Patterns of adult and old-age mortality in rural Burkina Faso
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Summary
Based on a demographic surveillance population from 39 villages in rural Burkina Faso, we describe mortality patterns in adults (15–59 years) and older people (≥60 years), and discuss seasonal trends in mortality. During the study period 1993–1998, 589 deaths in adults and 593 deaths in older people were recorded from an average adult and older people population of 13,550. The crude all-cause mortality rate per 1000 for adults was 7.3 (95 per cent confidence interval (CI) 6.7–7.8) and for older people 55.8 (95 per cent CI 51.3–60.3). The probability of dying before age 60 after reaching age 15 was 34 per cent for males and 32 per cent for females. Malaria and diarrhoea, recorded through verbal autopsy, accounted for 21 per cent of total deaths in adults and 22 per cent in older people. A seasonal trend in mortality for older people with a peak in February was identified. The study shows that malaria is an important cause of death in adulthood.

Keywords: adult mortality, old age mortality, demographic surveillance system, verbal autopsy

Introduction
Unlike childhood mortality, adult (15–59 years) and old-age (≥60 years) mortality has not been a major research focus in sub-Saharan Africa (SSA). Hence, there is little knowledge of the mortality patterns in these groups even though they suffer from a much broader range of communicable and non-communicable diseases (NCDs). For instance, Kaufmann et al.1 have noted the scarcity of information on cause of death among adults in SSA.

One of the few projects focusing on adults is the Adult Morbidity and Mortality Project (AMMP) in Tanzania, established in 1992 by the Tanzanian Ministry of Health in collaboration with the UK University of Newcastle upon Tyne, to investigate the role of NCDs in the overall disease burden in Tanzania.2,3 The project estimated for its population in 1997 that ‘the proportion of all deaths occurring to those between 15 and 60 years of age may equal or exceed that of deaths to children under 5’.2

Based on the Nouna Demographic Surveillance System (DSS) operated since 1992 by the Nouna Health Research Centre in Burkina Faso,4 we have analysed the mortality patterns of adults and older people in the region. We present the results of a descriptive analysis of all-cause and, to a limited extent, cause-specific mortality patterns in adults and older people for the Nouna health district covered by the Nouna DSS for the period 1993–1998. Only deaths caused by malaria and diarrhoea have been specified.

Materials and methods
Study area
Figure 1 shows the study area in NW Burkina Faso, West Africa, with an estimated population of about 11 million, of whom 80 per cent live in rural areas. Kossi has an area of 7464.44 km² and a population of about 240,000.

The study area comprises 39 villages around Nouna town, the headquarters of the Nouna Health District. The distance from village to the few local health centres ranges from 0 to 34 km. The village population ranges from 121 to 2346 persons.

The Demographic Surveillance System (DSS)
The database for this study is based on the DSS of the Nouna Health Research Centre, which has been described before.4 The variables registered during vital events registration include births, deaths, pregnancies, and migration in and out of the household, as well as information on all the dates related to these events. The DSS database also contains data on household economics and maternal health. The causes of death are determined by the verbal autopsy (VA) method.5 However, this procedure is currently being implemented in the Nouna DSS, so the percentage of deaths with associated cause is still low. Hence we concentrate on total mortality for most analyses.

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Journal of Public Health Medicine 25(4) © Faculty of Public Health 2003; all rights reserved.
Fig. 1 Map of study area (source: Ref. 9).
Statistical and demographic methods

The methods used are similar to those applied elsewhere to describe infant and childhood mortality in the same area. Briefly, crude death rates and 95 per cent confidence intervals (CIs) were calculated based on the normal approximation, or for smaller sample sizes \((n < 20)\) using exact Poisson CIs. Poisson regression modeling was used to investigate patterns of mortality rates (age-specific death rates, ASDR) by season. Life tables were constructed according to Preston et al.

Results

Basic demographic parameters

The total population size (all ages) in 1993–1998 (on 31 December) for both sexes rose steadily by 14.5 per cent from 27 473 persons in 1993 to 31 476 persons in 1998, with a mean yearly population growth rate of 2.8 per cent. The two adult age groups (15–59 and \(\geq 60\) years) made up a little more than 50 per cent of the total population. The old-age group (\(\geq 60\) years) made up about 6 per cent of all adults. The population size of the adult age group (15–59 years) was 12 599 persons in 1993 and rose by 15 per cent to 14 484 in 1998, with a mean annual growth rate of 2.8 per cent. For the old-age group (\(\geq 60\) years) the population size also rose steadily by 7.3 per cent from 1670 persons in 1993 to 1792 persons in 1998. The mean annual growth rate was 1.4 per cent compared with 27 per cent for the entire country.

All-cause adult and old-age mortality

The Table gives the annual distribution of deaths, midyear populations and mortality rates by sex with their 95 per cent CIs. The all-cause adult death rate of 7.3 per 1000 for the total observation period is much lower than that of 35.0 per 1000 children under five in the same study region and period as reported by Sankoh et al. There were slightly more female adult deaths than male ones, 307 versus 282; this was the case also for the old-age mortality by sex by year (304 versus 289). There is high all-cause old-age mortality of (55.8 per 1000) collectively for 1993–1998. The data show that older women generally have a higher mortality than men.

Cause-specific adult and old-age mortality

As malaria and fever are not easily distinguishable causes through verbal autopsy, they are combined in this analysis. The rest of the causes are put under 'other causes', because for a large percentage of deaths no cause is available. Our results show that both malaria and diarrhoea account for about 39 per cent for female and 33 per cent for male of all deaths of known causes occurring in both adults and old-aged people in the study area.

Seasonal variation in mortality

Figure 2 illustrates the seasonable variation (by month) in the mortality rates with 95 per cent CIs for adults and older people. For the two age groups a trend toward lower rates in the months...
May–October (rainy season), and higher rates in November–April was observed.

The mortality rates achieved a peak in February and August. The results indicate a highly significant ($p < 0.001$) seasonal effect on mortality in the study area in the two age groups. The highest mortality rates were observed in the months of February and April and the lowest in the months of July and August. We looked at rate ratios for each month compared with November, used as reference month. Both age groups show a remarkably similar mortality pattern by month.

**Life tables**

We calculated the probability of dying before age 60 after reaching age 15 to be 34 per cent for males and 32 per cent for females.

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**Fig. 2** Death rates by month and 95 per cent CIs for adults (15–60 years) and old people ($\geq 60$ years).
The probability of dying in the 5 year age intervals remained less than 10 per cent for both sexes until 50–54 years. It increased steadily to 45 per cent for women and 51 per cent for men in the interval 80–84 years. The life expectancy for females at birth is 51 years, and slightly lower for males. However, given age 15, the expected age at death is 65 years. This clearly shows the large impact of childhood mortality on life expectancy in this population.

Discussion

The adult and old-age mortality patterns identified are largely consistent with the general pattern identifiable in most of SSA. For instance, Kitange et al.3 reported a crude all-cause adult mortality range of 6.1 per 1000 a year for women in Hai and 15.9 per 1000 a year for men in Morogoro rural area in Tanzania, East Africa. We report an average of 6.9 per 1000 for men and 7.5 per 1000 for women.

A seasonal trend in mortality for older people was identified in the Nouna data: higher rates from November to April with a peak in February and lower rates from May to October. This is strikingly similar to the seasonal trend in mortality in children in the same study region for this DSS population. Kynast-Wolf et al.4 reported higher total mortality from November to May with a peak in February and lower rates from June to October.

The VA method still remains the most viable option to determine cause of death in rural Africa. In this study, it led to results that reflect the reality of the problem. For instance, about 20 per cent of the adult and old-age deaths in both males and females reported from our analysis are attributable to malaria and diarrhoea. This agrees with Setel et al.,10 who reported malaria and diarrhoea as among the major causes of adult deaths in three DSS sites in Tanzania.

Finally, although there is some degree of uncertainty resulting from the probability of underreporting of adult deaths, it is reasonable to conclude that adult mortality in the Nouna DSS has remained low over the years. If the impact of the HIV/AIDS epidemic could be contained in the study area, coupled with the implementation of effective interventions to address the devastating impact of malaria, we do not foresee an increase in adult mortality in the Nouna area in the near future.

Acknowledgements

We would like to thank Pierre Ngom (African Population and Health Research Centre, Nairobi, Kenya) and Sam Clark (Aigincourt, South Africa) for their helpful comments on life table analysis. We also thank Gabriele Stiegblauer (medical documentalist) for assisting with the database. This work was supported by research grant SFB 544 (Control of tropical infectious diseases) from the German Research Foundation (DFG).

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Accepted on 10 June 2003