

affecting this study, the lack of complete record keeping may be affecting quality of care because of the inability to follow a mother throughout labor and delivery. For example, only a few records included use of the partograph, a tool used to track progress so as to avoid a prolonged labor or ruptured uterus. Additionally, high rates of complications accompanying intrapartum stillbirth could show a gap in care when such complications arise and EmONC practices must be followed. To improve EmONC practices and lower intrapartum stillbirth rates, detailed record keeping for continuous analysis is suggested. This may allow for improvement of care during labor, specifically surrounding common complications. Any improvement should then be monitored with continued use of the BABIES matrix.

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**Abstract #:** 2.014\_WOM

### Low-cost, Speculum-free, Automated Cervical Cancer Screening: Bringing Expert Colposcopy Assessment to Community Health

M.N. Asiedu<sup>1</sup>, S. Guillermo<sup>2</sup>, N. Ramanujam<sup>2</sup>; <sup>1</sup>Duke University, Durham, NC, USA, <sup>2</sup>Duke University, Durham, USA

**Background:** Although cervical cancer is on the decline in high income countries, the WHO estimates that 88% of worldwide invasive cervical cancer mortalities occur in LMICs and is expected to increase to 98% by 2030. Our work seeks to ameliorate key barriers to cervical cancer screening by developing: **1)** a speculum-free alternative, using an inserter and the POCkeT Colposcope, a Point of Care Tampon-sized digital colposcope, for a more comfortable exam, that also allows for self-colposcopy; and **2)** an image processing algorithm to aid health workers in the automated classification of cervical pre-cancer lesions real-time, using extracted features.

**Methods:** *Speculum-free device:* we explored a broad array of designs for a speculum alternative using computer aided finite element analysis and empirically validated the findings using a vaginal phantom. The top two designs were then evaluated under an IRB approved study (n = 15 volunteers) to assess the devices for cervix visualization, comfort and usability. *Automated screening:* we have developed image processing tools to extract features from digital colposcopy images based off acetowhitening and Lugol's Iodine staining. The algorithm first performs specular reflection removal, followed by Otsu's thresholding method, and feature extraction. Our algorithm was trained on 42 normal and pre-cancerous cervical images with Lugol's Iodine applied to determine sensitivity and specificity when compared to gold standard.

**Findings:** *Speculum-free device:* Studies with fifteen volunteers for self-insertion and physician-assisted cervix image capture, showed adequate cervix visualization for 83% of patients. Survey responses from volunteers indicated a 92.3% overall preference for the inserter over the speculum and all volunteers indicated that the inserter was more comfortable than the standard speculum. *Automated Diagnosis:* The pilot algorithm was able to classify 42 test images as normal or pre-cancerous with sensitivity of 85.7% sensitivity and specificity of 89.2%.

**Interpretation:** This study demonstrates the feasibility for comfortable, speculum-free image capture of the cervix and potential of an automated diagnostic algorithm for use by untrained community health workers and nurses in the field, with potential for self-screening. Ongoing studies seek to enable image classification as normal, low- or high- grade and also incorporate contrast enhancing approaches with the device.

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### Evaluating the Cost-Effectiveness of an Integrated Program to Reduce Maternal and Neonatal Mortality in Ghana

D. Goodman<sup>1</sup>, R. Ramaswamy<sup>2</sup>, M. Jeuland<sup>3</sup>, E. Srofenyoh<sup>4</sup>, C. Engmann<sup>1</sup>, A. Olufolabi<sup>1</sup>, M. Owen<sup>6</sup>; <sup>1</sup>Duke University School of Medicine, Durham, USA, <sup>2</sup>UNC Chapel Hill, Durham, NC, USA, <sup>3</sup>Duke University, Durham, USA, <sup>4</sup>Ridge Regional Hospital, Accra, Ghana, <sup>5</sup>University of Washington, Seattle, USA, <sup>6</sup>Wake Forest University, Winston-Salem, NC, USA

**Background:** Few studies have examined the cost effectiveness of facility based interventions in low-resource settings aimed at improving obstetric care. From 2007–2011, Kybele, an international NGO, partnered with the Ghana Health Service (GHS) to improve obstetric care through an integrated program addressing systems, skills, and leadership at a large tertiary hospital in Ghana. Despite doubling of patient volume and quadrupling of high-risk patients during this period, maternal mortality and still births were reduced. This study evaluates the program's cost effectiveness.

**Methods:** Costs included those incurred by Kybele, the GHS, and the value of time of volunteer medical workers traveling to Ghana, reported in 2015 \$US dollars (USD) adjusted for purchasing power parity (PPP). Benefits were calculated by modeling the counterfactual. Baseline case-fatality rates (CFR) were determined for hemorrhage and hypertensive disorders, the most common causes of maternal mortality. Deaths averted were modeled using a steady-state assumption for CFR predicting mortalities that would have occurred without program implementation. Model assumptions were tested with Monte Carlo simulations over 10,000 hypothetical scenarios. Maternal and newborn disability-adjusted life-years (DALYs) averted and the cost-effectiveness ratio [(CER); cost per DALY averted] were determined for each modeled scenario. The WHO defines a project as highly cost-effective if the CER is less than the country-specific GDP per capita, which, for 2007–2011, is \$2,917 in Ghana adjusted for PPP.

**Findings:** The total program cost was \$2,723,700. Models predicted that 236 ( $\pm 5$ ) maternal deaths and 129 ( $\pm 13$ ) intrapartum stillbirths were prevented, translating into 24,330 DALYs and a CER of \$112 ( $\pm 23$ ) USD. This is well below the highly cost-effective threshold. Results were robust to sensitivity analyses with varying DALY calculation methods, yearly risk factor prevalence, and yearly case fatality rates. Across all scenarios modeled, the program remained highly cost-effective, with a CER ranging from \$112–\$265.

**Interpretation:** Programs involving an integrated package of interventions addressing systems change, capacity building and leadership development have the promise to be highly cost effective in preventing maternal and neonatal mortality in low resource settings. Further research is needed to assess whether these results are unique to the particular circumstances of this implementation or whether they are applicable in other settings.

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**Abstract #:** 2.016\_WOM

### Differences and Determinants of maternal mortality ratio in Sub-Saharan African countries.

M. Gonzalez<sup>1</sup>, R. Ren<sup>2</sup>; <sup>1</sup>Dalian Medical University, Dalian, Liaoning, China, <sup>2</sup>Dalian Medical University, P R China, Dalian, China

**Background:** Reducing maternal mortality ratio (MMR) was a primary target of the Millennium Development Goals (MDG5a). In Sub-Saharan Africa only three countries achieved the MDG5a and MMR is still high in the region. This study aims analyzing the data among Sub-Saharan countries that did not achieved the MDG5a and defining the determinants affecting MMR.

**Methods:** Data were obtained from WHO, UNICEF, World Bank, UNDP, and health departments. Forty five countries were divided into four groups according to WHO classification: making progress (MP) insufficient progress (IP), no progress (NP) and achieved the goal (A). Twenty indicators were divided into four areas: social, health, education, and economic. Descriptive statistics was applied to compare the groups and correlation analysis to examine the relationship between MMR and the indicators.

**Findings:** Correlation analysis showed a significant negative correlation between MMR and HDI (-0.768), literacy rate (-0.739), hospital beds (-0.639) skilled attendance at birth (-0.660), contraceptive prevalence (-0.590), improved sanitation facilities (-0.587), and the number of nurses and midwives (-0.508). Fertility rate (0.750) and adolescent birth rate (0.700) showed a strong positive correlation with MMR. Comparison analysis showed large gaps between the countries that achieved the goal and the other three groups.

**Interpretation:** To reduce the gaps of MDG5 and to accelerate achieving - SDG3.1 in Sub-Saharan Africa, it is important to improve determinants within the health system, but also social, education, and economic determinants are critical. Higher level of education, more health resources, and increasing expenditure on health appears to be a requisite.

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**Abstract #:** 2.017\_WOM

### An Innovative, Mobile-health Enhanced, Peer-counseling Program to Improve Breastfeeding among Low-income, Minority Populations in Washington, DC

R. Robert<sup>1</sup>, A. Roess<sup>2</sup>, E. Cleaves<sup>3</sup>, D. Kuehn<sup>3</sup>, P. Thompson<sup>4</sup>; <sup>1</sup>The Catholic University of America, Washington, DC, USA, <sup>2</sup>George Washington University, Washington, DC, USA, <sup>3</sup>District of Columbia

Department of Health (DOH), Washington, USA, <sup>4</sup>District of Columbia Department of Health (DOH), Washington, DC, USA

**Program/Project Purpose:** Breastmilk is associated with reduced childhood obesity, asthma, infectious diseases, and sudden infant death syndrome, all of which disproportionately affect minority and low-income children in the US. Yet, breastfeeding rates are lower among low-income populations compared to the general population. Research has shown that peer-counselors, who come from the same culture and community and have experience breastfeeding, are effective in providing education and social support to improve breastfeeding behavioral outcomes. However, access to peer-counselors is limited; the use of e-technology can bridge this gap to reach low-income women with text messages. One-way texts provide consistent communication and high quality messages at low cost, and 2-way texts can respond to immediate needs with specific behaviors and support. BfedDC, a text-messaging program with 2-way texting capacity for peer-counselors was piloted in Washington DC clinics that are part of the US national assistance program for low-income families, ie WIC clinics, to address this need.

**Structure/Method/Design:** Two sets of text messages were designed, one for pregnant participants and another for mothers after delivery and into the first year of life; both available in Spanish and English. We examined process indicators (number participants enrolled, number dropped out, frequency of messaging, etc.) to understand the coverage and quality of the BfedDC program, and to link to breastfeeding behavioral outcomes.

**Outcome & Evaluation:** Coverage: 38.6% of those eligible enrolled in the program and within this total, about 40% of those had no prior experience breastfeeding. 5.6% of participants opted out of the program early. Quality: 1-way breastfeeding educational messages were delivered regularly, and 2 way texting conversations between mothers and peer counselors were observed in 13.5% of cases. Mothers most often texted questions about milk supply, latching, number of months to breastfeed, pumping and when support groups were occurring.

**Going Forward:** Significant work remains to address breastfeeding disparities particularly among low-income and minority populations. Our process data results informed the large scale implementation of BfedDC in Washington DC Process evaluation activities will continue as the program matures and will be linked to breastfeeding outcomes to determine the impact of the intervention on breastfeeding initiation and continued breastfeeding at 6 months.

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**Abstract #:** 2.018\_WOM

### Trends in Breastfeeding and Cesarean sections over a 20 year period in 40 low and middle income countries

A. Roess<sup>1</sup>, D.R. Robert<sup>2</sup>; <sup>1</sup>George Washington University, Washington, DC, USA, <sup>2</sup>The Catholic University of America, Washington, DC, USA

**Background:** WHO recommends that mothers initiate breastfeeding within the first hour after childbirth, **exclusively** breastfeed