21/7/1999
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Mortality transition in the Ovamboland region of Namibia, 1930-1990*

(Short title: Mortality transition in Ovamboland)

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Keywords: Namibia, mortality decline, mortality determinants, family reconstitution.

* Earlier versions of this paper were presented at the 1996 annual meeting of the Population Association of America and 1998 conference of the British Society for Population Studies. The authors thank Ossi Lemström for computing assistance and the Central Statistical Office of Namibia for providing us with special tables from the 1991 Census. The United Nations University, WIDER, Academy of Finland, and University of Helsinki have provided financial support for this project.

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ABSTRACT

Few long-term statistical series exist that can document the mortality transition in Africa. This paper uses data from the parish registers of the Evangelical Lutheran Church in Namibia to study mortality in Ovamboland between 1930 and 1990. It identifies significant discontinuities and reversals in the trend in mortality. Much of the mortality transition occurred in a rapid breakthrough concentrated between the early-1950s and early-1960s. Adult mortality fell more than existing model life tables would predict and the pattern of relatively high early-age mortality typical of modern Africa emerged only at this time. While a range of developments in Ovamboland contributed to the overall decline in mortality, the most important factor was the establishment by the Finnish Mission of a Western system of health care. In Ovamboland, the drive to 'good health at low cost' was articulated not through political institutions but through the church.

INTRODUCTION

Little is known about demographic trends in sub-Saharan Africa in the first half of this century. In particular, almost nothing is known about when mortality transition in the region began or the factors that drove death rates downward in the early phases of the transition. This paper analyses a detailed series of data on mortality in Ovamboland, the most populous area of Namibia. The series covers a sixty-year period, 1930 to 1990. The source of these data is the parish records kept by the Evangelical Lutheran Church in Namibia (ELCIN). The study examines the timing and characteristics of mortality transition in the north-west of Namibia and places this development in the context of determinants of mortality decline such as rising incomes, famine control, the spread of mass schooling, and the provision of health care services.

Useful data on mortality in Africa began to become available only with the conduct of demographic sample surveys in several French colonies and some other countries in the late-1950s. In addition, by the early-1960s a few national censuses had collected data that can be used to estimate infant and child mortality. Only with the publication of *The Demography of Tropical Africa*, which used new methods proposed by Brass to analyse many of these data, was a significant start made to documenting the evolution of mortality across region (Brass et al. 1968).

In much of Africa, however, mortality data were not collected until the 1970-round census, a World Fertility Survey inquiry fielded during the 1970s, or even later. Moreover, civil registration of deaths still remains very incomplete. Thus, while fairly up-to-date estimates of under-five mortality now exist for most African countries (Timæus 1997), few series of such estimates can be compiled that are more three decades long (Hill A. 1991). Moreover, many early inquiries collected no data on adult mortality. Measures for the 1960s exist only for about ten countries (Timæus 1991) and, even today, no information on adult mortality is available for several populous countries (Timæus 1997). A further limitation of the information available on mortality in sub-Saharan Africa is that census and survey data fail to provide detailed information on changes in mortality from year to year (Hill K. 1991). The indirect methods used to analyse census data smooth out short-term fluctuations in death rates and discontinuities in the trend in mortality while, in the results of surveys, such events can seldom be distinguished from recall and sampling errors.

Longitudinal studies of geographically localized populations can generate more specific information on mortality by age and year than retrospective data on national populations. In Africa, however, few such studies have remained in the field for the period of decades needed to yield insights into the long-term trend in mortality (Feachem and Jamison 1991). Even the earliest of these longitudinal studies only began to collect data in about 1960 (Cantrelle et al. 1986; Clark et al. 1995).

In short, documentation of the process of mortality transition in sub-Saharan Africa is partial in its coverage, of limited historical depth, often restricted to the first few years of life, and lacking in temporal detail. Little is known about the extent of mortality decline during the colonial period, about which age groups contributed most to rises in life expectancy, or about when mortality fell most rapidly. Long-run series of mortality statistics of various types have contributed greatly to our understanding of mortality in other parts of the world (e.g. Gray 1974; Palloni 1981; Wrigley and Schofield 1981; Johansson and Mosk 1987; Dyson 1989a; Dyson and Murphy 1991; Jannetta and Preston 1991). This paper analyses a data series that documents mortality transition in north-west Namibia since 1930.

BACKGROUND

Ovamboland is located in northern Namibia on the border with Angola. Because, originally, of the availability of water, it is the most densely populated rural part of the country. At the time of the 1991 Census, about 45 per cent of the 1.4 million inhabitants of Namibia lived in Ovamboland, which represents less than one tenth of the area of the country. After independence in 1990, Ovamboland was split between four new administrative regions, Omusati, Oshana, Ohangwena and Oshikoto. They make up the new Northwest health region. While this Northwest region covers a larger area than the old Ovamboland district, most of the additional territory is lightly settled. Thus, the populations of the two entities are broadly equivalent. Because this paper concentrates on the period up to Namibia's independence, we retain the earlier name for the area under study.

Political developments in Namibia

The colonial powers began their take over of present day Namibia in 1878. The borders of South West Africa were established by 1890 (du Pisani 1985, pp.12-23). The northern border arbitrarily splits the area inhabited by Ovambo communities into two. After the Herero and Nama uprising (1904-7), the German government divided the colony into a police zone and

the northern 'native' territories where they did not maintain a police or military presence. Ovamboland became a 'native reserve' (Eirola 1992, pp.185-192, 234-240; Tötemeyer, 1978, pp.40-42).

The surrender of the German forces in 1915 brought South West Africa under the control of South Africa. A Native Commissioner was stationed in Ovamboland and a system of indirect rule developed to administer 'native affairs'. Ovambos were only allowed to leave the reserve with a pass. In its essentials, this system was maintained throughout the colonial period. It reached its nadir under apartheid legislation enacted in 1968. Africans were divided into 'nations' whose 'citizens' could reside in 'white' areas only as migrant labourers with very limited rights (Mbuende 1986, pp. 91-94). The United Nations terminated South Africa's mandate to govern South West Africa in 1966 but South Africa remained in illegal occupation of the country until 1989. Since March 1990, Namibia has been an independent state.

Social and economic change in Ovamboland

In the mid-nineteenth century and early colonial period, the Ovambo people were divided into 16 autonomous polities. Eight of them inhabited territories that fell entirely or largely on the Namibian side of today's international border. Most of the polities had a powerful hereditary king (Williams 1991, pp. 98-115). Kings governed with the aid of counsellors, who normally acted also as district headmen. Districts were subdivided into wards of 10 to 20 homesteads, whose head had purchased usufruct for his lifetime from the district headman. While several royal dynasties were replaced by councils of headmen during the colonial period, this system of land tenure has remained basically intact.

Prior to the expansion of the system of migrant labour in the 1950s, the economy in Ovamboland was based on mixed farming. The basic unit of production and social organization has been the male-led household or *egumbo*. It comprises a man, his wife or wives, and their unmarried children and foster children. Within the household, a clear distinction exists between the property of the man and of his wife or wives. This, in combination with matrilineal inheritance and the system of land tenure, until recently prevented inherited differentials in wealth from emerging within Ovambo communities (Siiskonen 1990, pp. 49-55; Williams 1991, pp. 48-50). As adequate water supplies were unavailable until then, urban areas only began to develop in Ovamboland in the 1980s.

After the Herero and Nama uprising, a chronic shortage of labour existed in the expanding mining industry in the police zone. About 80 per cent of the Herero and half the Nama peoples had either been killed or escaped from German cruelties to present-day Botswana (Bley 1971, p. 150; Drechsler 1984, p. 214). The demand for labour was met by temporary labour migrants from the north of the country. Among the Ovambos, the lack of alternative ways of earning a cash income encouraged men to engage in migrant work, while kings and headmen profited from the development by extracting gifts from returning migrant workers (Clarence-Smith and Moorsom 1977, p. 107; Hayes 1992, pp. 151-153).

The migrant labour system led to profound socioeconomic changes in all Ovambo communities (Notkola and Siiskonen 1999). In general, only able-bodied men were recruited and they were allowed to leave Ovamboland only on fixed-term contracts. Initially, nearly all migrants were unmarried adults, although restrictions on the recruitment of boys aged less than 18 were ignored at times of famine. Population growth has led to a growing shortage of fertile land since the 1940s. Increasingly, livelihoods have depended on wage labour and small-scale entrepreneurship, while the importance of subsistence farming has declined (McKittrick 1995, pp. 95, 122; McKittrick 1997). Thus, by the late-1960s, significant numbers of men were continuing to work in the south of Namibia after they married. About 30 per cent of adult men were absent at any point of time and most men had worked as migrant labourers at some point in their lives (Banghart 1969, p. 97).

Christianization

The Finnish Missionary Society began to work in Namibia in Ovamboland in the 1870s. Two Lutheran parishes had been established in Ondonga by 1889. By 1920, the Finnish Missionary Society had six mission stations in Ondonga and one mission station in each of the other Ovambo polities (Statistical Tables of the Finnish Mission Field in Ovamboland for the Years 1900-1920, Aula ELCIN Library Archives, AEL). Thereafter, the number of parishioners grew rapidly (see Table 1).

Table 1 about here

For a few years after the withdrawal of the Rhenish Missionary Society in 1916, the Finnish Missionary Society was the only missionary organization working in Ovamboland. In 1924, however, the South African administration granted permission to the Roman Catholic and Anglican Missions to start work in the area (Minutes of Missionary Conferences, MMC, at Oshigambo, 20-21 January 1925, Hha:9, National Archives of Finland, NAF). While both churches became established, most Christians in Ovamboland remain members of the

Lutheran Church. By 1991, ELCIN had 92 parishes and 434,000 members. Only 24,000 of the church's members belonged to parishes located outside Ovamboland.

The responsibility for the administration of the Lutheran parishes was gradually transferred from the Finnish missionaries to native ministers. By the late-1930s almost all parishes were formally led by Ovambo ministers (MMC at Ongwediva, 10-11 January 1949, Hha:18, NAF). The last step on the way to an independent church was taken in 1954 with the establishment of the Evangelical Lutheran Ovambo-Kavango Church (later renamed ELCIN). However, Finnish missionaries continued to play an important advisory role in both the parishes and the administration of the church until the 1960s.

DATA AND METHODS

This study uses as its primary source the parish registers kept by ELCIN in five parishes in Ovamboland: Elim, Nakayale, Okahao, Oshigambo, and Tshandi. The earliest registers date from the 1880s. By the early-1930s, about a quarter of the population of Ovamboland belonged to the Lutheran church. During the 1950s, this proportion reached one half and, in 1991, about two-thirds of the population were members of ELCIN.

The parishes under study cover five of the eight Ovambo communities in Namibia. Except in Ondonga, they represent all parishes founded by 1925 that have records that are in good condition.[1] The parishes cover both economic and administrative centres and outlying areas that were settled early this century and settlements both close to and far from the main transportation and trade routes. All of the parishes have been sub-divided repeatedly since they were founded. Only the registers from the mother parish are used in this study.

The family reconstitution method was used to extract demographic data from the microfilmed registers (Fleury and Henry 1965; Wrigley 1966). Namibian parish registers are organized similarly to parish registers in Finland. Their structure was defined by ordinance in the 1920s and has been revised only in minor ways since.

A main book or family book exists for each parish. All the families in the congregation and their members are listed when the book is started. Couples that subsequently marry are added to it. All vital events in the listed families are recorded, including details of children born before marriage. Several successive main books exist for each parish, but families can be followed from one to the next (Notkola and Siiskonen 1999). Registers also exist of births, deaths, baptisms, migratory moves, and marriages. These history books can also be used in family reconstitution. In particular, data from the main

books and the registers of deaths were cross-checked exhaustively because some deaths were omitted from the main books.

Reflecting the structure of the registers, the basic unit of follow up is the married couple. The two data files refer to 8125 couples marrying in 1925 to 1985 and to their children followed up till their confirmation at about age 15. Information is not available on single adults and no attempt has been made to link married adults to the records for their family of origin.

To improve the reliability of the mortality data, about 14 per cent of adult women and 19 per cent of adult men in the registers were dropped from the analysis because they were mentioned only once or because the information on them was incomplete. The most common problem is missing dates of birth, especially of people baptized as adults. The main limitation of the data on children is that baptism occurs at an average age of 6 months and children who died before being baptized often do not appear in the registers. Thus, the unadjusted data severely underestimate infant mortality. In addition, about 29 per cent of children who are mentioned in the registers, including 45 per cent of children in Okahao, were lost to follow up and excluded from the mortality analysis. This was usually because their mother was expelled from the church, moved away, or died. None of these limitations of the data seem to have changed markedly in severity during the study period (Notkola and Siiskonen 1999).

The mortality statistics presented here refer to the *de facto* population and exclude the experience of men during any periods that they spent working as labour migrants. The paper considers the data on children aged 0-9 years, men aged 20-59, and women aged 20-39. The lower age boundary for adults was chosen because a small and decreasing proportion of Ovambos marry before age 20. The upper age limits reflect poor follow-up of older adults: beyond these ages, the death rates observed drop off sharply compared with those in model life tables fitted to the data on younger adults (Notkola and Siiskonen 1999). The results for the children are based on 190,500 person-years of observation over the sixty-year period and those for adults on 156,000 person-years of observation.

To distinguish the underlying trend in mortality from random variation in the measures, death rates by sex, five-year age group (but distinguishing infancy from 1-4 years), calendar year, and parish are modelled using Poisson regression. Separate models are fitted to the data on children and on adults. The models fitted to the death rates for adults incorporate an external standard as one of the independent variables. It comprises the equivalent death rates in Brass's (1971) General Standard.

Several further items of information in the parish registers, such as parish of residence, age of mother, birth order, and moves between parishes, have been linked into the mortality files. No individual-level data exist on other potentially important covariates of mortality such as education. Exploratory regression analyses revealed that the impact on mortality of almost all of the characteristics that we know about is small or insignificant (except that twins have death rates twice those of other children). Moreover, they add little to understanding of the *transition* in mortality. The only such characteristic that is considered further in this paper is parish.

The level of mortality, and for children its trend, varies significantly between the communities. These differences between the parishes are small compared with the changes over time. Nevertheless, to prevent changes in the composition by parish of the study population from distorting the trend in the mortality, all the results presented are standardized on the population by parish in 1958-62. Where we present death rates for broad age ranges, they are further standardized by age and by sex on the 1958-62 population structure.

EVOLUTION OF MORTALITY

Children

Figure 1 plots two series of death rates for 1-9 year old children in the five parishes for the years 1930 to 1990. We found no evidence that the trend in mortality has differed by age group or sex within childhood or that the age pattern of mortality differs by parish. Thus, the estimates in Figure 1 are based on regression models fitted to all children aged less than 10 years, including infants.[2] To produce the series of annual rates we represent calendar time by a series of dummy variables. To estimate the underlying trend in mortality we fit a log-linear spline to year of death.[3] The coefficients of the latter model are presented in Table 2.

Figure 1 and Table 2 about here

The annual series reveals that child mortality fluctuated greatly from year to year in Ovamboland, particularly before 1950. Underlying these fluctuations, four distinct phases in Ovamboland's mortality transition are apparent. Child mortality fell between the early and late 1930s, followed by a period of stagnation in the 1940s. Then a rapid drop in mortality ensued for about 15 years from the early-1950s to the mid-1960s. Finally, since the mid-1960s child mortality has continued to fall but more slowly than before. By the 1980s, death rates in childhood were about a fifth of their level half a century earlier.

Modelling childhood mortality using a log-linear spline function of calendar time allows us to assess whether these apparent non-linearities in the trend in mortality are

statistically significant. The most parsimonious model that fits the data adequately confirms the visual impression one gains from the annual estimates. The knots in the spline indicate that the rate of mortality decline changed significantly in about 1940, 1950 and 1965. All the major peaks in mortality apparent in Figure 1 (1932, 1934, 1938, 1951, 1956, 1961, 1967, 1971 and 1982) are significantly above the underlying trend.

Adults

The evolution of the standardized adult death rate at 20-59 years is shown in Figure 2. The rates plotted are for adults of both sexes. Women's death rates are about 20 per cent lower than those of men. This represents a much smaller sex differential in adult mortality than has been found elsewhere in Southern African (Timæus 1993). No evidence was found that the mortality of men and women has fallen at different speeds or that the age pattern of mortality differs by sex. Thus, the death rates of women aged 40-59 years have been estimated using the women/men rate ratio at 20-39 years and results presented for the entire age range 20-59 years and the sexes combined. As with the data on children, annual rates were estimated using a series of dummy variables for year and the underlying trend in mortality using a spline function. The latter regression model is presented in Table 3.

Figure 2 and Table 3 about here

Up to 1950, the recorded adult death rate fluctuates so much from year to year that it is unclear from visual inspection of the series whether any underlying trend in mortality existed. However, comparison of the regression model in Table 3 with one in which the earliest knot in the spline is placed in 1950 suggests that adult mortality probably did fall somewhat in the 1930s and early-1940s, though the trend does not pass conventional tests of significance (P=0.122). Any such downward trend was reversed in the second half of the 1940s. A massive fall in adult mortality began in the early-1950s. By the time that it tailed off in the late-1960s, adult death rates were about one third of their level in the mid-1930s or around 1950. The subsequent small increase in the death rate of adults in the 1970s and its reversal in the 1980s are both statistically significant. It is possible, however, that the latter trend is an artefact of undocumented loss to follow up of parishioners associated with the liberation struggle. In contrast with the children, no more of the annual peaks and troughs in the adult death rates differ significantly from the underlying trend in mortality than one would expect by chance.

Age pattern of mortality

Much of tropical Africa and some other parts of the developing world are characterized by higher mortality in childhood, compared with adulthood, than was found in most historical Western populations (Ewbank 1990; Timæus 1993). This has been ascribed to severe mortality from malaria and diarrhoeal disease (Preston 1976). Figure 3 examines the evolution of the age pattern of mortality in Ovamboland in comparison with each of the four families of Princeton model life tables (Coale and Demeny 1983). For this figure, the annual probabilities of dying between 1 and 10 years and 20 and 60 years calculated from the fitted annual age-specific death rates have been smoothed by taking medians of three and hanning (Marsh 1988).

Figure 3 about here

Figure 3 suggests that until the early-1950s mortality in Ovamboland was hovering around a high mortality equilibrium. During the 1930s and early-1940s, some advances were made against child, and then adult, mortality but these were lost later in the 1940s. Beginning in about 1953, however, mortality in Ovamboland entered a new phase in its history. Both child and adult mortality fell rapidly and more-or-less continuously for a period of about 10 years. Thus, the decade between the early-1950s and early-1960s saw what Caldwell (1986) terms a 'breakthrough' to low mortality. Since the mid-1960s, the *relative* variation from year to year in mortality has been similar to that up to the early-1950s. Nevertheless, child mortality has continued to drop slowly.

The breakthrough to low mortality in Ovamboland in the decade after 1953 produced a marked change in the overall age pattern of mortality. Until the 1950s, adult mortality was relatively high and child mortality relatively low compared with the Princeton model life tables. On average, the overall age pattern of mortality was slightly more extreme than in the West model life tables. During the ten years in which most of the drop in mortality occurred, adults benefited to a greater extent than the Princeton models would predict. Since the mid-1960s, Ovamboland has had relatively high child mortality and an overall age pattern of mortality intermediate to that in the South and North families of model life tables.

Regional comparisons

To compare the parish register data with other statistics on under-five mortality, one must infer the extent to which the registers underestimate infant mortality as a result of omission of infants who died before being baptized. Some Southern African populations have the relatively high infant, compared with child, mortality found in West model life tables (Coale

and Demeny 1983), while others are characterized by the relatively high mortality at 1-4 years found in North model life tables (Hill 1995). The 1992 Demographic and Health Survey (DHS) results suggest that the age pattern of mortality within childhood in Ovamboland resembles that in the North models (Katjiuanjo et al. 1993, Table 7.2). However, like the registers, the retrospective reports obtained by the DHS probably omit some neonatal deaths. Thus, we assume that the maximum plausible value for infant mortality in each year is that in the West model life tables corresponding to the observed death rate at ages 1-9 (Coale and Demeny 1983). These maxima are combined with the observed data for ages 1-4 to calculate adjusted estimates of under-five mortality. If the age pattern of mortality in childhood in this population is actually more like that in the North than the West model life tables, under-five mortality will fall between the two series plotted for the five parishes in Figure 4. The adjusted series is unlikely to be badly biased but presents a pessimistic rather than optimistic picture of under-five mortality in Ovamboland.

Figure 4 compares the register-based estimates of under-five mortality in the five Ovamboland parishes with estimates based on the 1991 Census data for the same parishes[4] and with an estimate for the whole of Northwest Namibia obtained from the 1992 DHS survey. It also presents estimates of under-five mortality for neighbouring populations. Both the observed and the adjusted series of rates based on the parish registers have been smoothed by taking medians of three and hanning (Marsh 1988). All the census-based estimates of mortality were made by applying Brass's method to data on children ever-born and surviving (United Nations 1983). For consistency and in the absence of other indications, these indirect estimates were calculated assuming a West pattern of mortality.

Figure 4 about here

Figure 4 reveals that the adjusted parish register data indicate almost exactly the same level of under-five mortality as the 1991 Census data for the same five parishes. Like the registers, the Census suggests that infant and child mortality fell only slowly during the 1980s. Second, by the late-1980s at least, under-five mortality in these five parishes was very similar to that in the whole of Northwest Namibia as measured retrospectively in the DHS survey. Figure 4 also compares under-five mortality in the five parishes under study with under-five mortality in the early-1930s in the Huila region of Angola (the part of Ovamboland under Portuguese rule) according to the 1940 Census. Mortality in Huila may have differed somewhat from mortality further south as, for example, the rains are more reliable in Angola. Nevertheless, these data support the finding that child mortality in Ovamboland in the 1930s was low for that time. As both ends of the series of estimates for the parishes tie in quite well

with independent estimates of child mortality, it is unlikely that the registers suffer major flaws as a tool for the study of mortality trends.

Figure 4 also plots three census-based series of indirect estimates of under-five mortality for Botswana. What distinguishes Ovamboland is not the low level of under-five mortality recently, which is similar to that in Botswana. The distinctive feature of Ovamboland, instead, is the accelerated transition to a moderate level of mortality in the 1950s and early-1960s. As a result, Ovambo children had distinctly higher survival rates than Batswana children for a period of two or three decades.

Life expectancy

By combining the adjusted estimates of mortality in infancy with those for older children and adults, one can calculate complete life tables for the population under study and produce summary estimates of life expectancy. Such measures are presented in Table 4 for the mid-1930s, the years around 1960, and the mid-1980s. The level of mortality at each date is determined from the models of the underlying trend in mortality shown in Tables 2 and 3. Death rates in infancy and at ages 10-19 have been extrapolated from those at ages 1-9 using West model life tables. Death rates at ages 60 and more for men and 40 and more for women are taken from the mortality schedule fitted to the General Standard (Brass 1971) in the regression model presented in Table 3. As infant mortality is inferred from child mortality using West model life tables, the estimates of life expectancy are pessimistic.

Table 4 about here

Even in the 1930s, the under-five mortality in this population was, at most, 240 per 1000. Slightly less than half the adult population died between ages 15 and 60 and life expectancy at birth was slightly more than 40 years. By modern standards, these indices represent high mortality. Compared with countries to the north of Namibia, however, they undoubtedly represent low mortality for this period. Indeed, mortality remained this high in some African countries as late as the 1970s (Hill 1993; Timæus 1993). The indices for 1960 are even more striking. By then, under-five mortality in Ovamboland had dropped below 130 per 1000, adult mortality had fallen to a low level and life expectancy at birth was almost 60 years. By the 1980s, a further significant drop in infant and child mortality had occurred, raising life expectancy at birth to nearly 68 years.

CAUSES OF MORTALITY DECLINE

The most profound division among theorists of mortality decline is between those who believe that modern Western medicine can improve the health and reduce the mortality of poor populations and those who believe that only socioeconomic development can secure good health. Within these two schools of thought, further major differences of opinion exist as to what health care interventions and strategies for service delivery, on the one hand, and what forms of development, on the other, will have most impact on mortality. Evidence from sub-Saharan Africa has been deployed in support of most of these views. Yet, it is possible that the linkages in Africa between mortality and such factors as malnutrition, maternal education, urbanization, and ethnicity may confound generalizations based on Asian and Latin American experience (Vallin 1992).

Standards of living

Namibia is a lower-middle-income country. Moreover, by the 1980s life expectancy in Ovamboland was typical of that in lower-middle-income countries. However, the low level to which mortality had fallen cannot be ascribed to economic development in Ovamboland. Standards of living among the rural African population of Namibia remained very low throughout the country's extended period of colonial rule. They are little better than in other countries in sub-Saharan Africa where life expectancy is 10 to 20 years lower. In particular, housing and sanitary conditions remain poor. According to the 1992 DHS survey, only 4 per cent of respondents in the Northwest region lived in housing with an electricity supply, 93 per cent of their dwellings had earth or sand floors, and only 14 per cent had any form of toilet (Katjiuanjo et al. 1993, Table 2.5).

Famine and epidemic control

Famine has been a recurrent event in Ovamboland and major famines have been documented back as far 1841 (Siiskonen 1998). The 1915-16 famine was the most serious of these. It resulted from total crop failure. Over 20,000 people may have died out of Ovamboland's total population of about 100,000. As so often, such severe mortality was in part the result of a war. No additional food was supplied to the area, whereas in the famine of 1911, for example, Finnish missionaries received about 10,000 kg of grain to distribute to starving people (Siiskonen 1998).

Between 1916 and the end of the 1920s, famine was largely avoided (Siiskonen 1998). In 1928-33 a severe drought occurred. Famine resulted by 1930 but a relief programme employing people to build dams was organized by the Finnish missionaries with finance from the colonial administration. Linked to this famine and probably also to the relief work mounted in response, an outbreak of plague began in December 1931 (Union of South Africa 1932, paragraph 667-686). The epidemic was halted by quarantine regulations and disinfestation of the homesteads (Union of South Africa 1932, paragraph 703-708). Subsequent famines, such as that in 1946, were also alleviated by governmental programmes of relief work and the sale and free distribution of food.

Not all mortality crises in the 1930s and 1940s were linked to famine. For instance, the marked peak in child mortality in 1938 was noted at the time and ascribed to epidemic infectious disease. 'A wave of influenza passed through the country; this was followed up by an epidemic of measles which together with its after effects claimed many lives, especially among the younger members of the community. This in turn was followed by the malaria season. These three diseases more or less overlapped and the general health of the population for the period under review cannot be described as good' (Union of South Africa 1939, paragraph 551). As with plague in 1932, when feasible the colonial authorities tried to control the spread of epidemics. For example, in 1942, an epidemic of meningitis developed and schools were closed for about two months to prevent the spread of the disease (MMC at Onandjokwe, 20-21 January 1943, Hha:20, NAF).

One factor leading to improved food security during the 1940s and 1950s was the growth in the number of labour recruits (District Surgeon, DS, Annual Report, AR, 1946, Archives of the Native Commissioner of Ovamboland, NAO, 37, 26/8, National Archives of Namibia, NAN; DS, AR 1953, NAO 65, 21/14, NAN). Since the mid-1940s, migrant work has been the most important source of income of many households. Those working outside Ovamboland have been able, if not always willing, to help their relatives (McKittrick 1997). For example, 1953 was a drought year and 'Ovambos at work were advised to send their relatives food supplies, with the result that about 3000 bags of mealie meal etc., have come to hand up to date' (Native Commissioner, NC, AR 1953, NAO 61, 12/2 v. 2, NAN).

Intensive development of water supplies started in 1954. The programme aimed to provide adequate supplies of water for local communities by constructing first excavation dams and then canals to convey water from the Cunene River. The first canal was completed

in 1960 and a series of further water supply projects have been undertaken since (Director of Water Affairs 1968, 35-42).

While not all years of drought in Ovamboland are detectable in the mortality data, many years of significant excess child mortality between 1930 and 1990 were famine years, including the most recent mortality peak in 1980-81. It is likely that the famine relief and quarantine measures mounted by the missionaries and colonial authorities had a significant impact on the severity of mortality crises. Massive famine mortality, such as that of 1915-16, never reoccurred. The peaks in child mortality shrank as intervention by the administration became increasingly effective and relief efforts were buttressed by economic diversification and water supply projects that reduced the vulnerability of the area to drought.

Figure 1 suggests that the volatility of child mortality fell most between the 1930s and 1940s and then again in the mid-1960s. Thus, initiatives to control famines and epidemics were probably an important factor in the decline in mortality up to the 1940s. However, while these measures no doubt continued to be of benefit subsequently, the decade of particularly rapid mortality decline is not one for which evidence exists of major reductions in crisis mortality.

Spread of schooling in Ovamboland

The basis of the educational system in Ovamboland was established during the 1920s and 1930s by the Finnish Mission. By 1938, 4600 pupils were enrolled in school (excluding confirmation classes) while, in 1945, 13,185 students were enrolled in school in the northern sector and 113 mission schools had been established, including 87 Finnish mission schools. From the late-1950s on, mission schools were gradually converted into community schools. Thus, the number of mission schools fell from 151 in 1955 to 103 by 1962 although the total number of schools rose to 215. By this year, it was estimated that about 49 per cent of the school-age population of Ovamboland were enrolled in school (South Africa 1964, pp. 226, 249). According to the 1992 DHS survey, only 11 per cent of women of childbearing age in the Northwest region had never attended school (Katjiuanjo et al. 1993, Table 2.8).

The spread of schooling has probably been one component of the changes in Ovambo society that have brought about the transition to moderately low mortality, especially in recent decades. However, the number of years that most children spend in school has remained low: even in 1992, only 40 per cent of women of childbearing age in the Northwest region had completed primary school (Katjiuanjo et al. 1993, Table 2.8). Moreover, the impact of

education on attitudes and behaviour is bound up with a series of interacting developments (such as Christianization, Westernization, and - eventually - political mobilization) that are often described by the blanket term 'cultural change': schooling itself may not be the crucial factor leading to changes in child rearing practices.

Did the spread of schooling contribute to the sudden acceleration of mortality decline in early-1950s? One might think not, as few of the Ovambo women who were of childbearing age in the 1950s attended school when they were growing up themselves in the 1930s and 1940s. On the other hand, Christian women in the well-established parishes whose registers are analysed here must have figured prominently among these pioneers. Nevertheless, while the spread of schooling probably began to have some impact on child mortality in the 1950s, we doubt that schooling fuelled the breakthrough to low mortality. It was adult rather than child mortality that fell most rapidly between the early-1950s and early-1960s. The gradual replacement of less educated cohorts of adults by more educated cohorts cannot account for this.

Development of health services in Ovamboland

Until the 1960s, health care in Ovamboland was based almost entirely on the work of the Lutheran, Roman Catholic, and Anglican missions. The Finnish Mission was particularly active. Before 1960, it was responsible for some 80-90 per cent of health care provision in Ovamboland. From 1934 on, the administration contributed funds to the health services organised by the missionaries but they themselves made a larger monetary contribution. The District Surgeon supervised the work of these services but practically all the medical and nursing personnel were recruited from among the missionaries or trained by them (South Africa 1964, p. 133).

The first Finnish doctor to work in Ovamboland arrived in 1909 and the first hospital was opened in 1911 (Taube 1947; Soini 1953; Anon. 1968). The mission hospital treated 354 patients and 1925 outpatients during 1923 (Union of South Africa 1923, p. 56). Malaria is prevalent in the area and, even at this early date, 'Quinine was issued free to all the Native reserves and communities in the malaria zone through Magistrates, Native Affairs Officials and Missionaries' (Union of South Africa 1923, p. 59). During 1927, 5286 hospital patients were vaccinated against smallpox in Ovamboland and another 1353 individuals were vaccinated by the District Surgeon and missionaries in Ondonga and Uukwanyama districts during the course of the year (Union of South Africa 1927, paragraph 256). In 1928, 20,950

patients were treated in hospitals or in semi-hospitals (Union of South Africa 1928, paragraph 651). By 1938, this number rose to 42,000.

The reports of Native Commissioner mention that, because of World War II, development of the missions' activities slowed in the early-1940s. Despite this, in a major campaign, 53,979 people were vaccinated against smallpox during 1945 and a further 18,718 during 1946. All labour recruits were vaccinated against the disease from 1947 (DS, AR 1949, NAO 65, 21/14, NAN).

From the late-1940s, provision of health care expanded rapidly. During 1949, about 40,000 outpatients were treated for malaria. Quinine remained free and was always given to children and pregnant women suffering from fever (DS, AR 1950, NAO 65, 21/14, NAN; Saloheimo, interview 4 January 1996). In 1949, 3435 patients were treated for syphilis (DS, AR 1950, NAO 65, 21/14, NAN). The first X-ray apparatus came into use at Onandjokwe hospital at the end of the 1940s and patients with tuberculosis were isolated from about this time. Hospital statistics suggest that, by the end of the 1940s, about 10 per cent of all pregnant women received some hospital-based antenatal care.

By the beginning of the 1950s, the health care facilities in Ovamboland comprised the main hospital in Onandjokwe and seventeen other hospitals and clinics. Most care was provided on an out-patient basis by nurses in small missionary stations. They distributed free medication. Seriously ill patients were transported, if possible, to Onandjokwe. The population of Ovamboland at the beginning of 1950s was about 190,000; about 80,000 of them were Christian. While the mission health care facilities could not cover the entire population, health care was not restricted to Christians.

By 1952, 15 local nurses had been trained and were in post. By 1955, 13 European nurses and 27 local nurses were working in Ovamboland and a further 19 students were enrolled in the nursing school at the main hospital (MMC at Olukanda, 14-15 June 1953, Hha:24, NAF). Penicillin and streptomycin came into use at the beginning of the 1950s (DS, AR 1953, NAO 65, 21/14, NAN). Modern antimalarial drugs were also introduced (Saloheimo, interview 4 January 1996). During 1955, the hospital started weekly neonatal care clinics. During the first year, 912 patients attended these clinics (Saloheimo, AR 1956, South West Africa Administration: Health Branch, HEA, 22 1/16/96, NAN; see also Saloheimo, AR for 1957, 1960 and 1964, HEA 22, 1/16/96, NAN).

Vaccination campaigns continued during the 1960s. An immunization programme against poliomyelitis was conducted, and about 46,000 people vaccinated, in Ovamboland

during 1960-61 (Polioveldtag Ovamboland 1963, HEA 38, 2/5/3, NAN). A smallpox and diphtheria vaccination campaign followed in 1962 (Director of Health Services 5 March 1962, HEA 39, 2/5/5, NAN). Immunization of those attending maternal and child health clinics began and a mobile mother care clinic was set up (Kalliokoski, interview 24 January 1996). A malaria control programme based on spraying with DDT was started in 1965 (Diseases Malaria Ovamboland, HEA 50, 2/5/12/20, NAN) and a mobile X-ray programme for the control of tuberculosis was established at the end of the 1960s (Diseases Tuberculosis Ovamboland, HEA 47, 2/5/10/20, vol. IV, NAN).

Thus, some effective forms of health care were deployed in Ovamboland as early as the 1930s. Then, based on the foundations laid before the Second World War, a system of health care deploying effective interventions such as antibiotics, presumptive treatment of fever with antimalarials, and vaccines developed rapidly in Ovamboland between the end of the 1940s and the 1960s. After a brief lag, mortality of both children and adults fell sharply to a moderately low level.

CONCLUDING DISCUSSION

The parish registers maintained by ELCIN in Ovamboland provide a much longer-term perspective on mortality transition in sub-Saharan Africa than the census and survey data collected during the last few decades. These registers can also be used to study fertility, nuptiality, and migration since 1930 (Siiskonen 1998; Notkola and Siiskonen 1999). While the careful record keeping of the Finnish Missionary Society and ELCIN might be unique, other parish registers probably exist in Africa that could be exploited to study demographic trends.

The registers only cover members of ELCIN. They first became indicative of the mortality of the majority of the population of Ovamboland in the 1950s. Nevertheless, socioeconomic differentiation in Ovamboland was limited until recently. Christians probably had either similar mortality to the rest of the population or, because they benefited most from the services provided by the missionaries, lower mortality. Thus, the rapid growth in the membership of ELCIN at the time that mortality fell most (see Table 1) probably attenuated, rather than magnified, the drop in mortality recorded in the registers. The reduction in the mortality of the total population during the 1950s may have been even more dramatic than that among Lutherans. Comparisons with 1991 Census and DHS survey results demonstrate both the accuracy and the validity of the more recent data (apart from the omission of deaths

of unbaptized infants). As the Ovambo people living on the two sides of the international border differed little, mortality data collected in the 1940 Census of Angola provide less definitive evidence to validate the other end of the statistical series.

The parish register data document significant discontinuities and reversals in the trend in mortality in Ovamboland. The transition to moderately low mortality was largely complete by the late-1960s. Only inconclusive evidence exists of any decline in the mortality of adults before the early-1950s and almost all the drop in adult death rates was concentrated into the 15 years from then to the late-1960s. Unlike adult mortality, infant and child mortality probably fell in every decade examined except the 1940s. For children as well as adults, however, the period between 1950 and 1965 was one of particularly rapid mortality decline.

Two interpretations of the history of mortality decline in Ovamboland seem possible. First, mortality transition was already underway by the 1930s and the adverse trends of the 1940s represent a temporary interruption of an ongoing process. Second, while some reductions in mortality occurred in the 1930s, the rapid fall in mortality between the early-1950s and early-1960s was qualitatively different from what went before or, indeed, came after. The data provide no way of making a definitive choice between these views. It is perhaps inevitable that, having generated a series of mortality data that stretch back to 1930, one wishes that data on the 1920s were available as well.

Two considerations suggest that the second description of the mortality transition in Namibia mortality may be more accurate. First, a prolonged period of drought, famine, and epidemics of infectious disease occurred in Ovamboland in the early-1930s. Mortality was probably lower in the 1920s than in the early-1930s and the fall in the death rate up to the 1940s could well be no more than the last in a long series of fluctuations in mortality. Second, the 1940 Census data from Angola reveal that childhood mortality in the region inhabited by Ovambos was much lower than elsewhere in Angola. The proportion of children of women aged 30-34 who had died (which corresponds approximately to under-five mortality) was 25 per cent in Huila but ranged from 31 per cent up to 43 per cent across the other regions of Angola (van de Walle 1968, Table 2.21). Even among women aged 50-59 years, most of whose children were born early this century, the proportion of children who had died was markedly lower in Huila than elsewhere. Thus, the discovery that life expectancy at birth was more than 40 years in Ovamboland in the 1930s need not imply that a substantial drop in mortality had occurred before then. The relatively low mortality of Ovamboland and many

other parts of Southern Africa, compared with most countries further north, may extend back to before the onset of mortality transition.

In all, life expectancy in Ovamboland rose by about 25 years between the 1930s and 1980s, reaching nearly 68 years. In contrast to other Southern African populations involved in labour migration, the mortality of married men as well as women fell to a low level. We lack data on single men and their mortality might be higher. Moreover, our data exclude the experience in southern Namibia of married labour migrants. Nevertheless, while some evidence exists of an adverse trends in adult mortality since 1970, health problems such as tuberculosis, alcohol abuse, and violence, which beset populations involved in labour migration throughout Southern Africa, may not be as severe in Namibia as they are further south and east.

Unfortunately, mortality almost certainly rose in Namibia during the 1990s. The country lies at one end of the belt of high HIV prevalence countries that stretches through Botswana to Eastern Africa. By 1996, more than 10 per cent of women attending antenatal clinics in rural areas were HIV positive (Namibia 1996). By now, AIDS mortality will have had a substantial negative impact on life expectancy.

In the 1980s, Ovamboland was characterized by a pattern of high child, relative to adult, mortality like that in the South model life tables. This pattern was found in most of Africa at the onset of the HIV/AIDS epidemic (Timæus 1993). If the history of other African populations resembles that of Ovamboland, however, relatively high child mortality may have emerged only a few decades ago as the mortality transition proceeded. In Ovamboland, adult mortality made a larger contribution to the rise in life expectancy than the Coale and Demeny (1983) or United Nations (1982) model life tables predict. Thus, the Ovamboland data support the argument advanced on the basis of historical data from both Europe (Wrigley and Schofield 1981, Chapter 6; Woods 1993) and India (Mari Bhat 1989, pp. 101-106) that very high mortality regimes are often misrepresented by existing model life tables. They may be characterized by extraordinarily high adult mortality rather than extraordinarily high child mortality (Dyson 1989b, p. 3).

Standards of living probably rose in Ovamboland during the colonial period. People acquired some manufactured goods but housing and sanitary conditions improved little. Nevertheless, opportunities for employment as a migrant labourer, together with public works that guaranteed water supplies and specific famine relief measures, gradually increased food security. This development, supplemented by quarantine measures, was probably the main

cause of mortality decline in the years up to 1945. During this period, the government were already providing resources for famine relief but the relief efforts were organised largely by the missions. We suspect that the adverse trends in mortality observed during and just after the Second World War are accounted for in part by a reduction in the concern and funds that an organization based in Finland could direct to Ovamboland at this time.

While improved food security reduced crisis mortality in Ovamboland, its impact is most evident among children and in the period up to the Second World War. Equally, although the spread of schooling has probably benefited child health, it is unlikely to account for the sudden fall in mortality, concentrated among adults, that began in the early-1950s.

In a Latin American context, Palloni (1981) has argued that rapid falls in mortality that are concentrated among adults can be attributed to the deployment of modern medical technology. In the absence of socioeconomic progress, children benefit less than adults from Western health care because few effective interventions exist against two of the main causes of death at young ages, diarrhoeal and respiratory infections. This analysis may not apply areas of Africa with holoendemic, as opposed to seasonal, malaria or to recent reductions in mortality fuelled by the Expanded Program on Immunization (Ewbank and Gribble 1993). It does describe the early breakthrough to low mortality in Ovamboland in the 1950s and 1960s. This took place in the 1950s because an extensive health care system delivering effective interventions against many of the common causes of death was built up rapidly in Ovamboland from the end of the 1940s.

Owing to the restricted governmental funding, the development of the health services depended largely on the leadership and funding provided by the missionary societies. Although health care was based initially on the mission hospitals, a package of interventions and a devolved nurse and clinic-based model for care developed in Ovamboland that presages modern recommendations for Primary Health Care in the developing world. Comparison of mortality trends in Ovamboland with those in the neighbouring country of Botswana, suggests that it is the rapidity of the mortality transition that distinguishes Ovamboland, not its end-point. This small, homogenous region gained an advantage for several decades because the new drugs, vaccines, and other medical advances invented in the middle years of this century were made available to the population exceptionally quickly.

In emphasizing the contribution of medicine, we are not positing a single-factor explanation of mortality transition in Ovamboland of the type that McKeown (1976) attempted to provide for England and Wales. The early availability and rapid uptake of

modern health care interventions had a major impact, particularly for adults and at the time that mortality fell fastest. Equally, other developments in Ovamboland made a more gradual contribution to the decline in mortality, especially that of infants and children. Moreover, Western religion, Western education, and Western health care were introduced and adopted largely as a package.[5] Important synergistic interactions between them are likely to have occurred (Mosley 1985).

The literature on 'good health at low cost' emphasises that the political will to improve health is an essential underpinning of efforts to achieve low mortality in poor countries (Halstead et al. 1985). Caldwell (1986) suggests that this drive may originate in a tradition of grass-roots rural radicalism or in the top-down mobilization of a society by a Communist state. Under South African rule, however, Namibia was manifestly neither democratic nor communist. Of course, the policies of the colonial government were not uniformly malign. However, the administration only began to commit significant resources to development programmes in Ovamboland in the late-1950s and only took on primary responsibility for education and health care in the 1960s. By then, not only were these services well established but the mortality transition was largely over. Thus, in Ovamboland, the will to achieve 'good health' was neither expressed politically nor articulated through State-led services. The government supported the missionary organisations because Ovamboland was an important source of labour for the rest of South West Africa. However, it was the blending of humanitarian concern with religious commitment among the missionaries and their converts that provided the drive needed to achieve a breakthrough to low mortality in this part of Namibia.

NOTES

[1] The mapping of the parishes into the political communities is: Oshigambo - Ondonga, Okahao - Ongandjera, Tshandi - Uukwaluudhi, Nakayale - Ombalantu, and Elim - Uukwambi. The westernmost Ovambo community, Uukolonkadhi and Eunda, was excluded from the analysis because, although a parish was established there in 1920, it remained very small until the 1950s (Statistical Table of the Finnish Mission Field in Ovamboland, 1950, AEL). Oshigambo was selected from among the parishes existing in Ondonga at the beginning of the 1920s because it remained undivided until 1966 and represents the new settlements set up in the forest area at the eastern edge of the zone inhabited by Ovambos. It was planned to include the Eenhana parish in the study to represent the remaining Ovambo community, Uukwanyama. Unfortunately, it was discovered during transcription of the data that the quality of the Eenhana parish records was too poor for them to be used for demographic research.

[2] One would not usually expect infant mortality to fall as rapidly as child mortality. In these registers, however, many of the infants who died unbaptized are omitted and the data on this age group are indicative of trends in post-neonatal mortality.

[3] The aim of modelling the data is to improve the description of them rather than to test a specific hypothesis. The same procedure was used to fit the models for children and adults. It was to step backward from a model with knots in the spline at five-yearly intervals (1925, 1930 …) by eliminating insignificant changes in the trend in mortality and then to test whether any of knots eliminated previously should be reintroduced into the most parsimonious model identified by stepping backward.

[4] The data from the 1991 Census of Namibia come from unpublished tabulations for the five parishes under study produced by the Central Statistical Office.

[5] Some Ovambo and other critics of the activities of the Christian missions would consider this package a mixed blessing. In arguing that it benefited health, we imply no judgement on this wider issue, which lies outside the scope of the paper.

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Table 1. *Membership of Lutheran parishes in Ovamboland*[*]

Year	Total	Year	Total
1900	827	1950	61,936
1905	1498	1955	90,013
1910	2006	1960	132,381
1915	2641	1965	156,204
1920	7695	1970	185,366
1925	17,445	1973	213,425
1930	24,024	1980	290,261
1935	31,615	1985	342,387
1940	37,288	1990	409,949
1945	48,138		

[*] Parishes established by the Rhenish Missionary Society between 1891-1915 and members of the Ovambo-Kavango Church (ELOC/ELCIN) in Kavango are excluded.
Source: Statistical Tables of the Ovambo Kavango Church (ELOC/ELCIN) 1883-1991, AEL; Kerkgenootskappe: Statistiek 1973-1974, OVE 20, 5/16/3, NAN.

Table 2. *Poisson regression coefficients for the underlying trend in infant and child mortality in Ovamboland 1930-1990, Evangelical Lutheran Church registers*

Variable	Coefficient	Standard error
Age of child (reference category: infants)		
1-4 years	-1.29861	0.04977
5-9 years	-2.54516	0.07451
Sex (reference category: boys)		
Girls	-0.22350	0.04646
Parish (reference category: Elim)		
Nakayale	-1.00703	0.36485
Okahao	-0.29726	0.31685
Oshigambo	0.46928	0.28954
Tshandi	0.84866	0.33815
Year		
1930-90	-0.07065	0.01894
1940-90	0.08117	0.02710
1950-90	-0.07115	0.01519
1965-90	0.02916	0.00960
Year by parish		
Year * Nakayale	0.02558	0.00617
Year * Okahao	0.01304	0.00534
Year * Oshigambo	0.00014	0.00492
Year * Tshandi	-0.01117	0.00591
Constant term	-0.10235	0.71262
Deviance	4298.6 (1806df)	
Pseudo R^2	0.345	

Table 3. *Poisson regression coefficients for the underlying trend in adult mortality (men aged 20-59, women aged 20-39) in Ovamboland 1930-1990, Evangelical Lutheran Church registers*

Variable	Coefficient	Standard error
Log_e standard rates	1.07571	0.10728
Sex (reference category: men)		
Women	-0.21011	0.08520
Parish (reference category: Elim)		
Nakayale	0.13087	0.11827
Okahao	0.31995	0.09575
Oshigambo	0.24258	0.09817
Tshandi	0.06417	0.11632
Year		
1930-90	-0.02929	0.18922
1945-90	0.09721	0.05324
1950-90	-0.19546	0.06618
1955-90	0.08316	0.04095
1970-90	0.08550	0.02354
1980-90	-0.08088	0.03330
Constant term	1.26742	0.91277
Deviance	3856.4 (3518df)	
Pseudo R^2	0.061	

Table 4. *Summary indices of mortality in Ovamboland, Evangelical Lutheran Church registers*

	Mid-1930s		Around 1960		Mid-1980s	
Mortality index	Men	Women	Men	Women	Men	Women
Unadjusted infant mortality (per 1000)	(90)	(72)	(42)	(34)	(19)	(15)
Adjusted infant mortality (per 1000)*	172	157	98	90	55	51
Under-five mortality ($_5q_0$ per 1000)	249	220	139	124	74	67
Probability of dying between ages 15 and 60 ($_{45}q_{15}$ per 1000)	487	419	259	216	209	172
Life expectancy at birth (years)	41.0	45.1	57.8	61.6	66.1	69.4

* Taken from the West model life table corresponding to the death rates at ages 1 to 9 years (Coale and Demeny 1983).

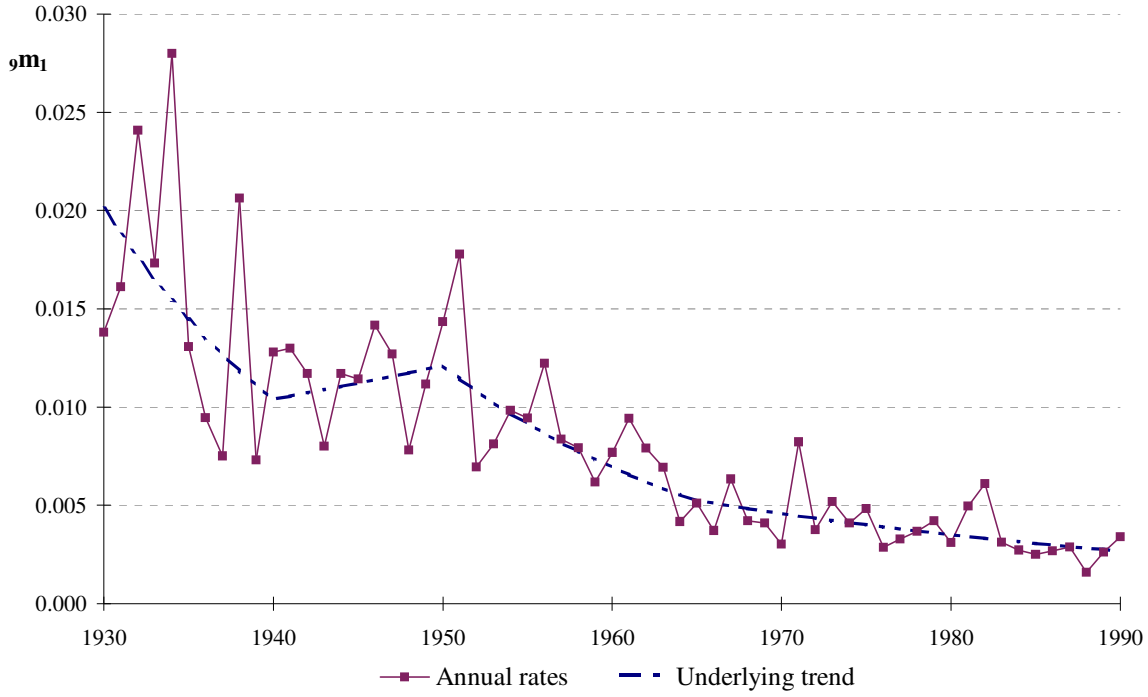
FIGURE TITLES

Figure 1. Death rate at ages 1 to 9, standardized by age, sex, and parish, Ovamboland 1930-1990. *Source:* Evangelical Lutheran Church registers.

Figure 2. Death rate at ages 20 to 59, standardized by age, sex, and parish, Ovamboland 1930-1990. *Source:* Evangelical Lutheran Church registers.

Figure 3. Evolution of mortality in childhood (${}_9q_1$)and adulthood (${}_{40}q_{20}$), Ovamboland 1930-1990. *Source:* Evangelical Lutheran Church registers.

Figure 4. Under-five mortality (${}_5q_0$) in south-western Africa, 1925-1990. *Sources:* 5 parishes - Evangelical Lutheran Church registers; 1991 Census - see endnote 2; Northwest Namibia - Katjiuanjo et al. 1993, Table 7.2; Huila - van de Walle 1968, Table 2.21; Botswana - Botswana N.D., Table D5, United Nations 1992, pp. 52-53.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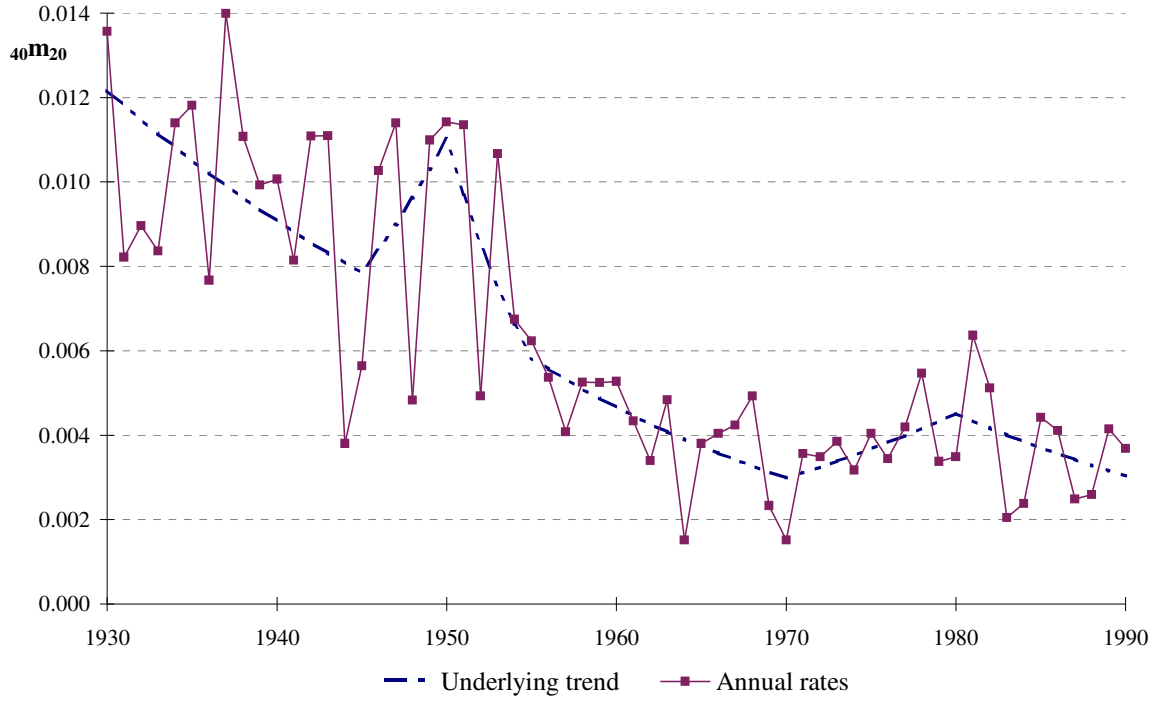
0.025
0.020
0.015
0.010
0.005
0.000
$_9m_1$
1930
1940
1950
1960
1970
1980
1990
Annual rates
Underlying trend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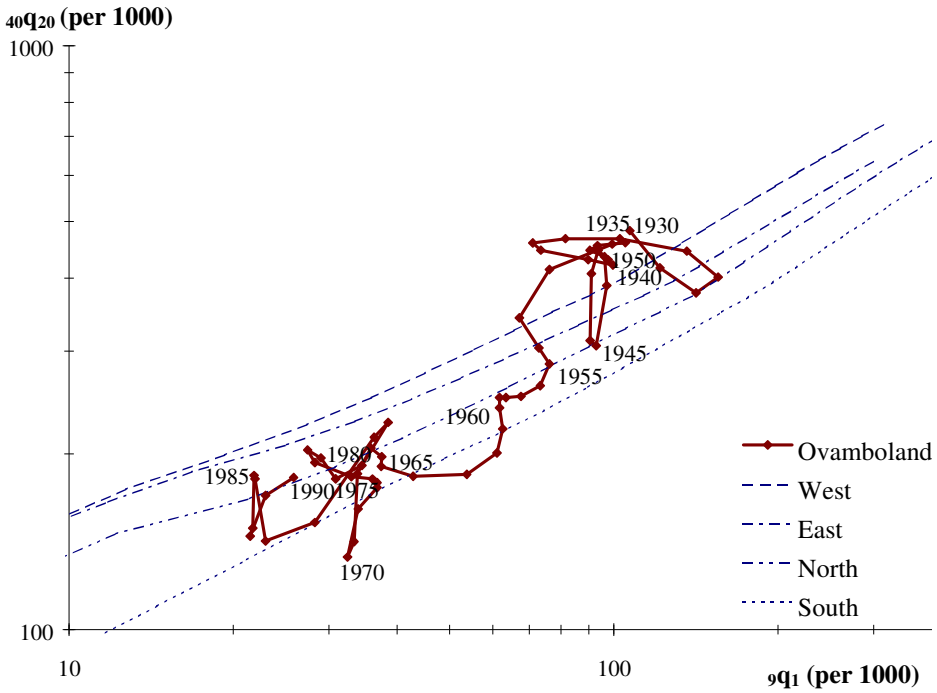
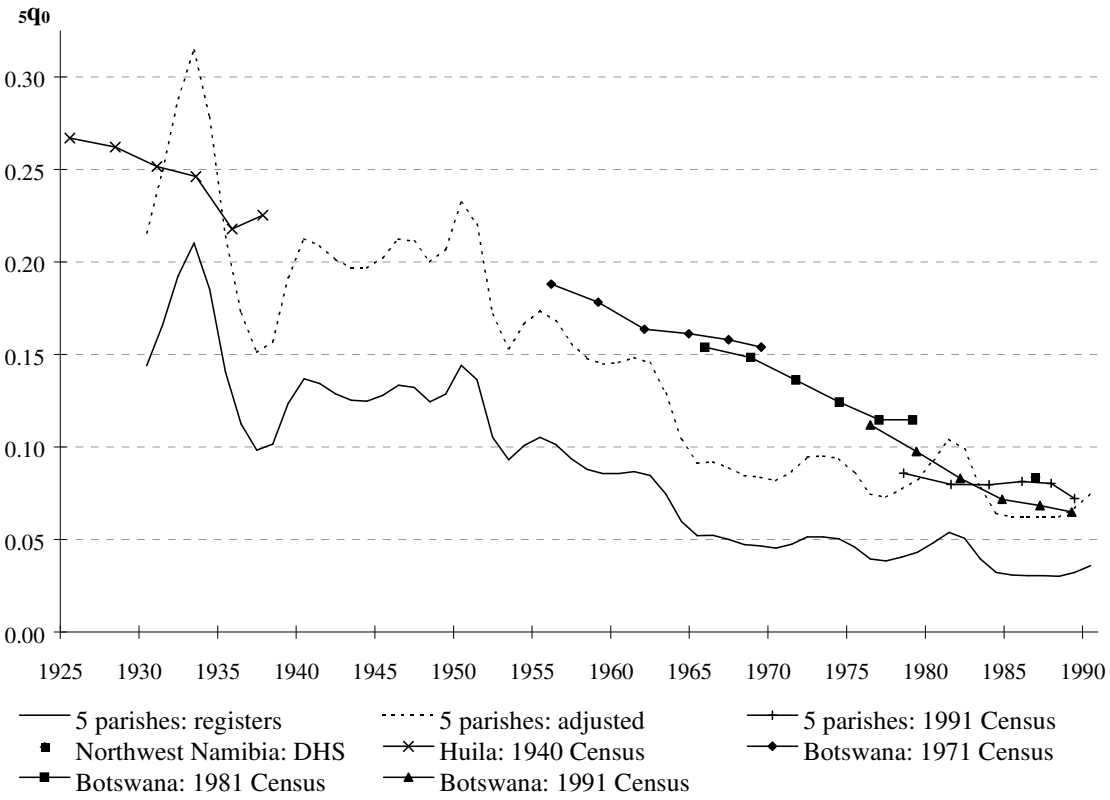
0.012
0.010
0.008
0.006
0.004
0.002
0.000
40m20
1930
1940
1950
1960
1970
1980
1990
Underlying trend
Annual rates


40q20 (per 1000)
1000
100
10
100
9q1 (per 1000)
1935
1930
1950
1940
1945
1955
1960
1980
1965
1985
1990
1975
1970
Ovamboland
West
East
North
South


5q0
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0.25
0.20
0.15
0.10
0.05
0.00
1925
1930
1935
1940
1945
1950
1955
1960
1965
1970
1975
1980
1985
1990
5 parishes: registers
5 parishes: adjusted
5 parishes: 1991 Census
Northwest Namibia: DHS
Huila: 1940 Census
Botswana: 1971 Census
Botswana: 1981 Census
Botswana: 1991 Census