowledge of condom use preventing HIV transmission has not been improving as much and even deteriorating in certain countries. Perceived discrimination against PLWHs is still persistent and is likely to get worse. Efforts and resources are still needed to turn the tide in these areas.

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#### CS02.003

##### Visibility, Transphobia, and Resilience: Addressing Transgender Women's Health in Lebanon

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Background: Worldwide, transgender women face a disproportionately high risk of HIV/AIDS, violence, mental health problems, and discrimination individually and structurally. In Lebanon, health disparities among transgender women have recently been established. Transgender visibility, a complex concept that involves "outness," gender expression, and context, is associated with risky sexual behavior among transgender women in Lebanon. This analysis, therefore, aimed to explore associations between visibility, transphobia, and resilience among transgender women in Lebanon.

Methods: Twenty semi-structured interviews and sixteen surveys were conducted in Lebanon during a transgender-specific HIV intervention pilot test. Participants were recruited via peer recruiters; inclusion criteria were being 18 years or older and identifying as a transgender woman. Mixed-methods analyses of the data assessed relationships between visibility, transphobia, and resilience. Quantitative and qualitative analyses included bivariate tests (Wilcoxon Signed Rank Test and Fisher's Exact Test) and the constant comparative method, respectively.

Findings: Quantitative results indicated significant associations between 'Visibility as Transgender' and two indicators of resilience: 'Social Cohesion' ( $p=0.0071$ ) and 'Community Connectedness' ( $p=0.0380$ ) with other transgender women. Individuals reporting being visible as transgender scored 50.0% and 26.67% lower on 'Social Cohesion' and 'Community Connectedness' scales, respectively, compared to individuals reporting being not visible as transgender. Qualitative analysis identified three themes: 'Isolation', 'Gender Identity Affirmation', and 'Resilience'. Participants indicated that transgender visibility increased risk of transphobic encounters, resulting in self-isolation as protection from transphobia. Validation of gender identity internally or externally (via physical appearance, gender affirmation procedures, or positive social interactions) was also important.

Resilience, among both those self-describing as visibly transgender and those who were not, may be bolstered through positive connections with other transgender women.

Interpretation: This analysis supports the importance of understanding visibility as a construct related to transgender women's health. Results indicate that achieving social cohesion and community connectedness with other transgender women could be integral for mitigating the deleterious impacts of transphobia in Lebanon, where a hostile environment for transgender women shapes the development of resilience within the continuum of visibility. Future research should seek to determine whether these associations hold true in larger samples of transgender women in Lebanon and the greater Middle East.

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#### CS02.004

##### Sexual and Gender-Based Violence Assessment in Internally Displaced Persons Camps and Host Communities in North East Nigeria

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Background: The North Eastern region of Nigeria has witnessed persistent increase in the number of internally displaced persons (IDPs) due to insurgency. The disruption in the socioeconomic lives of the women in this region places them at a high risk of all forms of abuse from the insurgents, security agents deployed to protect

the communities and other members of the community. The assessment aimed to determine the prevalence, pattern and determinants related to Sexual and Gender Based Violence (SGBV) in selected states in North East Nigeria.

Methods: A Mixed methods study design was used. Quantitative methodology was used to obtain data using interviewer-administered semi-structured questionnaires from IDPs and health facilities while qualitative methodology using Focus Group Discussions (FGDs) and In-depth Interviews were used to collect data from female IDPs, community leaders, security personnel, health workers in health facilities in the camps and host communities, and staff of NGOs and humanitarian organizations.

Findings: A total of 4868 IDPs were studied. About a third had experienced a form of sexual violence while a fifth reported physical violence. About three in ten had experienced socioeconomic or emotional violence while about half reported harmful traditional practices. Perpetrators of sexual violence include Boko haram insurgents (51.5%), 27.3% were unknown, 17.8% were members of the police and armed forces, intimate partners (15.4%) and relatives (5.8%). Majority of the women (80%) reported Boko haram insurgents as perpetrators of physical violence followed by unknown persons (12%), men in the camp or host community (5%), and police and army (3%). Overall about a third of women that experienced sexual violence, and half of those that reported physical violence sought care. While 35% and 37% sought care for emotional and socioeconomic violence respectively. Facility assessment showed that the basic facilities needed to better manage SGBV and prosecute perpetrators were lacking in many health facilities and police stations in camps and host communities.

Interpretation: Interventions are urgently needed to improve the capacity of the health team and security personnel to better combat SGBV. Community based SGBV prevention committees will also be of immense benefit in reducing the occurrence of the various forms of sexual and gender based violence.

Source of funding (if none, enter "None"): UNFPA

CS02.005

Factors Associated with HIV Medication Adherence among HIV Positive Women Enrolled in Option B+ in Zambia

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Background: Each year about 1.4 million women living with HIV become pregnant. Out of the 1.4 million pregnancies of HIV positive women, approximately 750,000 are not intended. This leads to about 220,000 new HIV infections among infants and children. Based on the current trend, it is estimated that, worldwide, the cumulative total death caused by HIV will reach 75 million by 2030. In an effort to eliminate mother-to-child transmission of HIV, the World Health Organization (WHO) has been recommending different treatment options with the recent being Option B+. In the current Option B+ treatment, HIV positive pregnant women are offered life-long antiretroviral (ARV) regardless of their CD4 count and viral load. The purpose of this study is to investigate factors associated with HIV medication adherence among HIV positive women enrolled on Option B+ in Zambia.

Methods: Using a cross-sectional descriptive study design, pregnant and breastfeeding HIV positive women enrolled on Option B+ treatment regimen residing in Lusaka (Urban) and Sinazongwe (Rural) Districts of Zambia were recruited. Descriptive statistics were used to characterize ARV adherence in the entire sample and by Zambian Districts. Four generalized Modified-Poisson regression models were built using a step-wise approach to assess the association between the factors and ARV adherence.

Findings: In all, 150 participants were included in the study. Approximately, 38% of the women missed taking their ARV at least once in the week preceding the data collection. There was a statistical significant association between adherence intention and district of residence ( $p < 0.001$ ). Also, counselling women on the side effects of the ARV was statistically significant in the overall sample and the Rural sample but not significant in the Urban sample. First prenatal visit during recent pregnancy was significant in the overall sample but not in any of the district stratified analysis. Multivariate analyses showed significant association between ARV adherence and counselling women on the side effects of the ARV (PR = 3.80, 95% CI: 1.10–13.12) after adjusting for socioeconomic variables and age.

Interpretation: Counselling women on the side effects of the ARV prior to initiating ARV could help promote adherence.

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CS02.006

A Multi-sectoral Approach to Eradicating Malnutrition Among Vulnerable Groups

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**Background:** Nutrition is essential in achieving Sustainable Development. Yet Uganda still reels from malnutrition and poverty affecting mostly women and under-five children. The pilot-study tests Uganda's National Development Plan of using a multi-sectoral approach to eradicate malnutrition. It examines the impact of financial products, agricultural and health extension services on food security, income and nutrition of smallholder farmers.

**Methods:** The study, conducted in South-western Uganda, used a clustered randomized control trial design both at village and household levels to estimate the treatment effects (intention-to-treat). 210 villages were randomly assigned to six treatment groups (180 villages) and one control group (30 villages), totaling to 7,787 households. There was a slight attrition of 2.55% at follow-up.

Treatment1: agricultural training for the first year.

Treatment2: agriculture and health interventions.

Treatment2a: agricultural credit over Treatment 2

Treatment 2b: voucher scheme for subsidized inputs over Treatment2

Treatment 2c: price insurance over Treatment 2.

Treatment3: growth monitoring and promotion for under-2 children, quarterly health and nutrition community forums, and conditional food transfers to pregnant women.

**Selection criteria:** agricultural households cultivating 5 or fewer acres of land, households containing a woman of reproductive age (15-49 years), households containing a pregnant woman or child aged less than 2 years, and female-headed households of a woman of reproductive age

The randomization was balanced using village size, and access to market and health clinics. A verbal consent was sought and the government approved the study.

Generating panel data after a year, Ordinary Least Squares were used for causality and Difference-in-Difference method to estimate the interventions' impact. Outcomes regarded: asset ownership, crop production and marketing, economic behavior and health and nutrition.

**Findings:** There was increase in consumption of fortified foods 50.33% ( $p < 0.01$ ), increase in food security by 2.17% points ( $p < 0.05$ ), reduction in wasting by 9.19% points ( $p < 0.05$ ) and reduction in under-weight by 11.2% points ( $p < 0.01$ ) in treatment groups than control group.

**Interpretation:** Agricultural inputs are more effective for food security than agricultural loans which can be diverted. Enough food combined with nutritional counseling and increase nutritional outcomes. Stunting can be caused by other factors like genes and diseases unrelated to malnutrition. Income from agricultural produce is compromised by price fluctuations.

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CS10.001

Determining the Pneumococcal Conjugate Vaccine Coverage Required for Indirect Protection within Asia and the Pacific

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**Background:** Pneumococcal disease is a leading cause of childhood morbidity and mortality worldwide. Evidence is required to support the introduction of pneumococcal conjugate vaccines (PCVs) in low- and middle-income countries (LMICs). PCVs prevent disease through both direct protection of vaccinated individuals, and indirect protection of unvaccinated individuals through reduction of nasopharyngeal (NP) carriage and transmission of vaccine-type (VT) pneumococci. We aim to determine the degree of indirect effects following PCV introduction at three sites in the Asia Pacific, and describe the relationship between PCV coverage and indirect protection.

**Methods:** We are recruiting and swabbing children aged 2-59 months of age, admitted to participating hospitals with acute respiratory tract infections in Lao People's Democratic Republic (Lao PDR), Mongolia and Papua New Guinea (PNG). Pneumococci are detected using IyA qPCR and serotyped by microarray. We are

comparing risk of VT carriage among under-vaccinated cases by village/subdistrict-level PCV13 coverage among under-5s, determined using administrative data or survey. Recruitment is due to finish in November 2018.

Findings: As of June 2018, we have recruited 1208, 1056 and 897 cases, and tested 1099, 624 and 405 samples, from Lao PDR, Mongolia and PNG respectively. Overall pneumococcal carriage varied from 37% in Lao PDR to 88% in PNG. In Lao PDR, VT carriage decreased from 18% to 6% from the first to the third-year post-PCV. In PNG, VT carriage decreased from 54% to 37% from the first to the third-year post-PCV. In Mongolia, VT carriage decreased from 31% to 24% pre-PCV compared post-PCV (year one).

Under-vaccinated children from villages with <50% coverage are 1.08 (95%CI 0.69-1.79) and 1.44 (95%CI 0.99-2.10) times more likely to be carrying VT than those from villages with ≥50% coverage, among the 336 and 83 children for whom we have both PCV and carriage data in Lao PDR and PNG, suggesting indirect effects.

Interpretation: In the absence of feasible methods for pneumococcal disease surveillance in LMICs, studies of NP carriage, which is a prerequisite for disease, provide useful information to guide vaccine policy. The inclusion of three sites, which have contrasting vaccine schedules and pneumococcal epidemiology, enable us to explore factors to maximise indirect protection from PCVs.

Source of funding (if none, enter "None"): Bill & Melinda Gates Foundation, Gavi the vaccine alliance.

#### CS10.002

Capacity for Innovation: Roll-out of First HIV Pre-exposure Prophylaxis Services in the Democratic Republic of the Congo

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Background: In the Democratic Republic of the Congo (DRC), HIV is concentrated in key populations (KP), specifically among female sex workers and men who have sex with men, with prevalence estimates of 7% and 18%, respectively, compared to 1.2% among the general population. Pre-exposure prophylaxis (PrEP) is an evidence-based intervention to reduce HIV incidence among populations at substantial risk of acquiring HIV. Building the capacity of clinics and outreach programs serving KP is a critical first step in scaling-up PrEP services. The DRC's National AIDS Control Program (NACP) and the US Centers for Disease Control and Prevention (CDC) established a target of initiating 350 KP on PrEP in 2018.

Methods: With support from NACP and CDC, ICAP at Columbia University facilitated PrEP implementation at seven KP-friendly HIV care and treatment facilities in DRC. Capacity-building activities included: guidance on national planning; establishment of a national PrEP technical working group; and the development of PrEP training material for multidisciplinary facility teams to provide and monitor PrEP services. Training addressed PrEP eligibility screening, initiation and follow-up; PrEP retention and follow-up activities; and monitoring and evaluation (M&E) of PrEP services. ICAP also provided ongoing on-site mentorship of clinic staff, and continuous evaluation of clinic procedures to ensure standardized PrEP service delivery across all facilities.

Findings: As of February 2018, 38 clinical staff and 48 peer outreach workers completed a six-day PrEP training using ICAP's PrEP training curriculum, participant and facilitator manuals, job aids, and M&E and reporting tools. Following the training, four sites in Kinshasa and three sites in Lubumbashi initiated PrEP services for the first time, resulting in successful achievement of the national PrEP targets.

Interpretation: Collaboration among national and global stakeholders resulted in the successful introduction of PrEP in DRC. PrEP implementation required extensive clinic training, tailoring of existing outreach activities to improve PrEP retention, inclusion of peer workers to help educate patients about PrEP, comprehensive M&E reporting, and ongoing mentoring of clinic staff. Lessons learned in DRC are being shared with other KP programs in African countries. Project findings will also support the endorsement of national PrEP guidelines and the scale-up of PrEP in DRC.

Source of funding (if none, enter "None"): CDC

#### CS10.003

Barriers and Facilitators to Digital Health Collaboration Between Academia and Industry: A Cross-Cultural Analysis

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**Background:** In a landscape of rising chronic disease burden in middle- and high-income countries, digital health is seen as a promising solution to improving population health. Importantly, the development and uptake of digital health technologies require multisectoral efforts from academia and industry. However, few have explored the factors that help or hinder the success of these collaborations. Our study aims to identify the themes, barriers and facilitators associated with industry-academia collaborations in digital health in middle- and high-income countries.

**Methods:** Semi-structured interviews with 22 stakeholders who are active in industry (n=10), academia (n=11) or both (n=1) were conducted according to pre-specified interview guides by trained research personnel.

Stakeholders were based in middle-income countries (China, India; n=15) or high-income countries (United States, Australia, Singapore; n=8), as defined by the World Bank. Interviews were conducted in the stakeholder's language of choice (Chinese, n=12; English, n=8). Qualitative interview questions elicited discussions about stakeholders' past experience with academia-industry collaboration, challenges they faced, and factors that facilitated the process. Interviews were audiotaped, transcribed verbatim and analyzed by inductive content analysis. A codebook was developed by the research team over five iterations and used by two bilingual coders to thematically code the data.

**Findings:** Four central themes emerged from the discussions: stakeholder role in collaboration, communication between partners, goals or expectations, and individual priorities. Stakeholders in both academia and industry identified the adoption of complementary roles, authentic communication between partners, and clearly outlined goals or expectations prior to the collaboration as primary facilitators for successful collaborations. Misaligned goals or expectations, particularly differences in timeline and difficulties balancing business outcomes versus scientific evidence, were identified as the primary barriers. Interestingly, stakeholders in high-income countries also reported inauthentic communication as a significant barrier to collaboration, whereas those in middle-income countries did not.

**Interpretation:** This study highlights the need for increased planning and communication prior to and throughout collaborations between academia and industry in the field of digital health. Outlining each party's goals and expectations for timeline, assigning complementary roles and communicating about priorities will facilitate fruitful collaborations in the future. Furthermore, best practices for communication styles may be dependent on the cultural setting, and thus should be adopted accordingly.

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CS10.004

An Analysis of South African Physician Emigration, Return Migration and Shared Migration, 1991-2017

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**Background:** Physician emigration ("brain drain") is a topic of great concern to health workforce planners. There are few registry-based studies that have analyzed physician return migration and shared migration trends along with emigration. South Africa (SA) has a high number of physician emigrants but has demonstrated some survey level evidence of increased return migration.

**Methods:** This study took a registry based approach to analyze South African trained physicians who had a history of registering in Australia, Canada, New Zealand (NZ), the United States (US), and the United Kingdom (UK) (ACNUU nations) between 1991 and 2017. An attrition based model, identifying non-retiree dropouts from UK, NZ, and US registries with cross-referencing with a South African physician registry was used to determine return migration from the UK, NZ, and the US; return migration counts in Canada were derived from secondary data from Canadian Medical Association surveys. Physicians who had active simultaneous registration in South Africa and one other nation were counted as shared migrants.

**Findings:** As of the fall of 2017, there were 11,224 South African trained physicians actively registered to practice in ACNUU nations, a third (30.2%) fewer than their peak of 16,095 in 2003. 3,596 (32.0%) of these physicians held dual active registration ("shared migration") in an ACNUU nation and South Africa. 5,008 physicians met criteria for return migration as of 2017, composing 30.1% of all non-retired SA physicians with history of practice in ACNUU nations. There has been a fivefold decline in emigration rates between 1991 and 2017 (from 1.8% to 0.3% per year; UK -88.9%, non-UK -74.2%), negatively correlated with a substantial rise in GDP per capita growth within South Africa in time adjusted models (-0.36% per \$100 increase, p=0.01, 95% CI .089, .632). There was also a temporary increase in return migration between 2000-2009 and a simultaneous sustained increase in shared migration.

**Interpretation:** This introduces a new approach to simultaneously assessing physician emigration, return migration and shared migration. The study shows evidence of a "mobility transition" in medical migration, shown by declining emigration rates and increasing return and shared migration rates.

Source of funding (if none, enter "None"): World Bank

CS10.005

Environmental Risk Factors for Cleft Lip and Palate: Considering Exposures Unique to Low Resource Settings

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Background: Cleft lip with/without palate is the most common birth defect globally. Although there is a clear algorithm of care established in developed countries, the lack of access to surgery globally means that millions live with this easily treated condition. While smoke exposure from cooking no longer occurs in developed world and is not routinely studied, it represents a great deal of smoke exposure in LMICs. We aim to understand if this type of smoke exposure could lead to the prevention of cleft and decrease the burden of disease in these regional areas.

Methods: We conducted a case-control study of 2,156 cases and 1,819 controls collected from seven countries in partnership with Operation Smile between 2011- 2017. Participants for this analysis were mothers who provided written consent with ethical approval from USC. The primary outcome of interest was smoke exposure in the form of either maternal smoking, paternal smoking, living with any smoker, and/or cooking indoors over a fire. Logistic regression with multiple adjustment models was used to assess the different roles these smoke exposures play as risk factors for cleft.

Findings: We found that <1% of the mothers in our study smoked cigarettes, but 60.2% cases and 38.6% controls cooked over a fire inside their home. We did not find a significant effect of household smoking, maternal, or paternal smoking in our data. Case mothers were 1.63 (95% CI:1.4,2.0) times as likely to cook over a fire compared to controls, after mutual adjustment for all other smoke exposure, confounders, and urban v. rural homestead.

Interpretation: Although maternal cigarette smoking is an established risk factor for cleft, it is necessary to contextualize where the majority of "smoke" exposure comes from in other settings. We believe that smoke from cooking could be a major modifiable risk factor in these populations. Considering there are existing solutions, ex. clean cookstoves, further research would greatly help the momentum for those initiatives and others like them. Without doing research for the specific context, we may miss the most important risk factors for the individuals who are least likely to have access to care.

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CS13.001

Kuska Tele-Wasi: An SMS Home Blood Pressure Tele-Monitoring System for Hypertension Control in Primary Care Centers

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Background: Hypertension is one of the leading causes of death worldwide and despite being a public health problem, less than one-third of hypertensive patients achieve blood pressure (BP) control. We propose an easy to use, with massively available communication technology and affordable tele-monitoring system based on a blood pressure device with the capability to send the BP readings via SMS (Short Message Service) that the health providers, at the primary care centers, could use for decision making regarding treatment, office visits, and follow-up.

Methods: A randomized clinical trial including adult hypertensive patients in pharmacological treatment with uncontrolled BP. We developed a communication-transferred hub based on open hardware and open software. The readings were uploaded to a web platform available for the health providers at the primary health center. Participants in the intervention arm used the system for 2 weeks and were followed for two more weeks.

Controls continued with the habitual monitoring for 4 weeks. The main outcome was to evaluate the blood pressure change between groups after the intervention. Values are expressed as median (interquartile range).

Findings: Twenty patients were enrolled in each group, 70% were females and the median age was 70.36 years (64.91 – 74.36) with no differences between groups. There was a significant difference in the systolic BP (SBP) and diastolic BP (DBP) change between controls and intervened. SBP: -4 mmHg (-21 – 3) vs. -12 mmHg (-28 – -5) respectively ( $p < 0.05$ ), DBP: -1mmHg (-4 – 2) vs. -8 mmHg (-14 – 1) respectively ( $p < 0.05$ ). In the intervention arm, the change in BP was higher the first 2 weeks (SBP: -24.5 mmHg (-30 - -12.5)  $p < 0.05$ ), and presented a slightly increased the 2 weeks after (SBP: +5 mmHg (0 - +13)).

Interpretation: Our study shows that an SMS home blood pressure tele-monitoring system is effective in reducing BP when working together with the primary care centers. Although slightly decreased, the effect remains even after stop using the system. Our findings represent an important new strategy for hypertension control.

Source of funding (if none, enter "None"): Runachay: Information and Communication Technologies for Global Health (NIH: 1R25TW009710-01) Masters Program in Biomedical Informatics in Global Health Thesis Funding (UPCH-FondeCyT)

### CS13.002

#### Solar-Powered Oxygen Delivery: An Innovative and Cost-Effective Intervention to Treat Childhood Pneumonia in Low-Resource Settings

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Background: Pneumonia is the leading cause of pediatric mortality globally, causing over 900,000 deaths annually. Access to oxygen is essential in treating hypoxemia in pneumonia, but this remains limited in low-resource settings. Current methods of oxygen delivery are often unsustainable in LMICs. Oxygen cylinders require a robust supply chain and operator training, while concentrators rely on consistent access to the power grid. As a result, gaps remain in oxygen delivery in low-resource settings despite the potential to reduce pneumonia mortality by up to 35% with consistent access. Therefore, innovative approaches to oxygen delivery are required in low-resource settings.

Methods: Our team has developed, installed and monitored two solar oxygen systems in Jinja and Kambuga, Uganda, to provide off-grid access to oxygen. These systems consist of solar panels, batteries, and an oxygen concentrator, and cost USD\$15,420 and \$17,328, respectively. A randomized-controlled trial of 130 patients with pneumonia compared outcomes between solar oxygen and cylinder therapy, based on hospital length-of-stay. Further cost-effectiveness analysis was performed using WHO-CHOICE guidelines, and qualitative assessment of these systems was provided by health care workers

Findings: There was no difference in mortality or time to discharge between solar oxygen and cylinder groups. Solar oxygen has a cost per disability-adjusted life year (DALY) saved of \$17/DALY, significantly less than published values for oxygen cylinders (\$50/DALY) and other pneumonia interventions such as the pneumococcal and HiB vaccines. Maintenance costs are projected at \$90 per month (including battery replacements) over the life time of the system. Health care workers express that solar oxygen systems are easier to use than cylinders.

Interpretation: Solar oxygen is a reliable and cost-effective option to provide oxygen therapy for children with pneumonia in low-resource settings. A twenty-site expansion throughout Uganda is being planned, with a stepped-wedge randomized controlled-trial to assess mortality benefit. There will also be a focus on developing best practices for training staff to use and maintain these systems. Our team has engaged with local implementing partners, including health authorities, to ensure effective uptake of solar oxygen. Further reductions in cost and experience with maintenance are required to ensure effective widespread implementation.

Source of funding (if none, enter "None"): Grand Challenges Canada - Stars in Global Health

### CS13.003

#### Building Capacity for Geospatial Cancer Research in Uganda

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Background: There is a growing epidemic of cancer and other non-communicable diseases in Sub-Saharan Africa (SSA). Targeted, specific, cost-effective strategies are needed to manage the growing burden of cancer. Geospatial analysis has transformed the landscape of cancer control in higher resourced areas through



geographic targeting of interventions and/or policies. A similar approach could significantly impact cancer control in SSA; however, georeferenced cancer data and increased geospatial research capacity are needed. Methods: We set out to assess the feasibility of geocoding and mapping small area cancer data from a cancer registry in Uganda. We established a partnership including the Makerere University (MU) Department of Pathology (DPath), School of Public Health (MakSPH), and College of Computing and Information Sciences (CoCIS), the Kampala Cancer Registry (KCR) and the Medical College of Wisconsin (MCW). The overarching goal of our multidisciplinary and multi-institutional partnership is to increase geospatial cancer research capacity at MU to enhance the prioritization and targeting of limited cancer prevention and control resources in Uganda. We leveraged the MCW Global Health Pathway, Kohler Scholar Fellowship, and Medical Student Summer Research Program to build geospatial cancer research capacity at the KCR.

Findings: MCW and MU faculty jointly mentored two MCW medical students to work in Kampala with registry staff to identify, enter, and quality check geographic codes of residence for approximately 2100 cervical cancer records from 2007-2016. The district and sub-county were available for the vast majority of cases, and the parish was identifiable for a large proportion of cases, with increasing availability in more recent years. A seed grant supports ongoing capacity building at KCR, including the purchase of new computing hardware and software and the implementation of a revised geographic data collection protocol to support future geospatial analysis of KCR data.

Interpretation: It is feasible to geocode cancer registry records in Kampala, Uganda and to create cancer incidence maps to identify areas with higher than expected cancer burdens. This capacity building partnership is a catalyst to improving targeted prevention and control efforts to reduce the burden of cancer in Uganda.

Source of funding (if none, enter "None"): MCW Kohler Scholars Program, Class of 2001 Scott Sprtel Summer Research Training Fellowship, MCW Office of Global Health Seed Grant

#### CS13.004

Low confidence and critical gaps in cardiovascular risk-factor management in rural Botswana: an urgent need to improve healthcare provider training

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Background: An epidemiological transition in Botswana is resulting in increased prevalence of cardiovascular disease (CVD). Providers, majority nurses, in this setting have limited training in managing CVD risk and few opportunities for continued medical education (CME). We aimed to evaluate providers' perceived confidence in managing CVD risk-factors and describe management practices among hypertensive patients attending public-sector clinics in a rural district of Botswana.

Methods: In this cross-sectional study, 55 public-sector providers working in 11 ambulatory clinics in the Kweneng East district of Botswana completed an anonymous questionnaire survey. Additionally, CVD risk-factor management practices were evaluated among 228 hypertensive patients at 6 of the 11 sites surveyed. We used descriptive statistics to evaluate providers' confidence in managing CVD risk (Likert scale: 1 = low confidence, 5 = high confidence) and observed management practices. T-tests were used to compare confidence levels between groups of providers and specific risk-factors.

Findings: 44 registered nurses (79.6%), 4 family nurse practitioners (7.4%), and 7 doctors (13%) completed the survey. Providers reported feeling significantly more comfortable managing hypertension than diabetes (3.73 vs. 3.15,  $p < 0.0001$ ) and lowest confidence with an average Likert rating of 1.95 (95% CI 1.58-2.31), 2.27 (95% CI 1.93-2.62), and 2.13 (95% CI 1.75-2.51) prescribing aspirin, statins, and adjusting insulin, respectively.

Among 228 evaluated hypertensive patients, 48.2% (106/220) had uncontrolled hypertension, and 53.9% (55/102) of those with uncontrolled hypertension had no changes to their medications over the course of a year. Of patients who also had diabetes 48.7% (19/39) had uncontrolled disease and an additional 20.5% (8/39) had no recent blood glucose checked. Of patients with 10-year CVD risk greater than 10% only 59.5% (22/37) were prescribed aspirin and 13.5% (5/37) a statin.

Interpretation: Public sector healthcare providers in rural Botswana have low confidence in managing CVD risk-factors. While reported confidence was higher in managing hypertension over diabetes, significant lapses were observed in the management of both diseases. CVD and diabetes account for 22% of all adult deaths in Botswana. It is imperative to improve training. To address low provider confidence and gaps in guideline-driven CVD prevention, we plan to implement an integrative CME program.

Source of funding (if none, enter "None"): Hospital Medicine, Beth Israel Deaconess Medical Center

#### CS13.005

Profile of bacterial infectious disease and antimicrobial choices in an urban hospital at Maputo

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Background: Few antimicrobial resistance profile data exist for Mozambique. Limited antimicrobial stewardship favors almost “anarchic” antibiotic use. We studied antibiotic selection rationale, empiric therapy, and use of cultures in our teaching hospital.

Methods: Our prospective observational study recruited 232 adults admitted to Maputo Central Hospital’s medical wards who were prescribed antibiotics in early 2018. Data were collected from patient charts and prescription sheets. We studied the profile of acute bacterial infections, antibiotic treatment choices and possible treatment errors.

Findings: The 232 patients studied represent 12.5 % of admissions during the study period. Of these, 61.6% were HIV infected, more than half (64%) with <200 CD4 cells/ml. Diagnosed infections included: Community Acquired Pneumonia (106), Bacterial Meningitis (50), Aspiration Pneumonia (42), Acute enteritis (38), Chronic enteritis (7), UTI (19), Soft tissue infections (11), Sepsis (11), brain abscess (3), neutropenic fever (3), otitis with effusion (1). Antibiotics were prescribed for 46 patients with no recorded infection on the medical chart. Eight cases were meant for infection prophylaxis in patients with hepatic encephalopathy, Stroke, DKA and hematologic malignancies.

Inpatient outcomes: 12.1% (28) died, 77.2% (179) were discharged home improved, 10.8% (25) transferred to lower acuity hospitals for chronic care and 4.3% (10) transferred to a tuberculosis hospital.

A total of 347 prescriptions were prescribed to 232 patients. One antibiotic was prescribed in 57% of cases and two or more were prescribed to 37 % (86). Ceftriaxone 50.7% (176) and metronidazole 16.4% (57) were most frequently prescribed.

Prescribing errors: in 12.7% (46) no indication was recorded on the chart. In 12 % (42) the antibiotic choice was not consistent with international guidelines. Two percent (8) had an incorrect duration of therapy and 6.05 % (21) received an incorrect antibiotic.

Glomerular filtration rate estimations seldomly used to adjust dosage. Blood cultures were rarely ordered 0.86% (2). CSF was cultured in 38 patients, with no positive findings.

Interpretation: Limited antimicrobial availability, shortages of qualified human resources, local stewardship antimicrobial programs, poor laboratory capacity promote the overuse of empiric therapy compared to etiologically driven treatment decisions. Findings suggest the need for continued education, accurate and updated hospital antimicrobial resistance algorithms for best clinical practices.

Source of funding (if none, enter "None"): Fogarty International Center from the NIH D43TW009343 and the UCGHI.

#### CS15.001

Improving Isoniazid Preventive Therapy among People Living with HIV in North Central Nigeria: A Quality Improvement Strategy

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**Background:** Isoniazid preventive therapy (IPT) significantly reduces the incidence of active TB among people living with HIV (PLWHIV). However, uptake of IPT remains grossly suboptimal with implementation impeded by several health worker and patient related barriers despite high tuberculosis morbidity and mortality rate among PLWHIV. We evaluated the use of a quality improvement approach to improve isoniazid preventive therapy in Federal Medical Centre Keffi a high HIV burden tertiary hospital in North Central Nigeria.

**Methods:** A 4-week pilot quality improvement (QI) project was conducted in July 2018. The facility QI committee comprising of different cadres of staff working in the ART clinic together reviewed their HIV quality of care indicators which revealed that only 3% of eligible HIV clients received IPT between September 2017 and March 2018. Poor knowledge of clinicians on the importance of IPT, fear of developing INH resistance, frequent stock out of isoniazid and poor medication adherence were major root causes identified following a root cause analysis conducted by the QI committee. IPT orientation for clinicians, incorporation of IPT education into routine health education for PLWHIV, display of IPT information education and communication (IEC) materials in consulting/patient waiting rooms and auditing of client's folders prior to consultation to identify and tag eligible folders with IPT sticky notes were key change ideas implemented to reduce missed opportunity and improve IPT uptake in the midst of overwhelming work load.

**Findings:** During the intervention, 278 adult clients with a clinic appointment had their folders audited for IPT eligibility with 108 eligible folders identified and tagged with an IPT sticker. Of those eligible for IPT, 103 (95%) kept their clinic appointment and all had a 6-month dose of isoniazid prescribed by clinicians. However, only 93 (90%) received IPT due to isoniazid stock out.

**Interpretation:** A quality improvement strategy for improving IPT among HIV patients was effective with a resultant 87% increase. QI principles such as team work and implementation of change ideas targeted at addressing identified root causes of the problem were pivotal to the success. Continued implementation and scale up of effective change ideas to other hospitals could significantly reduce TB morbidity and mortality among PLWHIV while ensuring continued availability of isoniazid.

**Source of funding (if none, enter "None"):** CDC-PEPFAR

CS15.002

Effects of Implementing Free Maternity Service Policy in Kenya; An Interrupted Time Series Analysis

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**Background:** In Kenya, more than 6,000 maternal deaths, and 35,000 stillbirths occur each year. The Government of Kenya abolished user fee for maternity care under the Free Maternity Service (FMS) policy, in June of 2013 in all public health facilities a move to make maternity services accessible and affordable, and to reduce maternal and perinatal mortalities. This study aimed to establish whether, all else constant, the FMS policy influenced utilisation, access and quality of maternity care.

**Methods:** An observational retrospective study was carried out in 3 counties in Kenya. Six maternal health output indicators were observed monthly, 2 years pre and 2 years post free maternity service policy implementation. Data was collected from daily maternity registers in 90 public health facilities across the 3 counties.

Interrupted Time Series Analysis (ITSA) with a single group was used to assess the effects of the FMS policy. Standard linear regression using generalized least squares (gls) model was used to run the final results for each of the six variables of interest. Absolute and relative changes were calculated using the model coefficients.

**Findings:** After policy implementation, significant increase was observed in antenatal care visits, health facility deliveries, and live births with 89%, 97%, and 98% increase respectively. An immediate and significant increase of 27% was also observed among women who had pregnancy complications and received Emergency Obstetric Care (EmONC) services. No significant change was observed in the stillbirth rate and caesarean section rate.

**Interpretation:** After two years of implementing FMS policy in Kenya, immediate and sustained increase in the use of skilled care during pregnancy and child birth was observed. These findings suggest that the hospital cost is the main expense incurred by most women and their families whilst seeking maternity care services and hence a barrier to maternity care utilisation.

**Study strengths and limitations:** Use of a long time series, and multiple indicators enabled this study to provide compelling evidence on the effects of the policy on maternal health care service utilisation, accessibility and to some extent the quality of care. The study design was non-experimental hence claiming causality is limited.

**Source of funding (if none, enter "None"):** The project was funded through the Afya Bora Consortium fellowship career development award.

CS15.003

Using an Implementation Model to Guide Rural Malawi Communities in Scaling Up an Effective HIV Prevention Program: An Implementation Science Study

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**Background:** Scaling-up of evidence-based programs is a global priority, especially for HIV prevention programs in high-prevalence areas. Numerous implementation models exist, but a major barrier is the lack of implementation models straightforward enough for use by community volunteers with little education or research experience. Our previous research established efficacy of a peer-group HIV-prevention program in Malawi that is ready for wider dissemination. Our current research shifts ownership of this program from researchers to rural community volunteers. To do this, we adapted an existing implementation model to guide rural Malawi community members in implementing this program. This research describes communities' use of this 3-step (Prepare, Roll-out, Sustain) Community Implementation Model (CIM).

**Methods:** Using a hybrid stepwise design, we simultaneously evaluate three communities' use of the CIM to guide the implementation processes and assess program effectiveness; here we focus on describing the implementation process. We brought together district health, political and traditional leaders, who agreed to support community program implementation. Each community established a Coordinating Committee, which organizes implementation. We conducted workshops to develop leaders' capacities for following the CIM. The Committee tracks progress every six months using simple benchmarks (number achieved, of 28 items).

**Findings:** To date, two of the three communities have successfully begun implementation using the 3-step CIM. During Prepare, each community developed a plan and trained peer group leaders. During Roll-out, peer leaders offered the program. One community has begun to Sustain, making and carrying out plans to continue and expand the program. They have developed capacities needed to sustain the program, and have submitted a proposal to obtain funding from the project; they will soon apply for local funding. Benchmarks have increased over time and are shared with local leaders. Both communities have been highly enthusiastic and successful in carrying out the implementation.

**Interpretation:** Findings to date suggest that the CIM is an effective, replicable model to guide future community implementations of this and other health promotion programs. If the pattern of results continue with the third community, the model will support transfer of program ownership from researchers to community members.

**Source of funding (if none, enter "None"):** National Institutes of Health/National Institute for Nursing Research R01NR015409 and R01 NR08058.

CS15.004

Task-shifting HIV Testing from Lab Personnel to Nurses Improves Pediatric and Adolescent HIV Testing Rate and Yield in Rural Nigeria

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**Background:** Globally, Nigeria has the 2<sup>nd</sup> highest burden of HIV among children <15 years (220,000) and adolescents 10-19 years old (230,000), globally. Unfortunately, less than a quarter of these children and adolescents are identified and linked to treatment. Decentralizing HIV testing services (HTS) to high-yield service delivery points can facilitate identification of undiagnosed HIV-positive children and adolescents. However, adoption of HTS decentralization remains low partly due to chronic workforce shortages. We evaluated the effectiveness of task-shifting HTS from specialized lab personnel to nurses to improve HIV case identification among pediatric and adolescent clients.

**Methods:** This cross-sectional task-shifting strategy was implemented at a secondary healthcare facility in a high HIV prevalence rural district of North-Central Nigeria between April and July 2018. A zero to-19 year patient testing point was established at the in-patient ward, and pediatric nurses were trained by laboratory personnel to provide HTS to children and adolescents admitted into the ward.

**Findings:** In the 3 months prior to the intervention when HTS was provided only by laboratory personnel, a total of 276 pediatric/adolescent admissions were recorded, of which only 22 (8%) underwent HIV testing with no positive case identified. However, over the four-month intervention period, a total of 179 pediatric/adolescent clients were admitted, of which 169 (94%) were tested for HIV by nurses with four positive children newly-

identified, at a 2.4% yield. Additionally, linkage to care and ART initiation was achieved for all newly identified children within 24 hours of diagnosis.

Interpretation: Task-shifting of pediatric/adolescent in-patient HTS to nurses was more effective than testing by laboratory personnel. In resource limited settings where shortage of manpower remains a major challenge, implementation and scale-up of task shifting for HTS can significantly improve pediatric and adolescent HIV case identification and treatment coverage.

Source of funding (if none, enter "None"): CDC-PEPFAR

#### CS15.005

Predictive algorithm to identify infants at-risk for child undernutrition in India

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Background: India is at the epicenter of global child undernutrition, with nearly twice the total burden of malnourished children as all of Sub-Saharan countries combined. Indian government has established numerous national level initiatives to address this public health crisis. However, there is substantial inter and intra-state variation in the prevalence of child undernutrition and strategies to identify at-risk populations are needed in the context of limited resources.

Methods: Data from 232,440 children aged 5 year or less from the 2015-16 National Family Health Survey were used. A child was considered as undernourished if either height-for-age, weight-for-height, or weight-for-age standardized z-score was 2 standard deviation below the WHO median. Predictor variables were identified using existing literature and included if they could be measured at the time of delivery. Multilevel logistic regression was applied to model the outcome. Model calibration was assessed using Hosmer-Lemeshow table. Internal validation of the model was performed using 200 bootstrapped samples representing half of the total datasets to derive optimism adjusted c-statistic. All analyses were performed using svy command in STATA to account for complex clustered sampling.

Findings: In 2016, 54.7% of Indian children under the age of five were either stunted (38.4%), underweight (35.8%), or wasted (21.0%). The predictive model for overall undernutrition included maternal (height, education, reproductive history, number of antenatal visits), child (sex, birthweight), and household characteristics (district of residence, caste, rural residence, toilet availability, presence of a separate kitchen). The model demonstrated good discrimination ability (c-statistic: 0.73, optimism-adjusted c: 0.72). The group of children classified in the lowest decile for risk of undernutrition had a prevalence of 19.0%, while the group classified in the highest decile had a prevalence of 85.0%.

Interpretation: We are developing a mobile-based app to collect the information and categorize each child into a risk decile at the time of delivery. Considering that more than 80% of the births in India are registered by the Community Health Workers, who are also responsible for implementing child nutrition programs, this tool can help them identify at-risk infants and prioritize their intervention.

Source of funding (if none, enter "None"): Apurv Soni: NIH-NCATS (TL1-TR001454) and NIH-NICHHD (1F30HD091975-01A1). Jeroan Allison: NIH-NIMH (P60-MD006912-05).

#### CS23.001

Public Health Education in a Tribal College Setting

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Background: Background: Models of academic public and global health programs that are culturally situated and that provide training to meet the needs of communities struggling with health disparities can provide inspiration for the development of similar programs throughout the world. In the U.S., for example, more American Indian health professionals and researchers are needed to develop culturally relevant health education and for Native Nations to exercise their sovereignty by designing programs and passing policy to achieve health equity by recognizing the role that culture plays in our understandings of health.

Objective: Diné College (Navajo Nation Tribal College) has worked to build and institutionalize the social and institutional infrastructure needed to enhance the Navajo Nation's professional public health capacity by training Navajo students, practitioners, and researchers.

Methods: Methods: Public Health Faculty at Diné College have developed a Bachelor's of Science degree that meets the specific health needs of the Navajo Nation. The program is grounded in the Diné educational philosophy, Sa'áh Naagháí Bik'eh Hózhóo (SNBH). SNBH provides a philosophy for healthy living through balance with the universe and protection from life's deficiencies. SNBH is composed of four equal and

interdependent components: 1) thinking, 2) planning, 3) living, and 4) assurance. In addition, the B.S.P.H program is guided by core competencies that both reflect Western public health practice and traditional Diné ideas about health, healing, and the research process. Through culturally-informed curriculum, this program aims to produce Diné scholars uniquely qualified to conduct health research and to practice public health in their communities.

Findings: Evaluation of project impact is tracked through student enrollment, completed courses, and articulated student experiences documenting factors associated with academic success and application of learned skill sets. Students report that the indigenous focus of the program reinforces their commitment to a career in health/public health service and research.

Interpretation: Academic programs that use culturally-situated curriculum to successfully target aspiring global health practitioners from rural communities that confront health disparities can serve as models to increase the diversity of global health researchers and the global health workforce.

Source of funding (if none, enter "None"): Navajo NARCH Partnership National Institutes' of Health National Institute of General Medical Sciences (NIH-NIGMS), S06GM123550. Diné College Title III Funding

### CS23.002

Integrating Experiential Learning into Global Health Training Curricula by Applying Virtual Reality Technology

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Background: Since the late 1990s there has been a rapid proliferation of Global health academic programs at universities around the world. Multiple evaluations of global health training programs indicate that their quality often falls behind expectations. While acquiring adequate levels of theoretical knowledge, global health graduates often lack practical skills and hands-on experiences that are necessary for effective performance in the field. Limited integration of the experiential learning method into global health training curricula is considered a contributing factor to the above problem.

Methods: We are developing a global health training course based on virtual reality technology. VR technology allows integration of experiential learning into global health curricula by immersing students in simulated, but highly realistic global health field environments - such as refugee camps, sites of epidemic outbreaks or natural disasters, where students can experience physical presence and perform specific tasks.

Findings: We will present a prototype training module, which simulates outbreak of Ebola in a low-income country setting. We will discuss the pedagogical and technological approaches that have been used for developing VR-based training module and will overview the challenges and opportunities for scaling-up the application of VR/360/3D technologies in global health education.

Interpretation: Integration of virtual reality technology into global health training can significantly improve the quality and outcomes of global health education programs by improving the experiential learning component. Experiential learning means learning by doing. The method is widely used in the education sector. For example, in clinical medical education students spend only the first 2 years in classrooms, then move to teaching hospitals to acquire practical skills and experiences (e.g. clinical, behavioral, emotional, communicational etc.) by performing practical tasks. Using the experiential learning method in global health training has been a challenge, since for the obvious reasons it has not been feasible to deploy global health students at the sites of global health practice. VR technology allows "bringing" global health field into the classroom in risk-free and cost-efficient way.

Source of funding (if none, enter "None"): Georgian Innovation and Technology Agency (Tbilisi, Georgia)

### CS23.003

AFREhealth Student Exchange Pilot: Impact Assessment

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Background: Not all medical and health professions students from African countries can go on global health electives due to lack affordability and accessible opportunities. This has led to mobility imbalance with many

African institutions hosting students from developed countries while their own students are unable to go on electives in developed countries<sup>11</sup>.

GEMx, a service program of ECFMG®, partnered with AFREhealth to implement a south-to-south student exchange pilot through intra-institutional partnerships. The aim was to provide affordable global health learning opportunities to African students.

[1] Eaton, DM, et al, "Training Healthcare Professionals for the Future: Internationalism and Effective Inclusion of Global Health Training," *Medical Teacher* 33, no. 7 (July 1, 2011)

Methods: Thirteen medical and nursing institutions in eight African countries participated in the pilot. Institutions entered into a multi-lateral agreement. The GEMx web-based system was used to centralize elective placements where students gained access to opportunities and applied online. Institutions waived their administrative fees and provided a manager to support students. ECFMG hired a contractor to work with stakeholders. ECFMG GEMx provided student mini-grants. Findings from stakeholders were collected through surveys using SurveyMonkey.

Findings: GEMx facilitated 48 student exchanges in medicine, nursing, and pharmacy in 8 African countries from April 2017 through June 2018. Twenty students revealed they have never gone on an elective exchange in another country and confirmed that this opportunity would not have been possible without GEMx. Five top student learning experiences reported by institutions were: 1) learned and compared different health systems; 2) improved clinical skills; 3) increased confidence; 4) developed professional networks; 5) managed and cared for patients different from their educational experience. These findings correlated to the feedback collected from students.

Interpretation: Translation and implementation for impact in global health requires models that provide a positive balance for students. The south-to-south model provided a suitable platform to evidence this. The outcomes revealed a strong commitment amongst intra-institutional partners within AFREhealth. ECFMG GEMx investment to facilitate student exchanges played a critical role in the successful implementation of the AFREhealth student exchange pilot. Additional funding contributions are needed to expand AFREhealth student exchange program.

Source of funding (if none, enter "None"): ECFMG Challenge Grant. The hiring of a GEMx Representative - Africa

CS23.004

Analyzing the Migration Patterns of Undergraduate Medical Students in Elective Exchanges

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Background: Our aim with this research initiative is to analyze the migration patterns of medical students for elective exchanges and identifying intention of continued migration in their selective career path. The significance of this research project cannot be understated, an international and global medical education program helps develop an individual's skillset as a healthcare professional, and can be a crucial factor in their progression from medical student to practicing physician.

Our learning objectives are as follows:

To determine the most popular countries and specialty types that medical/health profession students intend to go for elective exchanges

To assess prevalence of different factors contributing to the students choice to migrate for an elective.

To assess factors leading to the intent of permanent migration once course of current study is successfully completed at home institution.

Methods: Our research deals with experiential learning in a global health setting via analyzing the trends and patterns of medical student pursuing medical electives worldwide. The main method of data collection was via a multilingual questionnaire where 363 students were examined from 15 different countries across a timeframe of one month.

Findings: Most popular countries for electives was the United States at 31.2%, The most popular specialty types were Surgery and Internal Medicine. The most important factors contributing to elective participation were Expanding Medical Training (42.62%), Enhancing CV Credentials (29.51%) and Expanding Research Opportunities (8.2%).

The main factor contributing to permanent migration was "Expansion of Opportunities in Desired Specialty" (36.6%) whilst the main factor deterring students from permanent migration was "Desire to disseminate acquired learning to native home country healthcare providers/systems" (60%)

Interpretation: The results of this study emphasized the importance of elective exchanges to medical students all around the world. Not only was it proven to significantly impact and steer the course of their careers as Medical Professionals, but it also proved to be crucial in creating a more holistic educational experience when combined with their home institution's curriculum.

Global electives are an initiative that all schools should dedicate resources to pursuing. The elective process is vastly scalable and can be applied at medical schools in all regions of the world.

Source of funding (if none, enter "None"): None

### CS23.005

El Manual Para el Pueblo - The Manual for the People: A Pictorial Aid for Community Health Workers

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Background: Access to safe, effective and affordable surgical care is a pressing contemporary public health issue. Deaths from surgically-treated conditions exceeds those from HIV, Tuberculosis, and malaria combined. Community outreach is a potential driver of access to surgical treatment, yet sufficient education among Community Health Workers (CHW) regarding such conditions is poor. This program developed and tested a novel pictorial-based curriculum for CHWs to identify and refer surgical conditions in a largely illiterate population.

Methods: Using the context specific expertise of Central American rural multi-ethnic indigenous groups and surgical providers, the groundwork of El Manual Para el Pueblo ("The Manual for the People") was established in fall 2017. During July 2018, participants in a pilot implementation were assessed before and after the teaching program for situational problem-solving. Quantative surveys were administered which measured the efficacy of an accompanying curriculum on the scheme and iconography of the manual; participants also qualitatively reported the utility with respect to their practice patterns.

Findings: The surgical manual included 13 chapters with 133 different medical and surgical conditions represented. Overall 61% of participants scored 75% or higher on the initial survey with 42% of participants scored 85% or higher. Manual understanding and utilization abilities improved from pre-intervention mean score of 15.37 to 15.91 post-intervention (p=.0148) Qualitative assessment further demonstrated the need for the manual, the readability of the manual, and the willingness to use the manual: 93% needed to take themselves or loved ones to the hospital, 96% found the manual easy to read, and 96% would use this manual again.

Interpretation: Surgical disease burden is one of the most pressing public health problems globally and there is an important opportunity to improve care for the 5 billion people internationally who could benefit from such improvements. El Manual Para el Pueblo is one such tool. These data suggest that this curriculum can be an effective educational tool for improving on-the-ground understanding of the triage of surgical and medical disease, as well as techniques for best utilizing the manual. Finally, our study reinforces the need to invest in education for local personnel when implementing similar interventions to achieve maximum societal impact.

Source of funding (if none, enter "None"): Operation Smile

### CS31.001

Implementing edible insect programs in developing countries to improve food security

E. Frank, G. Wimer; MealFlour, Quetzaltenango/GT

Background: In 2013, the UN Food and Agriculture Organization released a report explaining the potential of nutrient-dense and environmentally friendly edible insects to help reduce malnutrition and feed the growing population. Since the report released, very few programs have emerged to test this theory. The MealFlour program started in Guatemala in July 2016 with the goal of increasing access to protein, reducing malnutrition, and improving food security. MealFlour partners with local organizations to teach people how to make in-home mealworm farms and how to process mealworms into a protein-rich powder. Mealworm powder is easily incorporated into existing recipes, and can be sold as a source of income. In 2018, MealFlour started a train-the-trainer program with bilingual (Spanish and Mayan languages) instructors to reach indigenous populations. Methods: MealFlour partners with local organizations with existing outreach programs in food insecure communities. The partners identify community leaders, health workers, or teachers who are interested in



participating in a train-the-trainer program. Trainers participate in a 6 month program consisting of 5 classes, weekly home visits, and monthly focus groups. The train-the-trainer model expands the program and creates a community of mealworm farmers. MealFlour's local partners help conduct long-term monitoring and evaluation of the program. The program measures farm success and the improvements in health, income, and diet. Findings: MealFlour has worked with 5 partner organizations, introduced mealworm farming to 272 people, and helped 21 families set up farms. Because of the climate in the western highlands, the first program yielded no output of mealworms for several months until solutions to improve the farms were discovered by the participants and shared during structured focus groups. 100% of participants retained farming knowledge from the classes. Evaluation of farm outputs and effects on nutrition is ongoing.

Interpretation: The primary ongoing challenge in the MealFlour program is optimizing the farm output in the varying Guatemalan climates using low cost materials. Future edible insect programs should set up test farms with local partners to adapt the process to varying climates, do acceptability studies, and involve participants in the optimization of the farming process. Future studies should analyze the risk of relying on only one insect species.

Source of funding (if none, enter "None"): The Resolution Project, HealthRoots Foundation, UChicago

### CS31.002

#### Reversing the Current Lead Testing Paradigm Through Citizen Science: Development of Scaleable, Low-Cost Home Lead Test Kit

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Background: There is no safe level of lead in children's bodies. Currently, the Centers for Disease Control (CDC) estimates that more than 500,000 children under the age of six are being impacted by low level lead exposure in the United States. Low levels of lead can cause irreversible neurological damage in children. Currently, the optimal way to test for lead exposure is to test blood lead levels in children. The current strategy for identifying lead hazards is not only retroactive, but also ineffective if children are not being tested. The aim of this study was to design a proactive screening device in which citizens will be given the ability to test their homes for lead.

Methods: The study was a blinded case-control study in Saint Joseph County, Indiana. Participants were divided into three groups (Pre-1950, 1951-1978, and post-1979). The post-1979 homes were considered the control group due to lead paint being outlawed in 1978. Participants were residents of the county and were recruited through community partnerships, a community lead testing event, and flyers. Participants utilized the home lead test kit in the home and the study team measured lead levels on-site and lead levels of samples collected by the participant. On-site lead levels were correlated with sample lead levels from the lead test kit. Informed consent was obtained and this study was approved by the University of Notre Dame IRB.

Findings: Forty-five homes were recruited, 17 homes were pre-1950, 11 homes were 1951-1978 and 17 homes were post 1979. Of the 17 pre-1950 homes 100% had at least one elevated lead results, of the 11 1951-1978 homes 45% had one elevated lead results, and of the 17 post 1978 homes 0% had one elevated lead results. After removing outliers the  $r^2$  value of on-site results correlated to kit sample results was 0.924.

Interpretation: This study lays the foundation for the creation of a home lead test kit model that can be implemented in a variety of settings. While this model will not provide the participant with a in-depth lead risk assessment, it has the potential to be a screening tool to proactively screen homes for environmental lead hazards.

Source of funding (if none, enter "None"): Local Private Donor

### CS31.003

#### Magnitude and associated factors of postpartum morbidity in public health institutions of Debre Markos town, North West Ethiopia, 2016.

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Background: Postpartum maternal morbidity is maternal illness that occurs after one hour of expulsion of placenta up to six weeks of childbirth. Though the true burden of this problem is not well known estimates of WHO, UNICEF and UNFPA showed that 1.4 million women experience acute obstetric morbidity annually.

Knowledge of magnitude and predicting factors postpartum morbidity is central to understand the extent of the problem and will help us a cornerstone in designing and implementing better preventive strategies.

Methods: Institutional based cross sectional study was conducted in DebreMarkos town public health institutions by reviewing delivery charts, delivery records and reporting log books. Total deliveries in each health institution in the previous year were identified and number of records to be included from each institution was determined by probability proportion to size. Systematic sampling technique was employed to select 308 charts for review. Data was collected by trained midwives using structured checklist; entered by Epi info and analyzed using SPSS 20. To present findings descriptive statistics using frequencies, charts and figures were used accordingly. Finally binary and multiple logistic regressions were performed to identify predicting factors.

Findings: The magnitude of postpartum morbidity was found to be 101(32.8%). Divorced/widowed women [AOR = 10.920, 95% CI: (2.168, 54.998)], women who didn't have ANC follow up [AOR = 3.710, 95% CI: (1.749, 7.870)], abnormal labor [AOR =3.496, 95% CI: (1.69, 7.22)], women delivered by doctor [AOR =0.111, 95% CI: (0.027, 0.454)] and women who were not attended postpartum visit [AOR =0.088, 95% CI: (0.040, 0.194)] were the factors associated with postpartum maternal morbidity.

Interpretation: Maternal morbidity in DebreMarkos health institutions was found to be major maternal health issue. Being divorced/widowed, absence of ANC visit, intrapartum abnormalities, delivery attended by skilled professionals and no post-partum visit were important predictors of maternal postpartum morbidity.

Source of funding (if none, enter "None"): Debre Markos University

#### CS31.004

##### Investigating Attitudes Towards Highly Pathogenic Avian Influenza (HPAI) and Biosecurity Mitigation Practices in Rural Vietnam

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Background: Highly pathogenic avian influenza (HPAI) resulted in the culling of 45 million birds at the peak of its 2004-2006 outbreak, and has jeopardized sustainable agricultural production in South East Asia. HPAI is highly virulent, and small-scale farms present a high-risk environment for zoonotic disease transmission between animals and humans. The purpose of this study was to investigate how attitudes towards HPAI influence biosecurity mitigation behaviors such as water source management and sanitation on small-scale farms in Vietnam.

Methods: We used a participatory approach that included representation from farmers, government, academia, and industry. Cross-sectional data representing demographics, farm level production, and attitudes and preferences with respect to HPAI and mitigation strategies were collected in North and South Vietnam (Thai Binh and An Giang Provinces respectively). A stratified randomized selection of 600 small scale mixed livestock, crop, and fish farmers were interviewed using questionnaires and in-person interviews. Participant numbers were calculated using standard epidemiologic sample size formulae (Dohoo, 2003) using alpha = 0.05. All participants provided verbal informed consent approved by Canadian and Vietnamese ethics boards. Probit regression analysis was used to examine the relationship between factors influencing HPAI attitudes and behaviors. Further correlation analysis is under investigation, including Pearson correlation and principal component analysis.

Findings: Preliminary results show that half the farmers (51%) did not treat their water according to FAO guidelines, and fewer than 7% said they would report a suspected HPAI case due to cost and inconvenience. However, those farmers who expressed concern about HPAI were more likely to practice mitigation behaviors (P<0.05).

Interpretation: These preliminary analyses indicate that biosecurity guidelines may not be consistent with management styles of small-scale farms in Vietnam, but also indicate cause for concern for controlling HPAI on such farms. These results should be of interest to public health and policy authorities addressing HPAI mitigation. Our results may not be generalizable to all small-scale farmers in Vietnam, as water sources and farming strategies vary across communes.

Source of funding (if none, enter "None"): Funding is acknowledged from Grand Challenges Canada (Grant Number 0231-01 Stars in Global Health Round 4) and IDRC, Ottawa.

#### CS31.005

##### Scaling Up a One Health Model In Uganda and The Democratic Republic of Congo: The Conservation Through Public Health Experience

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Background: Critically endangered mountain gorillas are threatened by habitat destruction, wildlife poaching and disease, exacerbated by high levels of poverty and high human population growth rates in and around Bwindi Impenetrable National Park in Uganda. In 2003, Conservation Through Public Health (CTPH) was founded when fatal scabies skin disease outbreaks in Bwindi gorillas was traced to local communities with inadequate access to basic health services. In 2007, CTPH implemented volunteer-community based family planning and later trained Village Health and Conservation Teams (VHCTs). VHCTs under the one health approach, promoted family planning, health and conservation. This approach resulted in 3-fold increase in family planning users, reduced gorilla disease incidences, greater community support for conservation, and women become more involved in conservation and men become more involved in family planning.

Methods: In 2015, with an award from Global Development Network Japanese Social Development Fund, CTPH expanded the model of VHCTs sustained by Village Savings and Loan Associations (VSLAs) to another protected area with gorillas, at Mikeno and Mount Tshiabirumu sectors of Virunga National Park in Democratic Republic of Congo, and to a non-gorilla protected area, in Bukwo, Kween and Bulambuli Districts of Mount Elgon National Park in Uganda. Both areas have high poverty levels and human population densities. CTPH staff monitored the project and VHCTs collected data at household level.

Findings: Within two years, 81,000 people from 13,000 households in 139 villages in 5 districts were reached by 163 VHCTs. Ten financially stable VHCT and VSLA networks with group livestock income generating projects were established. The number of households with better water sanitation and hygiene increased as well as referrals of suspect patients with malnutrition, Tuberculosis, HIV/AIDS, scabies and diarrhoea. Tree planting at Mount Elgon increased. Free contraceptive provision, by Ministry of Health in Uganda, significantly enabled the number of new family planning users; Mount Elgon with 3,829 and Virungas with only 285.

Interpretation: CTPH's One Health approach has promoted population, health and environment in Uganda and the Democratic Republic of Congo. Scaling up requires more resources and dedicated organizational, governmental, professional and community collaborations.

Source of funding (if none, enter "None"): Global Development Network Japanese Social Development Fund

#### CS33.001

Reporting of surgical response to disasters in low- and middle-income countries: a review of the literature

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Background: Disasters commonly exceed the capacity of surgical systems in low- and middle-income countries (LMICs). Most literature regarding peri-disaster surgical care focuses on international relief efforts rather than on how disasters stress local surgical capacity. Furthermore, our understanding of factors affecting the ability of health systems to absorb increased volume and case-complexity is limited. We conducted a structured literature review to identify if components of capacity were reported as part of surge response in local surgical care after disasters.

Methods: We queried PubMed and Medline databases for articles published since 2008 using English language search terms for LMICs, surgery, and disasters. A total of 7704 articles were identified. After applying exclusion criteria, which included foreign aid response, 84 articles were selected for analysis. We extracted the WHO region, disaster classification, and the components of surge capacity using the 4S framework: Staff (human resources), Stuff (equipment/supplies), Space (infrastructure), and Systems (logistics). The 4S components were further classified by data quality into the following categories: quantitative description, qualitative description, or no description.

Findings: The data were heavily weighted, with 59/84 (70%) articles describing earthquakes and 40/84 (48%) describing events in the Western Pacific. Using the 4S framework, we identified articles that reported quantitative data: 16 (19%) for Staff, 3 (4%) for Stuff, 21 (25%) for Space, and 9 (11%) for Systems. Despite a low threshold for quantitative categorization, only 1/84 (1%) articles describe all four components with quantitative data. In comparison, 51/84 (61%) articles provide no quantitative data on any of the four components.

Interpretation: There is no organized framework for evaluating surgical surge capacity in disasters. Our analysis shows that this has resulted in minimal descriptions of capacity within disaster literature and a limited understanding of LMIC health system response to surges in surgical volume. Without a structured framework to collect data on health system response, we miss opportunities to identify and strengthen areas of insufficient capacity. We propose the 4S framework as a conceptual model for understanding the surgical system response to disasters.

Source of funding (if none, enter "None"): None

CS33.002

The Macroeconomic Burden of Firearm Mortality among Organization for Economic Co-operation and Development (OECD) Countries

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Background: In 2015, firearm related unintentional injuries, physical violence, and self-harm caused over 36,000 deaths and 100,000 total injuries in the United States, and over 250,000 deaths worldwide. Among these, more than 64,000 occurred in Organization for Economic Co-operation and Development (OECD) countries.

Nonetheless, firearm injury risk reduction remains socially and politically controversial. While the costs of treating firearm injuries has been estimated, little is known about the macroeconomic impact of firearm deaths. Methods: Using the Value of Lost Output approach, which estimates the macroeconomic burden of deaths due to lost economic productivity, we estimated the annual and cumulative GDP losses due to firearm mortality from 2015-2030 in all 36 OECD countries.

Findings: Across OECD countries, macroeconomic losses from firearm mortality were estimated to be \$578.3 billion in lost economic output from 2015-2030, with \$17.4 billion in annual losses in 2015 growing to \$57.1 billion lost annually in 2030 (\$27.8 billion from physical violence, 27.1 billion from self-harm, and \$2.3 billion from unintentional injury). This represents 0.085% of total estimated 2030 GDP, or \$1 lost for every \$1172 of potential economic output.

The USA is estimated to lose the most of any OECD nation, with annual GDP losses of \$40.1 billion by 2030, representing 0.17% of USA GDP in 2030, and \$407.2 billion cumulative losses from 2015-2030. Mexico is estimated to lose \$9.7 billion annually by 2030, representing 0.33% of Mexican GDP in 2030 including \$91.3 billion from firearm related fatalities in Mexico. No other OECD country had cumulative losses greater than \$16.8 billion from 2015-2030, or greater than 0.07% of GDP in 2030. When considered as a proportion of 2030 GDP, USA losses were 103% higher and Mexico losses were 292% higher than across all OECD countries.

Interpretation: Firearm related deaths are expected to cause disproportionately high macroeconomic losses in the USA and Mexico between 2015-2030. These losses represent a significant proportion of GDP, and should be considered in broader social, economic, and health policy decisions surrounding firearm regulation. Future studies might consider cost-benefit analyses that weigh the costs of risk reduction interventions against the potential economic savings of reducing firearm mortality.

Source of funding (if none, enter "None"): none

CS33.003

Assessment of Staffing Need through Workload Analysis in Two Selected Districts (Jhenaidah and Moulvibazar) in Bangladesh

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Background: Improving the performance of health workers is vital to improve healthcare service delivery. Workload management is important to improve the performance. This study aimed to assess the current workload and staffing need for delivering optimum health care services at the public-sector district health system in Bangladesh.

Methods: Implemented during July-November, 2017, this study followed the steps of WHO's Workload Indicator of Staffing Need (WISN) methodology. Combining qualitative (document reviews, key informant interviews, in-depth interviews, observations) and quantitative methods (time-motion survey), this study was conducted in 24 health facilities from District Hospitals up to Community Clinics in Jhenaidah and Moulvibazar in Bangladesh. The study covered cadres of Physicians, Nurses, Medical Assistants, Family Welfare Visitors, Community Care Providers, and Family Welfare Assistants. Workload components were defined based on inputs from experts (n=5), refined further by actual service providers (n=87). Using WHO WISN software, standard workload, category allowance factor, individual allowance factor, total required number of staff, WISN Difference, and WISN Ratio were calculated.

Findings: Seven out of the 20 staff categories are found having a Very High workload (WISN Ratio 0.30-0.49), followed by five staff categories with Extremely High (0.10-0.29)— indicating an overall high workload among the service providers studied. The highest workload is observed among the Medicine Consultants (WISN Ratio 0.16), followed by other Specialists.

Highest number of health workforce in the selected health facilities is required for Nurses at District Hospitals (136 Nurses on an average), followed by General Physicians (35 on average). Nurses are found to be

predominantly occupied with support activities (60% in case of District Nurses and 50% in Sub-District), instead of actual nursing care.

If the vacant posts are filled, understandably, the workload is reduced. However, only filling up the vacant posts are not enough in case of some of the staff categories, such as the Consultants, General Physicians and District Nurses.

Interpretation: WISN method of estimating workload and staff requirements can aid the policymakers in optimizing utilization of existing human resources. Thus, WISN should be incorporated as a planning tool for managers at the District level. Implementation research should be carried out on how the workload-based staffing decisions can be effectively integrated into the health systems.

Source of funding (if none, enter "None"): WHO Bangladesh.

#### CS33.004

##### Targeting Millennials: Bringing Health Professionals to Shortage Areas

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Background: Millennials, defined as those born between 1981 and 1996, have begun to enter the physician workforce, and now comprise 15% of all active physicians. A better understanding of their aspirations and consideration of the unique education and skillset of millennials may lead to more effective recruitment and retention.

Methods: We assessed the availability of "cross-training" (defined as obtaining multiple degrees and/or complete combined medical residency training) for millennial physicians at the undergraduate, medical and graduate medical education levels. Then we compared the availability of jobs in the medical marketplace that advertised for cross-trained physicians.

Findings: U.S. undergraduates had a 70% increase in college double majors between 2001 and 2011 and double majors are increasing among matriculated medical students. The number of medical schools offering a Master of Business Administration (63), has doubled since 2006. At some institutions, as many as one-third of students earn an additional degree along with their MD.

No residency programs, outside of those in preventive medicine, provided trainees with formal opportunities to obtain an MBA or MPH prior to 2001. In 2018, 45 residency programs have a pathway for residents to pursue an MBA, MPH or PhD during residency. Over the past 20 years the rate of increase in total number of combined residency programs (49%, from 128 to 191) is triple that of corresponding categorical programs (16%, from 1350 to 1562). Between 1996 and 2016, 17 new specialty combinations became available for residency training. Medical jobs tailored to cross-trained physicians have not kept pace with the numbers of such specialists currently in medical school and residency training. Data show few advertised jobs that specifically require skills demonstrated by combined degrees or combined residency training.

Interpretation: Millennial physicians are choosing to "cross-train" throughout undergraduate, medical, and graduate medical education, and that the current physician marketplace does not match the skills of this population. A mismatch between provider skills and available jobs is costly for both employers and workers, and such a mismatch can adversely affect health systems. Health care organizations should capitalize on this trend toward more cross-trained personnel in order to effectively recruit and retain the next generation of physicians.

Source of funding (if none, enter "None"): None

#### CS33.005

##### Using Innovative Technology to Strengthen the Obstetric Referral System in the Greater Accra Region of Ghana

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Background: Ghana's Country Action Plan identified weak obstetric referral systems as a major barrier to achieving the Millennium Development Goals for maternal mortality. High-risk referrals are often delayed, leading to severe compromise or death during transport or soon after arrival to tertiary hospitals. Essential components for an effective obstetric referral system include: an adequately resourced referral center; active collaboration across sectors; formalized communication and transport arrangements; supervision and accountability of performance; the capacity to monitor effectiveness; and policy support.

Methods: This innovative pilot program developed strategies to promote the uptake of best referral practices. A cluster of 13 institutions was selected to host the implementation of interventions including: the establishment of an early warning system for major obstetric complications, the development of pre-referral treatment guidelines, and the application of WhatsApp mobile technology to facilitate remote communication. Participants included

staff from 8 health centers, 4 district hospitals, the Greater Accra Regional Hospital and doctors, administrators, and representatives from other tertiary hospitals in Accra and medical consultants abroad.

Findings: The Kybele WhatsApp mobile technology platform launched March 1, 2017 with encouraging results. Over 1500 cases have been posted among providers; an average of 100/month. Platform users have grown from 69 to 110 participants including the national ambulance service. A six month analysis (March-August 2017) found the highest frequency response times were 3-7 minutes and 83% of cases had a receiving hospital identified. Leading referral indications were: pre-eclampsia (23%), obstructed labor (15%), preterm labor (15%), fetal compromise (9%) and hemorrhage (6%). In 50% of cases, treatment instructions were provided over the platform to stabilize the patient prior to transfer. The platform provided useful feedback on patient outcomes, announced system failures (such as oxygen outages and anesthesia machine malfunctions) and discussed near-misses as learning opportunities.

Interpretation: Uptake on the Kybele WhatsApp platform has been rapid and sustained. Care providers and administrators recognize its potential to improve obstetric referral processes and to reduce delay. The platform has highlighted improvements in care at the district and sub-district hospitals, including better management and stabilization prior to patient transfer. Learnings from this pilot program could apply to other low resource obstetric referral networks.

Source of funding (if none, enter "None"): USAID Systems for Health, Kybele, Ghana Health Service

CS33.006

Prospective Study to Explore Changes in Quality of Care and Perinatal Outcomes after implementation of Perinatal Death Audit in Uganda

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Background: Annually an estimated 2,7 million neonatal deaths and still births occur world wide. The neonatal mortality in Uganda of 27 deaths per 1000 has not changed over the last 10 years. The increase in institutional deliveries to 74% has not translated into improved neonatal outcomes. Sub optimal care still occurs in hospitals increasing maternal and neonatal morbidity. Perinatal death audit significantly reduces the perinatal mortality. However there is paucity of data on the impact of audit on perinatal outcomes in Uganda. This paper describes perinatal outcomes that were observed after introduction of perinatal death audit in a tertiary Hospital in Kampala Uganda.

Methods: Prospective review of deaths ( 2008- 2015) was done . Cause of death was identified through Consensus. Standard of care was assessed against existing guidelines. Interventions implemented gradually addressing the Gaps in care identified . Outcomes for preceding years (2006-2007) were analyzed for comparison .

Findings: Perinatal mortality rate decreased(48.4 to 43/1000 births),stillbirth rate (32.9 to 22/1000births). The proportion of neonatal deaths reduced from 11.2% to 4.9%. Major cause of death was : Hypoxia (35.4%), unknown(43.2%). Interventions done included: neonatal resuscitation training, building a new maternity theatre, training on use of partograph, increasing human resource for maternity and the newborn care unit, provision of equipment: Ambubags, Bubble Continuous Positive Air way Pressure ( CPAP) machines, Radiant warmers, Skills introduced: Kangaroo mother care, use of antenatal steroid, use of CPAP surfactant and phototherapy.

Case fatality rates decreased for hypoxia ( 21.1% to 15.5%), complications of prematurity ( 26.4% to 11.1%), increased for infections (1.9%to 5.7%)

Interpretation: It is feasible to conduct perinatal death audits in Uganda and they improve perinatal outcomes  
Source of funding (if none, enter "None"): None However data analysis was funded by Liver pool school tropical medicine - Department of maternal and newborn

CS34.001

An Innovative Ketamine Package for Sedation Supports a Human Rights Imperative in Acutely Painful Procedures

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**Background:** Adequate pain management for painful procedures improves the quality and safety of patient care and has become an accepted basic human right. In low-resource settings, pain relief for painful procedures is scarce due to "cultural, attitudinal, educational, legal and system-related reasons". A practice of 'hold still', where patients are forcibly held down, remains common in Kenya and elsewhere. In December 2013, we deployed an innovative Every Second Matters-Ketamine (ESM-Ketamine) package in Kenya, in support of emergency surgery when no anesthetist is available. The study objective was to describe how ESM-Ketamine providers independently broadened use of their skills to provide procedural sedation for patients in need of painful procedures when an anesthetist would not have been previously called.

**Methods:** A 5-day ESM-Ketamine competency based training program for non-anesthetist providers was administered to medical officers, nurses, and clinical officers in Kenya. Each facility active with ESM-Ketamine was provided with wall charts, checklists, and kits. Patient demographics, pre-operative diagnoses, procedure(s) performed, medications administered, and ketamine-related adverse events were recorded and analyzed. Ethical approval was obtained from Partners Healthcare and Maseno University.

**Findings:** Between December 2013 and July 2018, 62 ESM-Ketamine providers across 11 facilities supported 512 painful procedures in non-training settings, where an anesthetist would previously not have been called. 273 (53.3%) were male and median age was 23 years (IQR 11-36 years). The five most common indications were incision and drainage and/or debridement (n=159, 31.1%), fracture reduction (n=56, 10.9%), circumcision (n=41, 8.0%), wound repair (n=29, 5.7%), and foreign body removal (n=26, 5.1%). The median ketamine dose was 2.0 mg/kg (IQR 2.0-3.0). Hallucinations or agitation treated with diazepam, and brief oxygen desaturation occurred in 45 (8.8%) and 22 (4.3%) cases, respectively. Prolonged (>30 secs) desaturations below 92% occurred in 2 (0.4%) cases. The lowest desaturation was 85%. All patients recovered uneventfully. There were no deaths or injuries associated with ketamine use.

**Interpretation:** The ESM-Ketamine package appears safe for use by trained providers in support of procedural sedation when previously an anesthetist would not have been called. Scale of the ESM-Ketamine package may support the human rights imperative that every person deserves pain relief when undergoing a painful procedure.

Source of funding (if none, enter "None"): Saving Lives @ Birth Partners, R2HC/Elrha

CS34.002

Implementation of a two-step screening procedure for depression in humanitarian crises

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**Background:** Despite the urgency of mental health surveillance and treatment in humanitarian emergencies, there is a lack of evaluations of instruments that minimize the response burden. The aim of this study was to evaluate a two-step screening process for the detection of major depressive disorder (MDD) to improve the efficiency of screen-confirm procedures using the two- and eight-item Patient Health Questionnaires (PHQ-2 and PHQ-8, respectively) among 135 Syrian refugees.

**Methods:** Acceptability was assessed through instrument completion. The correlation between the PHQ-2 classification and the summed score of the remaining six items of the PHQ-8 was assessed with logistic regression. MDD screening via a two-step process was simulated using empirical data. This two-step process replicates the diagnoses captured if the PHQ-2 was used to narrow the population receiving the full PHQ-8 assessment. First, all respondents are screened using the PHQ-2. Next, only respondents who score above a threshold are considered at risk for depression and complete the remaining six items. The sensitivity and specificity of this two-stage screening process was evaluated. The deviance information criterion (DIC) was used to compare the logistic regression fit of the PHQ-2 to the saturated model for the prediction of MDD classification.

**Findings:** The PHQ-2 and PHQ-8 instruments were completed by 91% and 87% of respondents, respectively (p=0.014). The scores of the PHQ-2 and remaining six items of the PHQ-8 were significantly correlated (p<0.001). With a PHQ-2 cut-off score of ≥2, the two-step screening process has a sensitivity of 90% using the PHQ-8 classification as the reference standard and a specificity of 100%, meaning there were no false negative classifications. The two-step screening process eliminated the completion of the full PHQ-8 instrument for 34

respondents (25% of respondents). The PHQ-2 model did not lack a predictor explaining a significant proportion of the variation (DIC:  $p=0.395$ ).

Interpretation: The two-step screening process detected 90% of individuals with symptoms consistent with MDD. Concurrent validity of the PHQ-2 and PHQ-8 was demonstrated. Our results suggest that this two-step screening approach is a useful strategy to streamline MDD surveillance in humanitarian contexts with a scarcity of mental health specialists while simultaneously reducing the response burden.

Source of funding (if none, enter "None"): None

CS34.003

Redefining National Security Using the Case of Antimicrobial Resistance (AMR)

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Background: More than two decades after the UN's introduction of the human security concept national security has hardly changed from its conventional military notion. Consequently, issues like global health security threats receive less-than-deserved attention from governments and researchers. As a major problem, human security is an intellectually loose concept lacking clear interrelationships among its components. This study assesses some of the leading definitions of security to determine what makes AMR a security issue. AMR and health security are presented as starting points for a coherent human security framework and security analysis in general.

Methods: A review of the online and print security literature was carried out. AMR securitization cases from the WHO, the US, the EU, Russia, India, South Africa and Ethiopia were analysed to determine securitization level. The entities/countries were selected based on different criteria relevant for the analysis.

Findings: 1. Security is about the protection of core values.

2. A security issue has cascading multisectoral consequences.

3. Security is not always about emergencies.

4. To traditional security scholars, security is about war and conflicts, external and state-centric.

5. The human security concept places the individual in focus. It has seven components: health, economic, political, community, environmental, personal and food security.

6. AMR is a human security issue with multisectoral effects.

Interpretation: 1. Traditionalists' view of security is parochial and unrealistic.

2. Per the human security concept, security situations can arise internally. The idea is however too broad and vague.

3. A prioritization of the human security components as suggested by Paris (2001) can help overcome the weakness of intellectual incoherence. This prioritization can begin with the health sector.

4. AMR has short and long-term multisectoral ramifications, hence qualifies as a national security matter.

5. Health security cases like AMR hold the key to a coherent security framework. This is because clear interrelationships can be drawn to all other security forms.

Strengths: The application of security definitions to the cases was comprehensive, with country selections made on several factors that influence security practice at different levels of analysis.

Limitations: Policy documents of some countries were not available in English. Translation of texts may not have captured the real motives behind AMR securitization.

Source of funding (if none, enter "None"): None

CS34.004

Experiences of Gender-Based Violence in Women Asylum Seekers from the Northern Triangle

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Background: Every year, thousands of women flee gender-based violence (GBV) in the Northern Triangle (NCTA) countries of El Salvador, Honduras, and Guatemala, and attempt to seek asylum in the United States.

Some participate in medical evaluation by clinicians to document the impact of these human rights violations.

The aim of this study is to elucidate the forms of persecution women in this region are experiencing, and the physical and psychological sequelae of this violence.

Methods: We undertook a retrospective, qualitative study of asylum-seeking adult women fleeing GBV from the NCTA who were seen by evaluators in the Mount Sinai Human Rights Program (MSHRP). This study was approved by the Mount Sinai Institutional Review Board. A total of 57 cases were eligible for inclusion. The participants ranged in age from 18 to 42 years ( $M = 29$ ;  $SD = 5.88$ ) and identified as Salvadoran ( $n = 20$ ), Guatemalan ( $n = 11$ ), and Honduran ( $n = 26$ ). We used a modified consensual qualitative research (CQR-M) approach to identify themes found across the archival and de-identified evaluations.



Findings: The women reported violence perpetrated by their communities, families, intimate partners, and powerful gangs, and faced a justice system in their countries that they felt would not protect them. They survived verbal, physical, and sexual assaults, threatened death, control, extortion, and harm to their children. This led to psychological symptoms associated with anxiety, depression, and PTSD; as well as suicidality. They endured physical injury including bruising, head injury and loss of consciousness, and gynecological harm including miscarriage and forced sterilization. They reported internal displacement before fleeing and stated that they traveled with their children, experienced hazardous conditions and violence during their journey, and were detained once in the U.S. Finally, they reported resilience associated with their religious beliefs, family, temperament, and ability to make meaning from their experiences.

Interpretation: This study highlights the systemic nature of gender based violence in the NTCA. The results also articulate the perils these women encountered during their migration and sheds light on the continued structural violence that awaits them if they are denied asylum and returned to their countries of origin.

Source of funding (if none, enter "None"): None

CS34.005

"Hear My Pain, I Am A Human Too": Violence Against Women and Girls with Disabilities During and Post 2015 Nepal Earthquake.

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Background: Disasters affect people with disabilities disproportionately. Violence against women and girls, including sexual and psychological, have been reported to increase during and after natural disasters. Despite getting worldwide attention for devastation 2015 Nepal earthquake caused, the impact of elevated risk of violence against women and girls with disabilities and their experiences during the crisis and recovery phases remain under researched. This study aims to explore disabled women and girls' experiences of violence immediately after the earthquake and during post-earthquake recovery period. Our overall aim is to provide evidence and highlight issues that, when addressed, will promote gender and disability sensitive and inclusive policies and programs to shape emergency and humanitarian assistance during and post disaster.

Methods: This paper is informed by thematic analysis of the qualitative data collected through semi-structured interviews and focus group discussions with 40 women and girls with disabilities from some of the hardest earthquake hit districts in Nepal between May 2015 to February 2018.

Findings: The social stigma against gender in Nepal and further stigma against disability led to double risk of violence. Results show that women and girls with disabilities experienced increased psychological, physical and sexual violence immediately after the earthquake mostly in and around temporary shelters. Physical and psychological violence were reported to be committed by partners, family members and sometimes by the members of the society; whereas sexual violence against girls with disabilities were reported to be committed by close family members or opportunist stranger. Higher level of violence was reported against girls and women of female lead households where main male member of the family was absence. Our findings highlight that being female with disability, having limited rights and independence and having limited access to financial resources lead to increased longer-term violence even during recovery and reconstruction phase.

Interpretation: Recommendations for gender and disability sensitivity training to all emergency responders to eliminate stigma against women and girls with disabilities. Government, national and international humanitarian agencies to work together with local-level organisations to strengthen gender and disability-inclusive preventative, reporting and justice mechanism.

Source of funding (if none, enter "None"): None

CS39.001

Operation Save the World from Adverse Drug Reactions

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**Background:** The attainment of satisfactory global health demands global drug safety because adverse drug reactions (ADR) are among the top ten causes of death and in some countries, account for up to 5% to 35% of mortality. "Operation Save the World from Adverse Drug Reactions" (ADR) is a drug safety surveillance program (DSSP) developed in 2005 by the Institute of Human Virology Nigeria (IHVN) to address Nigeria's crisis of under-reporting of ADR in the midst of millions of people using antiretroviral, anti-tuberculosis and anti-malaria drugs.

The DSSP runs in major public hospitals but managed by the National Pharmacovigilance Center (NPC) in collaboration with IHVN. The goal is ensuring public and global health, while the primary outcome is reporting ADR to the Uppsala Monitoring Centre (UMC), through the Nigerian National Agency for Food and Drug Administration and Control (NAFDAC). Pharmacovigilance training and publishing of papers are secondary outcomes.

**Methods:** The uniqueness of DSSP is combining six key activities: (a) Collaboration of government and private sector (b) Training of medical doctors, pharmacists and nurses (c) Establishing Pharmacovigilance centers in public hospitals (d) Developing platforms for submitting individual case safety reports (ICSR) (e) Publishing peer-review articles and (f) submitting ICSRs. To ensure sustainability, we collaborated with the Nigerian Government, research institutions and trained only government health care workers (HCW) randomly selected from a pool of applicants that applied to advertisements in three national newspapers. The setting was the six geopolitical regions, Nigeria.

**Findings:** Before the DSSP, only 16,500 ICSR were submitted to the NPC from 2004 to 2016. The number of qualified HCW for ADRs reporting was <300 and no training model was available. However, with the DSSP in place, over 5,000 ICSRs, with more than 40,000 individual drug reactions have been submitted, over 3,000 HCW trained, a training model (SPHARTI) developed and two articles published. Bilateral Gynaecomastia, violent psychiatric disorders and Stevens Johnsons Syndrome – serious ADRs, reported.

**Interpretation:** The DSSP increased the reporting of ADRs and the critical mass of qualified HCW, ultimately promoting global health. Its strength is in combining six key activities. Causality assessment of the reported ADRs and operating the DSSP at Primary Health Centers (PHC) are challenges.

**Source of funding (if none, enter "None"):** US PEPFAR

CS39.002

Can integrated clinical simulation trainings improve person-centered maternity care? Results from a pilot project in Ghana

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**Background:** Person-centered maternity care (PCMC) is maternity care that is responsive and respectful to women's needs and values. It is a key dimension of quality capturing the experience or interpersonal dimensions of care. Poor PCMC contributes to high maternal mortality directly, as well as indirectly through decreased demand for services. While there is growing recognition of the importance of PCMC to maternal and child health outcomes, few evidence-based interventions exist on how to improve it. We sought to evaluate the effect of an integrated simulation training on provision of PCMC.

**Methods:** The pilot project was in a rural district in Northern Ghana. To improve quality of care including PCMC, we integrated specific components of PCMC, emphasizing Dignity and Respect (DR), Communication and Autonomy (CA) and Supportive Care (SC), into a simulation training to improve identification and management of obstetric and neonatal emergencies. Forty-four providers in the district participated in two two-day trainings led by PRONTO international trainers. Six providers were then trained as simulation facilitators, who led four monthly refreshers at the five highest volume delivery facilities in the district. For evaluation, we conducted surveys at baseline (N=215) and endline (N=320) with recently delivered women to assess their experiences of care using the 30-item PCMC scale.

**Findings:** Compared to the baseline, women in the endline were more likely to report higher PCMC. The average PCMC score increased from 52% at baseline to 71% at endline, a change of 37%. Scores on the sub-scales also increased between baseline and endline: from 76 to 81 for DR, 31 to 58 for CA and 54 to 72 for SC. The greatest increase was in communication and autonomy which increased by 87%. These differences remain significant in multilevel multivariate analysis controlling for several potential confounders and accounting for clustering at the facility level.

**Interpretation:** The findings suggest that integrated provider trainings that give providers the opportunity to learn, practice, and reflect on their provision of PCMC has the potential to improve PCMC in developing settings. Incorporating such trainings into pre-service and in-service training of providers will help advance global efforts to promote PCMC.

Source of funding (if none, enter "None"): USAID Systems for Health

CS39.003

Ebola Survivor Corps: Employing Ebola Survivors as Health Educators and Advocates in Ebola Affected Communities in Northern Sierra Leone

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Background: The 2014-2016 West African Ebola outbreak resulted in 28,652 cases and over 11,000 deaths. The survivors were faced with persistent health sequelae, stigma and loss of livelihood. Additionally, the outbreak shattered an already weak healthcare system. The need to address Ebola survivor concerns and strengthen the capacity of the health sector in affected countries became clear. Ebola Survivor Corps (ESC), founded in 2015, addresses these issues in Koinadugu District, Sierra Leone. Koinadugu is particularly difficult to reach resulting in poor access to health care and low health literacy. ESC employs Ebola survivors as Survivor Health Advocates (SHAs) to provide health education, facilitate access to healthcare and elevate their status by becoming trusted sources of health information. In 2018 the SHAs reached over 80 communities, with 23,295 individual contacts, educating on locally relevant infectious and chronic disease topics.

Methods: ESCs goals are to 1.) improve outbreak readiness through health literacy and passive disease surveillance, 2.) facilitate access to healthcare and 3.) reduce stigma through elevating Ebola survivor status. Koinadugu was selected as the initial program site due to the demonstrated need determined by interviews with local stakeholders. The program integrates ESC SHAs with Koinadugus district level health programs and priorities to offer services in an underserved locality.

Findings: A program evaluation and needs assessment were conducted in Summer 2018 to identify strengths and challenges and inform future directions of ESC. We found that ESC provides a needed service that the government is not able to supply for logistical reasons. The SHAs are enthusiastic health educators and provide a richness of information through one-on-one meetings with community members. Additionally, SHAs are viewed as respected sources of health information in their communities and report reduced stigma.

Interpretation: ESCs work remains relevant due to gaps in services from the closure of Koinadugu Ebola survivor programs. Communication and transport remain challenging in this remote area. Initial program goals have been met, however, the assessment revealed additional directions identified by the Ebola survivor community. This includes the development of Health Clubs to deepen knowledge of community determined health topics and Community Initiative Grants to improve livelihood security.

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CS39.004

Antibiotics in a Haitian NICU: The Right Dose at the Right Time

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Background: In the critical care setting, delay in the administration of antibiotics has been associated with as much as a three-fold rise in mortality. Working in a NICU in rural Haiti we attempted to reduce the time between patient admission and the administration of the first dose of antibiotics and to reduce the frequency of dosing errors by implementing a Plan-Do-Study-Act (PDSA) cycle-based QI project.

Methods: The study took place at St Boniface Hospital (SBH), a 130 bed hospital serving 2.3 million people in rural Haiti. A retrospective chart review was performed on every patient admitted to the 24 bed NICU over a 2-week period. Baseline data was recorded by noting the time of patient admission and the time of administration of the first doses of antibiotics. In addition, the dosage of each antibiotic was checked for accuracy. Two subsequent 2-week data collections were performed over 6 months interspersed with PDSA cycles. These cycles included improving staff awareness about the risks of delaying treatment and of incorrect dosing, identifying barriers to care, introducing nurse-initiated standing orders, data review and dissemination of results to the staff. This study was approved by the SBH Research Ethics Committee.

Findings: The baseline data collection period included 26 patients; period 2, 33 patients; period 3, 28 patients. At baseline, the mean delay in antibiotic administration was 6.2hrs CI<sub>95%</sub> [4, 8.4]. In weeks 2 and 3 the mean delays were 0.6hr CI<sub>95%</sub> [.35, .85] and 0.4hr CI<sub>95%</sub> [.16, .64] respectively. At baseline, dosing errors were noted in 60% of ampicillin orders and 18% of gentamicin orders. In weeks 2 and 3 there were no errors. In the baseline period 7.6% of patients received the first dose of antibiotic within 1 hour and in periods 2 and 3, 91% and 86%, respectively, did so.

Interpretation: In a low resource setting delays in administration of antibiotics to newborns admitted to the NICU and dosing errors can be successfully reduced using a PDSA-based QI project. This approach does not require expensive interventions or new technology and has the potential to reduce neonatal morbidity and mortality.  
Source of funding (if none, enter "None"): None

#### CS39.005

##### Creation of a Global Emergency Research Network by Leveraging the Global Reach Infrastructure

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Background: The epidemiology of emergency care globally is largely unknown, especially in the developing countries, because of a lack of common taxonomy, absence of robust reporting mechanisms and that emergency medicine (EM) is variably recognized as a subspecialty. Disease/specialty specific research networks have addressed similar problems which has improved health of populations. The University of Michigan's Department of EM is developing an international emergency department (ED) research network to study the epidemiology of emergency visits in developed and developing countries. Our objective is to describe the first steps taken in creation of an international ED research network, lessons learned and the proposal of a feasibility pilot study to determine epidemiology of ED visits across 8 participating international EDs. Methods: We contacted sites that have academic EDs and have an existing collaboration with the university (Global Reach partners) which include China, India, Ghana, Brazil, Taiwan, U.S.A. We determined site capabilities by conducting a survey for research related resources and access of ED visits. Finally, we proposed a feasibility study to determine interest as well as ability to participate.

Findings: We noticed substantial variation in the ED triage process, access to consultants, definitions of levels of severity of illness, management of resuscitation and disposition to intensive and inpatient units by individual conditions across the participating EDs. We developed a manual of operations, standard taxonomy, and are working on IRB approval and data transfer agreements. We will be enrolling patients in prospective and retrospective manner with a sparse simultaneous sampling design over a period of 6 months. The data collected will have ongoing data quality check to confirm validity and reliability.

Despite some substantial barriers, it is possible to develop an infrastructure to study emergency care at a global level. The sustainability plan is to create a robust network that nurtures future investigators, identifies funding sources and works on collaborative research.

Interpretation: We anticipate challenges in collecting baseline epidemiology of ED presentations thus we designed two pathways to collect data: (1) retrospective Electronic Health Record query and (2) prospective data collection in real-time. We are planning an in-person meeting to establish standard processes for research priorities and resource allocation.

Source of funding (if none, enter "None"): None

#### CS39.006

##### Scaling-up the All Babies Count program to eliminate preventable neonatal deaths in Rwanda: experiences midway through implementation

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Background: Rwanda has made significant reductions in child mortality, however reductions in neonatal deaths have been slower. Despite near universal facility-based delivery, about half of neonatal deaths occur within 48 hours of birth when they are in health facilities. All Babies Count (ABC) is an evidence-based 18-month change acceleration process that provides neonatal equipment/supplies, neonatal training/mentoring, and district-wide quarterly Learning Collaborative Sessions (LCS) to promote peer-to-peer learning and continuous quality improvement (QI) among inter-professional teams. The Rwanda Ministry of Health and Partners In Health are scaling-up ABC to facilities in 7 hospital catchment areas (HCAs) from 2017-2019 to improve quality of care and reduce neonatal mortality. This study describes the first year of implementation.

Methods: An ABC QI Advisor supports implementation for each HCA through mentorship, training, and QI coaching. Four HCAs launched in June/July 2017 (phase 1) and three in October/November 2017 (phase 2), covering all 76 health facilities (7 hospitals and 69 health centers). HMIS data were used to monitor indicators of antenatal (ANC), intrapartum, postnatal (PNC), and inpatient neonatal care; process data were gathered from QI Advisor activity logs and LCS surveys. We used Chi-squared test to measure performance differences between baseline (phase 1: April-June 2017; phase 2: July-September 2017) and the most recent quarter of ABC implementation (April-June 2018).

Findings: Improvement in targeted performance measures improved in a number of areas including: percentage of women with 1st ANC in the first trimester of pregnancy increased from 48% (4414/9141) to 60% (6296/10486) ( $p < 0.01$ ) and first PNC within 24 hours increased from 85% (2862/3356) to 93% (3060/3282), ( $p < 0.001$ ). LCS participants reporting increased confidence in working in QI from 54% “very/extremely confident” (pre-LCS) to 95% (post-LCS,  $p < 0.001$ ) with 89 QI projects (69 ANC, 10 intrapartum, 3 PNC, 7 neonatology) initiated after two LCS in phase 1 HCAs and one LCS in phase 2 HCAs.

Interpretation: Improved quality among performance measures targeted by ABC was seen at halfway through ABC implementation, along with QI activities and confidence. These preliminary results show promise for ABC’s approach to improve care delivery and reduce neonatal mortality in diverse areas of Rwanda.

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