

infections (OR 3.93, 95% CI 1.28 - 12.05, $P=0.017$). Other factors in the model were not associated with rotavirus infection and did not significantly modify the effect of zinc. These results suggest a particular utility of zinc interventions in reducing the burden of rotavirus diarrhea compared to other etiologies. Future research will examine mechanisms of zinc protection in rotavirus.

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DECLINING CHILD MORTALITY DUE TO INFECTIOUS DISEASES IN AN URBAN SLUM IN NAIROBI KENYA

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Examining trends in causes of child mortality over time can help measure progress towards achieving Millennium Development Goal #4. Little is known about trends in child mortality in urban slums, where living conditions are precarious. We assessed child mortality rates and cause of death (COD) from 2009-2014 in a population of ~25,000 residents of Kibera slum in Nairobi, Kenya, under demographic surveillance. Participants were visited biweekly in their homes and queried about any deaths. Trained verbal autopsy (VA) interviewers used standardized World Health Organization VA questionnaires to gather data from a credible respondent on the circumstances leading up to death. InterVA-4 was used to code the most likely COD. We calculated rates of death per 1000 person-years-observation (pyo); for cause-specific rates, we extrapolated the observed proportion of COD by year to those with missing VA data. From 2009-2014, 336 deaths were reported among children aged <5 years. The child mortality rate declined from a high of 18.3/1000 pyo in 2009 to a low of 9.8/1000 pyo in 2013, then increased slightly to 11.4/1000 pyo in 2014. VA was completed on 255 (76%); 18 (7%) were classified as 'indeterminate' and 5 (2%) as 'other and unspecified neonatal'. Among the remaining 232 with a likely COD identified, the leading cause was acute respiratory infection/pneumonia, including 13/35 (37%) neonatal deaths and 102/197 (52%) in children aged 29 days to <5 years. Other common causes included malaria ($n=29$, 12%), diarrhea ($n=12$, 5%), and HIV/AIDS-related ($n=12$, 5%). Rates of pneumonia deaths peaked in 2010 at 9.8/1000 pyo, then fell to a low of 4.5/1000 pyo in 2014. Rates of all other infectious causes combined (excluding pneumonia) decreased from 9.8/1000 pyo in 2009 to 2.9/1000 pyo in 2013 and 2014. We observed a reduction in child mortality of more than 35% in recent years in Kibera. The decline was driven by falling mortality due to pneumonia and other infectious diseases. Possible factors contributing to improved survival include introduction of the pneumococcal conjugate vaccine in 2011 and scaled up malaria control and HIV prevention efforts.

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A SYSTEMATIC REVIEW ON THE EFFECTIVENESS OF STRATEGIES TO IMPROVE HEALTH WORKER PERFORMANCE IN LOW- AND MIDDLE-INCOME COUNTRIES: PRELIMINARY RESULTS ON UTILIZATION OF HEALTH SERVICES

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Improving health worker (HW) performance is a global health priority. Strategies that improve performance might also increase utilization of health services. To characterize the effectiveness of such strategies in low- and middle-income countries (LMICs), we conducted a systematic review

of 15 electronic databases, 30 document inventories of international organizations, and bibliographies of 510 articles. We included studies meeting accepted criteria for methodological adequacy (e.g., trials with comparison groups) of any strategy to improve HW performance on any health topic in any language, published or not. This analysis focuses on studies that measured continuous outcomes on the utilization of health services (e.g., number of patients seen per month). Effect sizes were calculated as percent change over time in the intervention group minus percent change over time among controls. We screened >105,000 citations, and 822 reports met inclusion criteria. Fifty-seven studies measured continuous utilization outcomes and were included in the analysis. Many strategies have been tested, usually with multiple intervention components. However, most strategies were tested by only one study. The median effect size (MES) across all studies was an improvement of 15 percentage-points (%-points) (interquartile range [IQR]: -14, 57). Among studies of facility-based HWs, three strategies tended to increase utilization: strategies that included financial incentives for HWs or health facilities (MES = 67 %-points, IQR: 2, 119), insurance schemes (MES = 16 %-points, IQR: -44, 47), and reducing or removing user fees (MES = 15 %-points, IQR: -12, 42). Introducing or increasing user fees tended to decrease utilization (MES = -53 %-points, IQR: -82, -17). Among studies of lay HWs, no clear patterns were identified. For example, strategies that included the combination of HW training + supervision + patient or community education had effect sizes of -29, 5, 79, and 306 %-points. Contextual and methodological heterogeneity made comparisons difficult. These results should inform decision-making on increasing utilization of health services in LMICs.

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THE IMPACT OF ANEMIA DURING PREGNANCY AND ITS RISK FACTORS ON THE COGNITIVE DEVELOPMENT OF ONE-YEAR-OLD CHILDREN

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The aim was to investigate the impact of anemia during pregnancy and its risk factors on the cognitive development of one-year-old children. Our prospective cohort study included 636 mother-singleton child pairs from 828 eligible pregnant women who were enrolled during their first antenatal care visit (ANV) in Allada, Benin, into the MiPPAD clinical trial. Venous blood samples of women were assessed for ferritin and hemoglobin (Hb) concentrations at the first and second ANV of at least one-month interval and at delivery. Stool samples of pregnant women were also collected during these follow-up periods to test for helminths using the Kato-Katz technique. All pregnant women were administered a total of 600 mg of mebendazole (100 mg two times daily for 3 days) to be taken after the first ANV. Women were also given daily iron and folic acid supplements throughout pregnancy. The intake was not directly observed. At age one year, cognitive and motor functions of children were assessed using the Mullen Scales of Early Learning. The prevalence of iron deficiency (ID) among pregnant women at first and second ANC visits, and at delivery was 30.5%, 34.0% and 28.4%, respectively. Prevalence of helminth infection was 11.5%, 7.5% and 3.0% at first, second ANV and at delivery, respectively. Prevalence of anemia decreased from 67.1% at first ANV [mean gestational age (Standard deviation), 22.1(4.0) weeks] to 40.1% at delivery. Children of mothers who were infected with hookworms at first ANV had 4.9 (95% confidence interval, CI: 1.3 - 8.6) lower mean gross motor scores compared to those whose mothers were not infected with hookworms at the first ANV. We observed a significant negative quadratic relationship between infant gross motor function and Hb concentration at first and second ANVs. Prenatal helminth infection is associated with poor with infant cognitive and motor development. However, in the presence of iron supplementation, ID is not associated with infant neurocognitive development. Further, there appears to be an Hb concentration range (90-110 g/L) that may be optimal for better gross motor function of one-year-old children.