News from the Regions

Causes of Death in a Rural Area of South Africa: An International Perspective

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Summary

The study compares the cause of death profile in a rural area of South Africa (Agincourt), with that in a rural area of West Africa (Niakhar), and in a developed country with the same life expectancy (France, 1951) in order to determine causes with high and low mortality and priorities for future health interventions. In the two African sites, causes of death were assessed by verbal autopsies, whereas they were derived from regular cause of death registration in France. Age-standardized death rates were used to compare cause-specific mortality in the three studies. Life expectancy in Agincourt was estimated at 66 years, similar to that of France in 1951, and much higher than that of Niakhar. Causes of death with outstandingly high mortality in Agincourt were violent deaths (homicide and suicide), accidents (road traffic accidents and household accidents), certain infectious diseases (HIV/AIDS, tuberculosis, diarrhea and dysentery), certain chronic diseases (cancer of genital organs, liver cirrhosis, gastrointestinal hemorrhage, maternal mortality, epilepsy, acute rheumatic fever, and pneumoconiosis) and malnutrition of young children (kwashiorkor). Causes of death with lower mortality than expected were primarily respiratory diseases (pneumonia, bronchitis, influenza, lung cancer), other cancers, vaccine preventable diseases (measles, whooping cough, tetanus), and marasmus. Verbal autopsies could be used in a rural area of a developing country without formal cause of death registration to identify the most salient health problems of the population, and could be compared with a formal cause of death registration system of a developed country.

Introduction

Little is known about the causes of death in sub-Saharan Africa. This is because of a strong under-registration of vital statistics, and a general lack of attention to recording causes of death.[1] The health profile of the continent is changing very rapidly due to numerous actions to improve health and socioeconomic status, and nowadays Africa simultaneously confronts diseases of poverty and diseases of development. South Africa, the most developed nation in the continent, presents an unusual combination of a quite advanced level of economic development and a modern health system co-existing with large pockets of poverty and of limited access to efficient health services. Its average situation seems roughly at a mid-point between the most advanced developed countries and the least advanced developing countries, although it often appears as more of a juxtaposition of the two. However, even the most remote places in South Africa enjoy some access to modern services, and in particular to a relatively advanced public health service.

Data on causes of death in rural areas of South Africa are virtually non-existent outside a few research sites, and are usually based on large categories of little use for public health.[2–4] One way of giving more value to cause of death data is to use more detailed categories, and to compare them with data from other countries. This type of comparison reveals at the same time problems due to the local environment and the development stage of the health system, and also permits the identification of specific problems, whatever their origin, and therefore allows priorities to be determined for future public health actions.

This paper attempts to provide a comparison of the frequencies of causes of death in a rural area of South Africa (Agincourt) with two other situations: a rural area of another developing country, in a similar traditional African setting where data collection was carried out in essentially the same way as in Agincourt (Niakhar, Senegal, 1983–1989), and a developed country with approximately the same life expectancy, and the same difference between male and female life expectancy (France, 1951).

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Data

The Agincourt site is located in the north-eastern part of South Africa, in the district of Bushbuckridge, near the Mozambican border, adjacent to the new provinces of Mpumalanga and Northern Province. The population of 20 villages has been studied prospectively by a team of researchers from Witwatersrand University since 1992. The total population accounts for about 60 000 people, two-thirds of whom are of local origin, and a third of Mozambican origin, former refugees of the civil war which raged across the border in the 1980s along with their relatives and offspring. Most of the population, however, belong to the same ethnic groups, and speak primarily Shangaan. The Agincourt community lives in the low hills of the lowveld, in scattered villages of both modern and traditional houses. People survive on income primarily from remittances of migrant workers and pensions, and also from local activities (game farms, fruit farms, trade, etc.), and from employment in the public sector. The level of monetary income is relatively low by South African standards (about 1000 SAR per person per year in 1993, or 300 USD), but certainly higher than in most rural areas of sub-Saharan Africa. Among the tropical diseases, only malaria is prevalent, at a relatively low level, although incidence may vary considerably from year to year. HIV/AIDS appeared in the area in the early 1990s and soon became a major causes of death. HIV seroprevalence among pregnant women was estimated at 16 per cent in Mpumalanga in 1995–1996. The Agincourt study is based on a Health and Demographic Surveillance System (HDSS) which routinely records birth, deaths, in- and out-migration since the initial census conducted in 1992. Deaths are further investigated by verbal autopsy using a comprehensive questionnaire. Verbal autopsy is a method of investigating the causes of death that has gained increasing recognition over the past 10 years.[5–12] The registration of births and deaths is considered virtually complete, although data on some infant deaths were missing in the first 2 years. Details on the study the DHSS and on the verbal autopsy system developed in Agincourt have been presented elsewhere.[13–17]

The second site, used for comparison with Agincourt, is located in a rural area of Senegal, in West Africa, near the town of Niakhar, district of Fatick. The population of 30 villages (about 25 000 people), was also followed by a research team from ORSTOM, and the data used for the comparison relate to the 1983–1989 period. The Niakhar study is similar in many respects to that of Agincourt, with a routine registration of births, deaths, in- and out-migration and investigation of causes of death by verbal autopsy. The registration of births and deaths is considered virtually complete, and the verbal autopsy questionnaire is very similar to that of Agincourt (in fact the Agincourt questionnaire was developed from that of Niakhar).[6] The Niakhar population belongs almost entirely to the Sereer ethnic group. People survive on a mixture of subsistence farming (primarily millet and cattle), cash crops (mostly peanuts) and remittances from migrant workers in Dakar, the capital city and in other cities. Among tropical diseases, malaria is a very serious health problem, as well as a range of filariasis, in particular elephantiasis. Malaria is highly seasonal, and malarial incidence is concentrated in the 4 months of the rainy season, July–October, usually associated with very high mortality. HIV/AIDS is prevalent in the area, although the prevalence was very low under the period considered (0.5 per cent among adult women in 1989), as in most of rural Senegal. The population is very poor, and the average annual monetary income per capita was roughly estimated in 1989 at 100 000 CFA per family of eight persons, that is an equivalent of 45 USD per capita (1989 value). In many respects, Niakhar is quite typical of rural areas of Sahelian West Africa: mortality was slightly higher than the average in Senegal or in Côte d'Ivoire, but lower than the worst cases of the region.

The third data set utilized here is France in 1951, and serves as a comparison with a developed country. The choice of country and date was derived from a collection of data sets gathered by Preston and colleagues,[18,19] that presents life tables by large categories of causes of death for 180 countries and time periods throughout the world. France 1951 was the country closest to the Agincourt situation as far as life expectancy and difference between male and female life expectancy is concerned. Once this choice was made, computerized data by detailed causes of death were obtained from INED, France, courtesy of Mr Vallin and Mrs Meslé. These data were based on a virtually complete vital registration system, with a good recording of the causes of death. Of course, this sample is much larger than the other two (565 830 deaths compared to 1001 in Agincourt and 3315 in Niakhar), and will serve as the gold standard for comparing the Agincourt data. French mortality in 1951 was similar to that of other western European countries at that time, although it was heavily affected by alcoholism, which greatly increased mortality for men compared with women for a variety of diseases.

Methods

For all three studies, a life table was computed, and the age structure of the associated stationary population used as the standard for computing age-standardized death rates. The use of the stationary population as a standard implies that age-standardized death rates are equivalent to death rates in a theoretical cohort with the same age-specific death rates. The distribution of deaths by cause in a cohort can readily be obtained by dividing the cause-specific death rate by the overall death rate. Age-standardized death rates were used to allow the breakdown by cause of death, since cause-specific age-standardized death rates do add-up to the overall age-standardized death rate.[19] Age-standardized death rates are given per million person-years. Risk ratios of cause-specific age-standardized death rates measure the relative risk of death in Agincourt compared to that of

TABLE 1

Age-standardized, cause-specific death rates (per million) in Agincourt, 1992–1995, and comparison with France, 1951, and with Niakhar (Senegal), 1983–1989: broad categories

	Age-standardized death rate, per million person-years, Agincourt 1992–1995			Relative risk: observed/expected with respect to	
Cause of death	Male	Female	Both	France	Niakhar
Infectious and parasitic	1662	1039	1309	1.70*	0.24*
Non-communicable	4645	4063	4306	0.38*	1.22*
Accident and violence	1880	569	1141	1.52*	3.48*
Unknown	5903	5711	5756	2.80*	0.50*
Total	14090	11382	12511	0.84*	0.60*

*Statistically different from 1, $p < 0.05$

France and of Niakhar, and therefore the relative weight of that cause of death in a cohort. Statistical testing of the differences in mortality between the three populations was performed by applying standard formulae for risk ratios.

Results

Level of mortality

The average level of life expectancy in Agincourt for the 1992–1995 period calculated from the raw data was 68.8 years (65.2 for males and 72.5 for females), and was most likely overestimated by about 2.5 years because of the undercount of infant deaths. This compares quite closely with France, where life expectancy was 66.4 years in 1951 (63.6 for males and 69.4 for females). The Niakhar situation had a much higher mortality, with an average of 48.8 years for the 1983–1989 period, and a much smaller difference between males and females (47.0 for males and 50.5 for females). However, it should be noted that the Niakhar situation was not that different in certain age groups from the Agincourt situation, and in particular male mortality for the age range 35–64 years in Agincourt (353 per 1000) was equal to that in Niakhar (354 per 1000) and only 12 per cent more than in France (314 per 1000).

Large categories of causes of death

Differences in life expectancy readily translate into differences in age-standardized death rates, which were

TABLE 2

Age-standardized, cause-specific death rates (per million) in Agincourt, 1992–1995, and comparison with France, 1951, and with Niakhar (Senegal), 1983–1989: infectious and parasitic diseases

		Age-standardized death rate, per million person-years, Agincourt 1992–1995			Relative risk: observed/expected with respect to	
Rank	Cause of death	Male	Female	Both	France	Niakhar
Frequent diseases						
1	Tuberculosis	1136	396	728	1.22	1.52*
2	Diarrhea and dysentery	295	446	369	11.3*	0.27*
3	AIDS	155	74	110	–	17.5*
4	Septicemia	10	75	45	1.59	0.46
Rare diseases						
5	Measles	11	5	8	0.65	0.03*
6	Malaria	10	4	7	38.5*	0.01*
7	Whooping cough	5	5	5	0.73	0.03*
8	Worm infestation	10	0	5	–	–
9	Typhoid	0	8	5	0.96	–
10	Meningitis	0	6	3	0.68	0.03*
11	Tetanus	0	5	3	1.35	0.01*
12	Hepatitis	5	0	2	0.57	0.10*
13	Other infections and parasitic	25	14	19	0.26*	0.01*
	Total infections and parasitic	1662	1039	1309	1.70*	0.24*

*Statistically different from 1 $p < 0.05$

TABLE 3
Age-standardized, cause-specific death rates (per million) in Agincourt, 1992–1995, and comparison with France, 1951, and with Niakhar (Senegal), 1983–1989: malnutrition

		Age-standardized death rate, per million person-years, Agincourt 1992–1995			Relative risk: observed/expected with respect to	
Rank	Cause of death	Male	Female	Both	France	Niakhar
1	Kwashiorkor	76	69	73	–	0.81
2	Marasmus	0	5	2	–	0.06*
3	Unspecified	5	5	5	–	0.03*
	Total	81	78	80	1.22	0.27*

*Statistically different from 1, $p<0.05$

16 per cent lower in Agincourt than in France (partly due to the missing infant deaths) and 40 per cent lower than in Niakhar, as expected (Table 1). The breakdown by large categories revealed the following: in Agincourt, mortality from infectious and parasitic diseases was higher than in France (RR = 1.70) but lower than in Niakhar (RR = 0.24); mortality from non-communicable diseases was lower than in France (RR = 0.38) but higher than in Niakhar (RR = 1.22); and mortality from accident and violence was higher than in France (RR = 1.52) and in Niakhar (RR = 3.48), all these differences being statistically significant. There was a large proportion of undetermined causes of death in Agincourt, most of them being non-communicable diseases, which biased the estimates for this category, and affected the comparison with the other sites. This was due to the low sensitivity of the verbal autopsy diagnosis of non-communicable diseases, estimated to be 65 per cent in the Agincourt validation study.[14]

Infectious and parasitic diseases

Three infectious diseases accounted for most of the mortality from infectious and parasitic diseases in Agincourt: tuberculosis, diarrhea and dysentery, and AIDS (Table 2). The death rate from tuberculosis was not significantly higher than in France (RR = 1.22), but significantly higher than in Niakhar (RR = 1.52); the death rate from diarrhea and dysentery was much higher than in France (RR = 11.31) but much lower than in Niakhar (RR = 0.27); of course, there was no AIDS in France in 1951, and the AIDS death rate was much higher in Agincourt than in Niakhar (RR = 17.5), although this comparison is not strictly valid since it does not apply to the same time period.

Each of the other infectious and parasitic diseases accounted for only a small share of overall mortality in Agincourt: malaria stands out as a small risk compared to Niakhar (RR = 0.01), as well as measles (RR = 0.03), whooping cough (RR = 0.03), meningitis (RR = 0.03), tetanus (RR = 0.01) and hepatitis (RR = 0.10), all of which are among the leading causes of death in West Africa. Cholera and varicella, which were important causes of death in Niakhar, were absent in Agincourt. The same applies to diphtheria, an important disease of the past in Europe, still existing in 1951 in France. Compared with France, mortality from these diseases (other than malaria) appears lower in general, with the exception of tetanus and septicemia; however, none of these individual differences was statistically significant. Worm infestation was prevalent in Agincourt, but could

TABLE 4
Age-standardized, cause-specific death rates (per million) in Agincourt, 1992–1995, and comparison with France, 1951, and with Niakhar (Senegal), 1983–1989: selected cancers

		Age-standardized death rate, per million person-years, Agincourt 1992–1995			Relative risk: observed/expected with respect to	
Rank	Type of cancer causing death	Male	Female	Both	France	Niakhar
1	Genital organs	260	497	400	1.99*	39.6*
2	Digestive track	243	173	206	0.21*	1.20
3	Breast		172		0.77	6.15*
4	Lung and respiratory	15	0	7	0.04*	0.49
5	Oral cavity	29	0	13	0.27	0.87
6	Other and unspecified	118	97	108	0.22*	2.51
	Total	666	939	825	0.40*	3.08*

*Statistically different from 1, $p<0.05$

TABLE 5

Age-standardized, cause-specific death rates (per million) in Agincourt, 1992–1995, and comparison with France, 1951, and with Niakhar (Senegal), 1983–1989: other non-communicable diseases

Rank	Cause of death	Age-standardized death rate, per million person-years, Agincourt 1992–1995			Relative risk: observed/expected with respect to	
		Male	Female	Both	France	Niakhar
1	Cardiovascular	1406	1228	1310	0.44*	5.50*
2	Cerebrovascular	1043	941	970	0.45*	2.45*
3	Digestive	685	444	542	0.93	6.85*
4	Respiratory	240	136	175	0.10*	0.14*
5	Diabetes and gangrene	223	104	158	1.41	3.95*
6	Maternal		89		2.84*	0.16*
7	Early infancy	76	31	53	0.23*	0.11*
8	Epilepsy	60	22	41	2.93*	0.44
9	Congenital defect	68	5	34	0.33*	1.32
10	Other non-communicable	97	47	69	0.06*	0.84
	Total non-communicable	4486	4039	4218	0.37*	1.21

*Statistically different from 1, $p<0.05$

not be compared to the other two sites, which may reveal a problem with cause of death classification.

Malnutrition

Comparison with malnutrition revealed a high risk of death for kwashiorkor in Agincourt, almost as high as in Niakhar (RR=0.81), whereas marasmus was rare in Agincourt, but was a leading cause of death in Niakhar (RR=0.06). There was no breakdown according to the same categories in France, where kwashiorkor probably did not exist. Mortality from all categories of malnutrition was only 22 per cent higher in Agincourt than in France; the difference was not significant (Table 3). This category included malnutrition of older persons in France.

Cancers

Cancer mortality could be broken down by site, although it should be remembered that the verbal autopsy data were of considerably lower quality than the hospital-based data of France. Cancer mortality appears lower in Agincourt than in France (partly because of the lower quality of data) but much higher than in Niakhar, with major differences by site (Table 4). Cancer of the genital organs had a higher mortality in Agincourt than in France (RR=1.99) and, most notably, than in Niakhar (RR=39.6). This was particularly true for females (RR=3.58 for cervical cancer compared to France). However, gastrointestinal cancers were lower in Agincourt than in France (RR=0.21) and breast cancer was not different from France, but much higher than in Niakhar (RR=6.15). Lung and other respiratory cancers appeared much lower in Agincourt than in France (RR=0.04).

Other non-communicable diseases

Other non-communicable diseases were in general lower in Agincourt than in France and higher than in Niakhar (Table 5). Compared with Niakhar, striking differences were in the higher rates of cardiovascular diseases (RR=5.50), cerebrovascular diseases (RR=2.45), digestive diseases (RR=6.85), and diabetes and gangrene (RR=3.95), and in the lower rates of maternal mortality (RR=0.16). Compared with France, striking differences were in the lower rates of cardiovascular diseases (RR=0.44), cerebrovascular diseases (RR=0.45), respiratory diseases (RR=0.10), and in the higher rates of maternal mortality (RR=2.84) and epilepsy (RR=2.93). Lower rates of early infancy and congenital defects should be interpreted with caution since data was missing for some infant deaths in Agincourt.

Among cardiovascular diseases, mortality attributed to hypertension in Agincourt was not significantly different from France, and likewise for mortality from infarcts and ischemic heart diseases and other ill-defined cardiovascular diseases, whereas mortality from acute rheumatic fever was higher than in France (RR=2.62).

Among digestive diseases, compared with France, there was a much higher death rate (RR=4.09) from gastrointestinal hemorrhage for both men and women, and a higher death rate (RR=1.8) from liver cirrhosis among Agincourt women, whereas the death rate from liver cirrhosis among Agincourt men was identical to that of French men. Other digestive diseases, peptic ulcer and cancer of the esophagus were not significantly different from France.

Another striking feature of causes of death in Agincourt was the far lower death rate from respiratory diseases than in France (RR=0.10) and in Niakhar (RR=0.14). This applied to virtually all detailed causes investigated (pneumonia, bronchitis, asthma, influenza, lung cancer and other respiratory diseases), with the sole exception of pneumoconiosis, a disease of mine workers,

TABLE 6

Age-standardized, cause-specific death rates (per million) in Agincourt, 1992–1995, and comparison with France, 1951, and with Niakhar (Senegal), 1983–1989: accident and violence

		Age-standardized death rate, per million person-years, Agincourt 1992–1995			Relative risk: observed/expected with respect to	
	Cause of death	Male	Female	Both	France	Niakhar
1	Motor vehicle accident	639	158	373	6.24*	11.1*
2	Household accident	100	112	108	2.42*	1.58
3	Other accident	169	107	132	0.29*	0.70
4	Homicide	742	179	419	13.3*	29.5*
5	Suicide	230	14	108	0.68	4.79*
	Total	1880	569	1141	1.52*	3.48*

*Statistically different from 1, $p<0.05$

which was higher than in France (RR = 1.61), and non-existent in Niakhar (there are no mines in Senegal). The death rate from pneumonia and bronchitis seemed outstandingly low. However, death rate from asthma was not much different from that in Niakhar.

Accidents and violence

Perhaps the most striking feature about the causes of death structure in Agincourt was the high death rate from accidents and violence (Table 6). In particular, homicide was 13 times higher than in France (RR = 16.6 for men and RR = 9.1 for women), and 30 times higher than in Niakhar (RR = 24.8 for men and infinite for women). Suicide was also much higher than in Niakhar for men (RR = 8.43) but not for women (RR = 0.74). Similarly, deaths from motor vehicle accidents were also far more frequent in Agincourt than in France (RR = 6.24) and than in Niakhar (RR = 11.1). The sex ratio of motor vehicle accidents (4.1 men per woman) was roughly the same as in France. Household accidents were also more prevalent than in France (RR = 2.42), but not statistically different from those in Niakhar. Among household accidents, there was no striking difference between men and women, as was the case in France, but contrary to the Niakhar situation where most household accidents occurred among males.

Discussion

The comparison of causes of death derived from verbal autopsy with causes of death derived from hospital-based diagnosis worked surprisingly well for a number of diseases, better than the investigators anticipated at first, and better than could have been anticipated from published values of sensitivity and specificity of verbal autopsies.[8–12] The main question is obviously how meaningful is this comparison, given the limitation of the data.

Despite a similar level of overall mortality, the comparison with France revealed striking differences in the pattern of causes of death in Agincourt. The two rural African sites had not only different levels of mortality but also striking differences in the pattern of causes of death. Many of these differences, even at the level of very specific causes of death, were statistically significant despite the relatively small number of deaths in Agincourt. Several of these differences appeared very robust to every check done on data quality, and were consistent with a priori knowledge of the three situations. Some of the differences (or lack of) might be due to inaccuracies in the data in one or both sites. While data on infectious and parasitic diseases and on accidents and violence seemed more reliable, this was not the case for non-communicable diseases: in this category, there was a large number of undetermined causes, as well as prior evidence of low sensitivity and low specificity of the verbal autopsy (VA) diagnosis. However, when mortality from non-communicable disease was significantly higher than in France (for instance cancer of the genital organs, maternal mortality, epilepsy) or very much lower than in France (for instance most respiratory diseases) it is likely that this difference was meaningful. When mortality in Agincourt was only slightly lower for certain non-communicable diseases, it remains possible that the difference could be attributable to the low sensitivity of the VA diagnosis; however, in these cases the difference was usually not statistically significant (for instance hypertension), and no conclusion could be drawn. The comparison with Niakhar was more straightforward, since the methodology of data collection was similar, but judgment on the validity of the comparison was more difficult, since diagnoses in both sites had a low sensitivity and specificity. However, the main differences (cardiovascular, cerebrovascular, respiratory, cancers) seemed to be in the expected direction, with no striking inconsistency between the two sites.

A second limitation of this analysis is the aggregation of age groups in the age-standardized death rates. It would be cumbersome to analyse all the combinations of 158 detailed causes of death, 19 age groups and two sexes, and furthermore most of the differences would not be significant due to the small number of cases in each

cell. However, in many instances, causes of death were quite specific to one age group (children, young adults, older adults); therefore differences in the age-standardized rates will reflect those of that particular age group. However, it remains possible that some of the differences not significant in the age-standardized rates could have been significant in the specific age groups, and vice versa, had the sample been larger.

Another limitation of the comparison is the difference in time periods. This inconsistency probably plays a smaller role in the Niakhar–Agincourt comparison, with the exception of HIV/AIDS, but may be more important in the comparison between France and Agincourt. In particular, vaccines and antibiotics are far more widely available, in quantity and quality, than in the 1950s. This may well explain the low rate of mortality from respiratory diseases, and above all of pneumonia, in Agincourt. Also, mortality from vaccine preventable diseases (measles, whooping cough, tetanus) diminished very rapidly in the late 1980s and early 1990s in West Africa, and a comparison of mortality from those diseases over the same period (1992–1995) in Niakhar would probably be very different.

Despite these limitations, there are striking features of the mortality profile in Agincourt which call for specific action. Above all, accidents and violence appear as the most important category of abnormally high mortality and cause of premature death in Agincourt. This applies not only for homicide and suicide, but also for road traffic accidents and household accidents. Among infectious and parasitic diseases, the complex of HIV/AIDS, tuberculosis, diarrhea and dysentery appears as the most important. For malnutrition, the mortality from kwashiorkor appears abnormally high. Among cancers, the death rate from cancers of the female genital organs (cervix and uterus) is the leading problem. Among other non-communicable diseases, maternal mortality and epilepsy could be much lower, as well as hypertension and acute rheumatic fever. There is also a special problem around liver cirrhosis and upper gastrointestinal bleed, France not being an appropriate standard, for these conditions are highly correlated with alcoholism. Pneumoconiosis is also a problem in Agincourt, and is a direct consequence of the mining industry, the leading industry in South Africa, which employs large numbers of migrant workers from Agincourt; note that pneumoconiosis was also prevalent among the French miners in 1951.

In terms of risk factors, and possible interventions, a few conclusions can be drawn. For young adults, special effort should be spent on controlling sexually-transmitted diseases (HIV/AIDS, cancers of the female genital organs), and on reducing the maternal risk. For older adults, monitoring and treatment of hypertension seems to have been neglected in the area. Alcohol seems a severe underlying problem behind digestive diseases as well as behind motor vehicle accidents and violence. For children, efforts should be devoted to the prevention and treatment of kwashiorkor, diarrhea and epilepsy. In addition, household structure, and in particular the very frequent absence of one or both parents of young children, seems to be an important risk factor of household accidents among children, and may be of kwashiorkor.

In summary, Agincourt appears as a transitional society, with a general level of mortality that is quite favorable given the level of income. It combines a relatively high prevalence of some diseases of the developing world (kwashiorkor, diarrhea), of new diseases prominent in modern Africa (HIV/AIDS, STDs, violence), and of some diseases of development (motor vehicle accident, hypertension, diabetes). For other diseases, the prevailing situation seemed to correspond with what might have been anticipated at this level of development, and sometimes was better (respiratory diseases).

Further improvements in health and mortality will require improvements in preventive and curative services, together with effective health education, increasing income, and improved levels of general education. In this respect, HIV/AIDS, other STDs, and tuberculosis appear to be crucial challenges to overcome, if a further reversal in general mortality trends, already visible for young adults, is to be avoided.[16]

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Checklist for Authors

Originality

Does the study make an original scientific contribution or new observation on the topic?

Usefulness

Are the findings likely to contribute to improved standards of care?

Would the findings have an impact on preventive/promotive care?

Design Features

Is the objective of the study clearly defined?

Is the study design appropriate for the objective?

Are the subjects for the study and their source, as well as the inclusion/exclusion criteria defined?

Are the sampling methods likely to give rise to bias?

Is there a statement included about sample size?

Is the method for collection of data clearly described and referenced for laboratory data?

Are the study and comparison groups similar in all respects except for the topic of inquiry?

Is the response rate satisfactory?

If intervention has been used was the allocation random and blind?

Have the outcome measures been defined?

Are there any drop outs?

Analysis and Presentation

Is the statistical procedure employed (including the software used) clearly stated?

Do the results adequately answer the research question?

Is the interpretation of results reasonable?

References

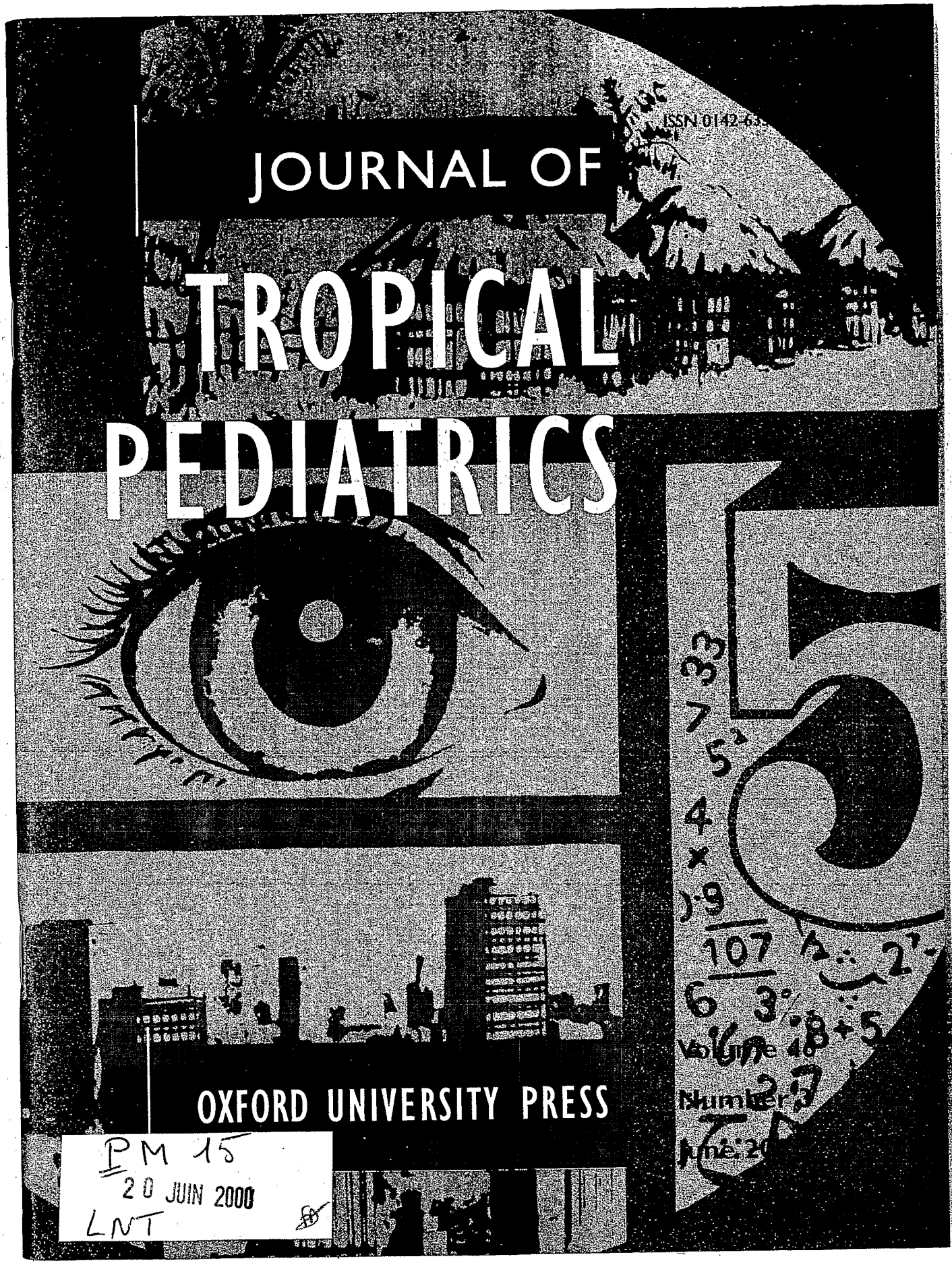
Are the references relevant to the study and up to date?

Are the references cited in the style required?

Ethics

Are the design and conduct of the study ethical?

Has the permission of the local ethical committee been sought and received?



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