

Title: Use of linked hospital-based morbidity surveillance to explain trends in mortality in Kilifi Health and Demographic Surveillance System

Amare Deribew^{1,2,3}, Jennifer C Moïsi⁴, D. James Nokes^{1,3,5}, Evasius Bauni^{1,3}, Mark Oteinde^{1,3}, Christopher Nyundo^{1,3}, Lilian Mwangi^{1,3}, John Ojal^{1,3}, Kevin Marsh^{1,2,3}, Robert W. Snow^{1,2}, Thomas N. Williams^{1,3,6}, J. Anthony G. Scott^{1,2,3,7}

¹KEMRI-Wellcome Trust Research Programme, Kilifi, Kenya; ²Nuffield Department of Clinical Medicine, University of Oxford, Oxford, UK; ³INDEPTH, Accra, Ghana

⁴Agence de Médecine Préventive, Paris, France; ⁵School of Life Sciences and WIDER, University of Warwick, Coventry, UK; ⁶Imperial College, London, UK; ⁷London School of Hygiene and Tropical Medicine, London, UK

Abstract

Background

The Kilifi Health and Demographic Surveillance System (KHDSS) is the largest population under continuous mortality surveillance in tropical Africa. Admissions to Kilifi County Hospital, the only inpatient facility in KHDSS, are linked to the KHDSS population register creating passive morbidity surveillance. We analysed the cause-specific incidence of hospital admissions and prevalence to interpret mortality trends in the KHDSS.

Methods

We studied all deaths in children and adults and all childhood (<5 years) admissions among residents of KHDSS from January 2004 to December 2013. We estimated mortality rates as the number of deaths divided by the person-years-at-risk (PYAR) of KHDSS residents during each study period. We used ecological regression analyses of observations from 15 locations in each of 10 years to estimate the association between admission rates and prevalence for major infectious diseases and child mortality rates.

Results

Among 2,449,153 PYAR in all ages, 13,615 deaths were observed; among 450,632 PYAR in children aged <5 years, 3592 deaths occurred (rate 8.2/1000/y). Mortality rates in children, infants and neonates declined by approximately 53% between 2004 and 2008 but remained stable subsequently. Mortality rates also declined for older children and young adults but not for individuals over 50 years of age. The admission rates of neonatal syndromes remained stable throughout the study period. Admission rates for severe malaria among infants (1-12m) and children (1-4 years) declined by 93% and 72%, respectively, between 2004 and 2008 but remained stable subsequently. By contrast, admission rates for severe pneumonia, invasive bacterial disease (IBD) and acute diarrhoeal diseases declined steadily throughout the whole period. Examining historical data from 1994-6, mortality in children aged 1-4 years fell by 89% over 20 years whilst malaria prevalence declined by 97%. In ecological analyses from 2004-2013, childhood mortality was significantly associated with both prevalence of malaria and incidence of hospitalised malaria; under-5 year mortality increased by 11.5/1000 PYAR for each 10 percentage points increase in the background prevalence of malaria.

Conclusions

Mortality rates declined precipitously in children and young adults but not in those aged >50 years. Although admission rates for most infectious diseases in children have declined steadily throughout this period, those for malaria most closely reflect the biphasic pattern of mortality reductions.