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Determinants of the Survival of Children under 5 Years in Rural and Semi-urban Burkina Faso

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This work focuses on determinants of child health and survival, including contextual factors, such as place of residence, household and familial characteristics, and household wealth, as well as certain measures to improve health and survival, such as vaccinations and health insurance. All analyses were conducted in the Nouna Health and Demographic Surveillance System, which was established in 1993. The average probabilities between 1993 and 2012 to survive the first year and the first five years of life were 95.1% and 86.4%, respectively. Trends in infant and under-five mortality between 1993 and 2012 were estimated by fitting Poisson regression models. The annual decreases in infant and child mortality were 1.4% and 2.6%, respectively. This translates to a decline in infant and under-five mortality of 23% and 40% between 1993 and 2012, but is still lower than necessary in order to achieve Millennium Development Goal 4 of a two-third reduction in under-five mortality by 2015. Mortality was lower and the decline more pronounced in the semi-urban town of Nouna town than in the rural areas.

Trends over time in the major risk factors for infant mortality were assessed by comparing a cohort born between 2005 and 2010 to a previous one, born between 1993 and 1999. Single- and three-level Cox regression models were used for analysis. The strongest risk factors between 2005 and 2010 were death of the mother and being a twin, which were also the strongest risk factors from the previous analysis period. Compared with the period 1993 to 1999, the effect of most risk factors was attenuated, notably ethnicity, religious affiliation, distance to the closest health facility, birth order, and season of birth. Disparities between groups decreased over time, demonstrated by the fact that the biggest reduction in mortality was in the groups with the highest mortality rates previously.

The relationship between household wealth and under-five mortality was studied in 15 543 children born between 2005 and 2010. Information on household wealth was collected in 2009 and wealth indicators were calculated using principal components analysis for the rural and the semi-urban households, respectively, which were then divided into quintiles. Cox regression was used to study the effect of the household wealth on under-five mortality. In the semi-urban area, household wealth was significantly related to under-five mortality after adjustment for confounding, whereas in rural children no effect of household wealth was seen. These results indicate that the more privileged children from the semi-urban area with access

to piped water and electricity had an advantage in under-five survival, while under-five mortality in the rural area was rather homogeneous and relatively high.

The effect of health insurance enrolment on under-five mortality was investigated using Cox regression, with adjustment for variables that were found to be predictive for health insurance enrolment, the most important being socioeconomic status, father's education, distance to the health facility, year of birth, and insurance status of the mother at time of birth. Based on 33 500 children, the risk of mortality was significantly different and 46% lower in children enrolled in health insurance as compared to the non-enrolled children. The strong effect of health insurance enrolment on child mortality may be explained by increased utilization of health services by enrolled children. Because malaria is a main cause of death in the study area, early consultation of health services in case of infection could prevent many deaths. Timely adherence to the vaccination schedule was studied in 1665 children between 12 and 23 months of age, born between September 2006 and December 2008. Applying logistic regression, mothers' education, socio-economic status, season of birth, and area of residence were significantly associated with timely adherence to the complete vaccination schedule. Rural children were less likely to receive tuberculosis vaccination on time within 28 days after birth than semi-urban children, while semi-urban children were far more likely to fail to adhere to timely vaccination scheduled for later ages. Additional health facilities could improve timely tuberculosis vaccination. Outreach vaccination teams visiting the rural areas are supporting timely vaccination of rural children, while semi-urban children rely on their mothers' initiative to visit health centers regularly to receive their vaccinations.

As a secondary outcome of a randomized controlled trial, the non-specific effect on severe child morbidity from an additional early dose of measles vaccination was studied in children aged 4.5 to 36 months. In addition to the routine measles vaccination at age 9 months, the intervention group received an early dose of measles vaccine at age 4.5 to 6 months of age. In 4496 children, 464 hospitalizations and deaths were observed. There was no difference in morbidity between intervention and control group, determined using Cox regression analysis. There was a protective but non-significant effect of early measles vaccination in children that had not been eligible for an oral polio vaccination campaign since enrolment. Despite not finding a significant protective effect of early measles vaccination in the trial, the true effects could have been obscured by non-specific effects of the frequent polio vaccination campaigns. While several measures showed positive effects on child survival, single measures and individual programs have to be evaluated in context for their ability to reduce child mortality. There is a strong imperative to continuously reexamine and adapt measures and programs to determine the magnitude and validity of their effects, and ultimately optimize their benefit to a population's health and survival.