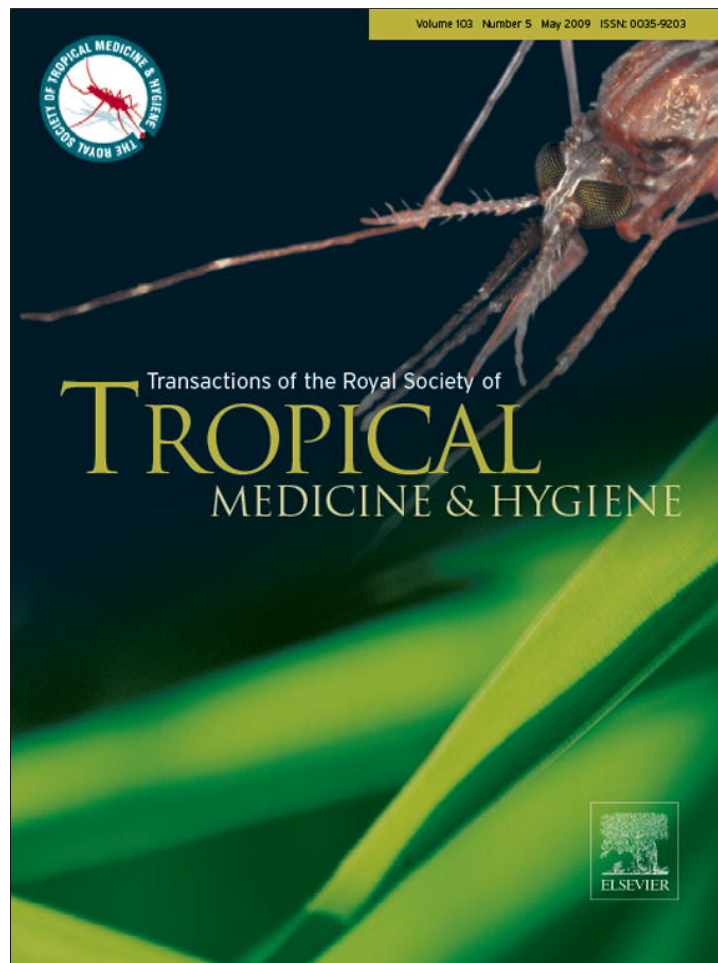


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Poverty, inequality and health: the challenge of the double burden of disease in a non-profit hospital in rural Ethiopia

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Received 18 July 2008; received in revised form 26 November 2008; accepted 26 November 2008

Available online 20 January 2009

KEYWORDS

Disease burden;
Poverty;
Communicable diseases;
Non-communicable diseases;
Healthcare;
Ethiopia

Summary This study was aimed at describing disease patterns in a rural zone of Oromiya region, Ethiopia through a retrospective analysis of discharge records for 22 377 inpatients of St. Luke Hospital, Wolisso, Ethiopia in the period 2005–2007. The leading cause of admission was childbirth, followed by injuries, malaria and pneumonia. Injuries were the leading cause of in-hospital deaths, followed by pneumonia, malaria, cardiovascular disease and AIDS. Vulnerable groups (infants, children and women) accounted for 73.3% of admissions. Most of the disease burden resulted from infectious diseases, the occurrence of which could be dramatically reduced by cost-effective preventive and curative interventions. Furthermore, a double burden of disease is already emerging at the early stage of the epidemiological transition, with a mix of persistent, emerging and re-emerging infectious diseases and increasing prevalence of chronic conditions and injuries. This will lead to fundamental changes in the volume and composition of demand for healthcare, with a more complex case mix and more costly service utilization patterns. The challenge is to address the double burden of disease, while focusing on poverty-related conditions and targeting vulnerable groups. Monitoring disease and service utilization patterns through routine hospital information systems can provide sustainable, low-cost support for evidence-based health practice.

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1. Introduction

The description of the disease profile of a country is crucial to guide health strategies and to address the key issues of the resources to be mobilized, their equitable distribution and efficient use.¹ Monitoring changes in disease profile is particularly important at the early stage of the epidemiological transition in developing countries, the process by which falling fertility and mortality produce rapid declines in communicable diseases among the young, leading to an ageing population with a rising proportion of older members among whom chronic disorders predominate.² The result is an overall decrease in mortality accompanied by a changed pattern of causes of death.³ The degree to which the current level of mortality might be reduced depends largely on the prevailing causes of death and the extent to which individual diseases may be controlled, either by the utilization of appropriate medical technologies or by improving standards of living, nutrition and sanitation.

Difficult choices have to be made from among competing demands for healthcare in the context of high disease burden and severely limited resources, and it is imperative to make informed decisions for management purposes. However, major information gaps exist and, in this context, readily available information collected using standardized procedures, such as data from hospital discharge records, becomes extremely important as these data can provide useful indications of the health situation at a low cost in a long-term, sustainable way.

This study was based on 22 377 medical records of inpatients admitted to St. Luke Hospital, Wolisso during the period 2005–2007, and its objective was to describe the morbidity and mortality patterns in the hospital as well as its performance in addressing the health needs of the catchment population.

2. Materials and methods

We reviewed all the discharge records in the period 2005–2007 for inpatients of St. Luke Hospital in Wolisso, Ethiopia (referred to as Wolisso Hospital). The analysis was limited to the principal cause of hospital admission recorded on the discharge records of 22 377 patients admitted during the study period, including 1019 records for patients who died in the hospital. The principal cause of hospital admission was coded according to the International Classification of Diseases, tenth revision (ICD-10).⁴ For the mortality analysis, the principal cause was considered to be the cause of death. The diagnoses were entered into a computerized database. The procedures for collecting and storing data did not change during the study period.

Wolisso Hospital is a private, non-profit facility located in Wolisso town, capital of the Southwest Shoa zone, Oromiya region, Ethiopia. It is the referral hospital for the zone, which has a population of over 1 175 000, and also hosts a college of nursing. The hospital is supported by an Italian non-governmental organization (Doctors with Africa-CUAMM) and it began services in January 2001, with the number of beds increasing over time from 83 in 2001 to 144 in 2007. The hospital has a policy of giving priority for

access to services, which are provided at subsidized prices, to economically and socially disadvantaged individuals. In recognition of these activities the hospital receives financial support from the Oromiya Regional Health Bureau within the framework of a public-private partnership. A public health programme supported by the Italian Cooperation is underway, focusing on the provision of preventive and promotional services in the community and on the development of the health referral system.

During the study period the hospital had four wards (medicine, surgery, paediatrics, and obstetrics-gynaecology), with the addition of a new orthopaedic ward in 2007. It provided a full range of clinical, diagnostic and ancillary services, including an outpatient department (OPD), antenatal and under-five-years clinics, public health department, psychiatric clinic, pharmacy, laboratory, x-ray and ultrasound services. The total number of outpatient visits was 157 155 in the period 2005–2007 and the total number of hospital admissions was 22 377, with a bed occupancy rate of 86.9%, an average length of stay (ALOS) of 6.6 days and a bed turnover rate of 52.2 inpatients per bed per year (St. Luke Hospital, unpublished report). The number of major surgical interventions increased from 1908 in 2005 to 2607 in 2007. Concerning obstetric services, of 5650 deliveries assisted during the period 2005–2007 almost half (43%) were abnormal, with 1444 caesarean sections being performed. Vulnerable groups (infants, children and women) accounted for 73.3% of admissions, a percentage which is higher than their proportion in the general population (59.5%).⁵

Indicators used to monitor the quality of care included the percentage of post-operative infected wounds (3.4% in the period 2005–2007), the percentage of peri-operative deaths (1.2%), the percentage of OPD patients discharged without treatment (0.8%), and the average number of drugs prescribed per patient by the OPD (2.0%). Preventive services performed by the hospital included antenatal visits for pregnant women (26 970 in the period 2005–2007), immunizations for infants (38 282) and voluntary counselling and testing for HIV/AIDS (7475). The hospital is also a centre for the prevention of mother-to-child transmission of HIV and the provision of antiretroviral treatment (ART), with 333 AIDS patients on ART in 2007.

Oromiya is the largest region of Ethiopia, a country located in the horn of Africa that has more than 77 million inhabitants. Ranking 99 out of 103 on the UNDP Human Poverty Index Ethiopia remains one of Africa's poorest states, with 45% of the population living below the poverty line.⁶

3. Results

The leading cause of admission was childbirth, with over a quarter of the total, followed by injuries, malaria, pneumonia and complications of pregnancy. The total number of admissions was higher for females (59.7% of the total) due to the high frequency of admission for childbirth and gynaecological-obstetric conditions. Men had more admissions for the other leading causes, with the highest male-to-female ratio being found for injuries and musculoskeletal diseases. The greatest number of bed days was

Table 1 Number of admissions by gender with bed days and average length of stay (ALOS) for the ten leading causes of admission

| Cause | Male admissions <i>n</i> (%) | Female admissions <i>n</i> (%) | Total admissions <i>n</i> (%) | M:F ratio | Bed days <i>n</i> (%) | ALOS (days) |
|----------------------------|---------------------------------|-----------------------------------|----------------------------------|--------------|-----------------------|----------------|
| Childbirth | — | 5650 (42.3) | 5650 (25.2) | — | 19382 (13.1) | 3.4 |
| Injuries | 1277 (14.1) | 482 (3.6) | 1759 (7.9) | 2.6 | 18393 (12.4) | 10.5 |
| Malaria | 698 (7.7) | 618 (4.6) | 1316 (5.9) | 1.1 | 7219 (4.9) | 5.5 |
| Pneumonia | 719 (8.0) | 484 (3.6) | 1203 (5.4) | 1.5 | 8807 (6.0) | 7.3 |
| Complications of pregnancy | — | 1088 (8.2) | 1088 (4.9) | — | 3213 (2.2) | 3.0 |
| Malnutrition | 546 (6.0) | 457 (3.4) | 1003 (4.5) | 1.2 | 13489 (9.1) | 13.4 |
| Diarrhoea | 615 (6.8) | 381 (2.9) | 996 (4.5) | 1.6 | 6416 (4.3) | 6.4 |
| Musculoskeletal disease | 637 (7.1) | 347 (2.6) | 984 (4.4) | 1.8 | 10624 (7.2) | 10.8 |
| Tuberculosis | 455 (5.0) | 415 (3.1) | 870 (3.9) | 1.1 | 9744 (6.6) | 11.2 |
| Cardiovascular disease | 353 (3.9) | 289 (2.2) | 642 (2.9) | 1.2 | 4247 (2.9) | 6.6 |
| Other illness | 3728 (41.3) | 3138 (23.5) | 6866 (30.7) | 1.2 | 46482 (31.4) | 6.8 |
| Total | 9028 (100.0) | 13349 (100.0) | 22377 (100.0) | 0.7 | 148016 (100.0) | 6.6 |

observed for childbirth, followed by injuries, and the longest ALOS was seen for malnutrition, followed by tuberculosis (TB) (Table 1).

With regard to the distribution of total admissions by age and gender (Figure 1), there were two peaks: the first in childhood and the second in young adulthood. Children aged 0–4 years accounted for 23.3% of admissions, yet they represented only 18.7% of the general population.⁵ Male children accounted for the majority (58.4%) of these admissions. A second peak was observed for young adults, with persons aged 15–34 years accounting for 46.3% of admissions but only 33.6% of the general population. Women accounted for over three-quarters (77.6%) of the admissions in this age group.

The distribution of the leading causes of admission by age group is shown in Figure 2. A limited number of diseases (malaria, pneumonia, diarrhoea and malnutrition) accounted for 59.0% of admissions in childhood. Deliveries, both normal and complicated, and complications of pregnancy and the puerperium accounted for the majority of female admissions in reproductive age groups, while injuries were the leading cause of admission among young adult males. Hyperplasia of the prostate and cardiovascular disease accounted for an increasing percentage of admissions among older age groups.

The distribution of in-hospital deaths, the proportional mortality rate (PMR) and the case fatality rate (CFR) for the ten leading causes of death are shown in Table 2. Injuries were the leading cause of in-hospital death (10.4% of the total), followed by pneumonia, malaria, cardiovascular disease and AIDS; whereas viral hepatitis, newborn diseases and AIDS were the most severe conditions, as shown by the high CFRs. The total number of deaths was slightly higher for males (54.5% of the total), and the leading causes were similar by gender, yet with some important differences: women had more deaths from viral hepatitis and fewer from injuries. Infectious diseases accounted for 33.5% of the total admissions and for 58.0% of the total deaths, while non-communicable conditions accounted for about one-third of both admissions and deaths (36.9% and 39.7%, respectively). The remainder were maternity admissions (29.6%), accounting for 2.3% of deaths.

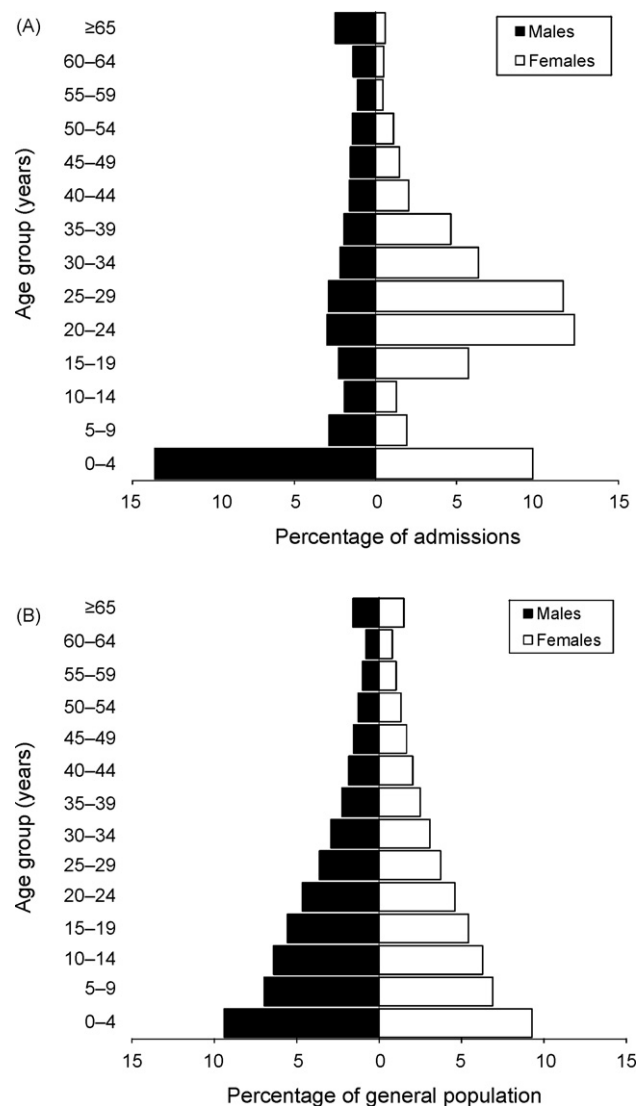


Figure 1 Percentage of admissions to Wolisso Hospital 2005–2007 by age group and gender (A), compared to the percentage of the population in Oromiya region by age group and gender (B)⁵.

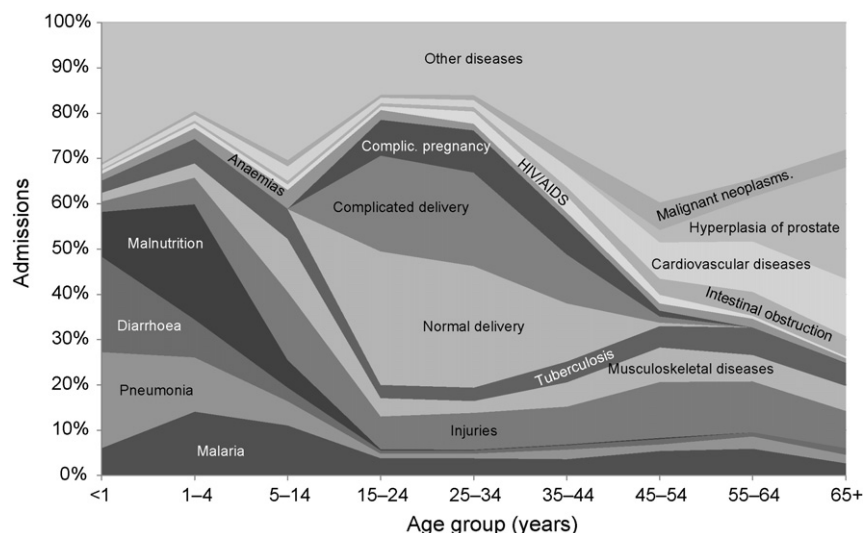


Figure 2 Proportion of admissions to Wolisso Hospital 2005–2007 for the leading causes of admission by age group among inpatients.

Table 2 In-hospital deaths, proportional mortality rate (PMR) and case fatality rate by gender for the ten leading causes of in-hospital death

| Cause | Male deaths | | Female deaths | | Total deaths | | M:F ratio | Case fatality rate ^a (%) | | |
|------------------------|-------------|----------------------|---------------|----------------------|--------------|----------------------|-----------|-------------------------------------|---------|-------|
| | <i>n</i> | PMR ^b (%) | <i>n</i> | PMR ^b (%) | <i>n</i> | PMR ^b (%) | | Males | Females | Total |
| Injuries | 81 | 14.6 | 25 | 5.4 | 106 | 10.4 | 3.2 | 6.3 | 5.2 | 6.0 |
| Pneumonia | 51 | 9.2 | 46 | 9.9 | 97 | 9.5 | 1.1 | 7.1 | 9.5 | 8.1 |
| Malaria | 47 | 8.5 | 41 | 8.8 | 88 | 8.6 | 1.1 | 6.7 | 6.6 | 6.7 |
| Cardiovascular disease | 35 | 6.3 | 38 | 8.2 | 73 | 7.2 | 0.9 | 9.9 | 13.1 | 11.4 |
| AIDS | 38 | 6.8 | 34 | 7.3 | 72 | 7.1 | 1.1 | 19.6 | 19.8 | 19.7 |
| Malnutrition | 30 | 5.4 | 37 | 8.0 | 67 | 6.6 | 0.8 | 5.5 | 8.1 | 6.7 |
| Tuberculosis | 34 | 6.1 | 28 | 6.0 | 62 | 6.1 | 1.2 | 7.5 | 6.7 | 7.1 |
| Meningitis | 22 | 4.0 | 16 | 3.4 | 38 | 3.7 | 1.4 | 18.8 | 19.0 | 18.9 |
| Viral hepatitis | 4 | 0.7 | 31 | 6.7 | 35 | 3.4 | 0.1 | 11.4 | 46.3 | 34.3 |
| Newborn diseases | 16 | 2.9 | 18 | 3.9 | 34 | 3.3 | 0.9 | 18.2 | 23.7 | 20.7 |
| Other disease | 197 | 35.5 | 150 | 32.3 | 347 | 34.1 | 1.3 | 4.4 | 1.5 | 2.4 |
| Total | 555 | 100.0 | 464 | 100.0 | 1019 | 100.0 | 1.2 | 6.2 | 3.5 | 4.6 |

^a The proportion of deaths out of the number of cases for a specific disease.

^b The proportion of deaths from a given cause out of the total number of deaths.

The PMR for the leading causes of death by age group is shown in Figure 3. Malaria, pneumonia and malnutrition, together with newborn diseases and septicaemia, accounted for 65.6% of the overall deaths in the 1–4 years age group. Injuries, AIDS, liver diseases and TB were the leading causes of death in the age groups between 15 and 54 years, while cardiovascular disease was the leading cause of death from age 65 onwards.

4. Discussion

Health systems in Africa are straining under a double burden of persistently high morbidity and mortality rates from communicable diseases coupled with increasing rates of non-communicable diseases. The health systems were developed to provide acute, episodic care and are,

therefore, inadequately designed and resourced to care for people with chronic or trauma-related conditions. In this context, hospital discharge records are an important source of data because they are readily available in the health facilities, monitor the resources used and services provided, and allow disease surveillance.⁷ However, hospital-based studies are prone to selection bias⁸ as patients admitted to the hospital may not be representative of all patients in the community and no community-wide inference should be made from hospital data.

Since socially marginal and economically deprived groups have the greatest overall need for healthcare but are least able to obtain it (the so-called ‘inverse care law’),⁹ the policy of Wolisso hospital is to give priority for access to quality services to the poor and vulnerable, and provide care at subsidized, low fees. Almost three-quarters of the inpatient services are currently targeted towards the most vulnerable

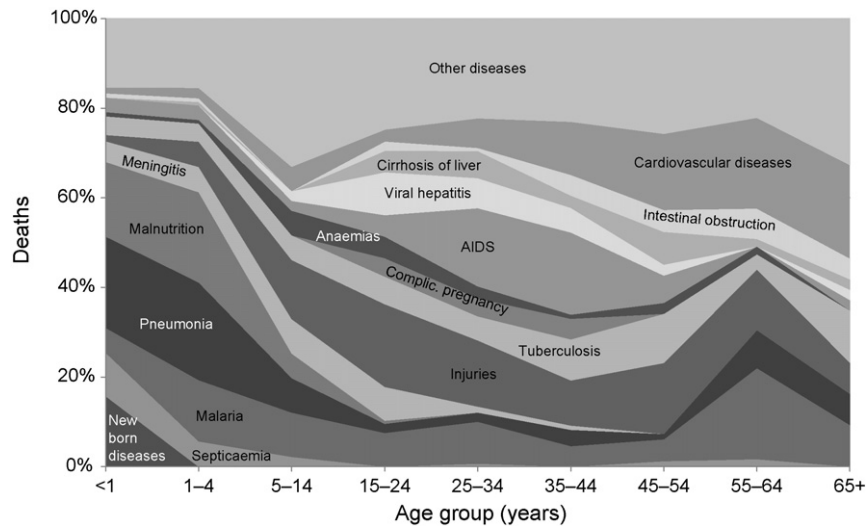


Figure 3 Proportional mortality rate at Wolisso Hospital 2005–2007 for the leading causes of death by age group among inpatients.

groups (infants, children and women). This is different from patterns observed in other hospitals in sub-Saharan Africa, where adults and the elderly represent a disproportionately high percentage of users (an estimated 70% of admissions,¹⁰ as do economically advantaged individuals.¹¹ The focus on infant, child and maternal care helps to target those in poverty, since the disease burden in young age groups and at childbirth is particularly high among the poor.¹² In fact, not only are death rates higher among the poor compared to the rich, but the highest poor-rich mortality ratio is observed for complications of pregnancy and childhood infectious diseases.¹³ In our study, females generally accounted for a higher number of admissions than males; however, this was mainly due to childbirth and gynaecological-obstetric conditions. Except for the female reproductive years (15–44 years), male admissions were more frequent in all age groups. In particular, a gender-based differential pattern of care was observed in childhood, with more admissions being found among boys than girls. This pattern has been reported in other developing countries,¹⁴ where girls are less likely to receive treatment than boys, reflecting unequal access to healthcare due to cultural norms and different roles in society.^{15,16}

The challenge at Wolisso Hospital is to address the double burden of communicable and non-communicable diseases, while focusing on vulnerable groups (infants, children and women) and giving priority to poverty-related diseases. The description of morbidity and mortality patterns is important for this purpose. Childbirth was the leading cause of admission, followed by injuries, malaria, pneumonia, complications of pregnancy and malnutrition. Injuries, pneumonia and malaria were also the leading causes of in-hospital death, followed by cardiovascular disease, AIDS and malnutrition. Childbirth and gynaecological-obstetric conditions accounted for almost one-third (30.1%) of admissions. It is worth noting that inpatient obstetric care is part of the hospital's wider strategy of combining prenatal care (focusing on maternal risks and the prevention and treatment of complications) with improved access to emergency obstetric care, thus ensuring a continuum of care during pregnancy and delivery, and after birth. Almost half of the

total maternity admissions were related to abnormal deliveries, reflecting the high number of cases referred to the hospital for complications.

Malnutrition is among the leading causes of morbidity and mortality in Wolisso Hospital, being the sixth most frequent cause of both admissions and deaths. This reflects the burden of malnutrition on child health in the country, where 47% of children suffer from stunting due to chronic under-nutrition, and 11% from wasting due to acute under-nutrition.¹⁷ As a result of this evidence, a malnutrition unit was set up in Wolisso hospital with case management performed according to the UNICEF 2004 guidelines. The outcome of severely malnourished children was evaluated after one year of experience and showed a mortality rate of 7.1%, which was significantly lower than reported in the literature.¹⁸ Of note is the fact that malnutrition is still the most important underlying factor in the high infant and child mortality in Ethiopia, and many children are simultaneously afflicted with malnutrition and multiple infections.

The chain of events leading to childhood death is complex. Malnutrition increases the severity of infectious diseases such as pneumonia, malaria and diarrhoeal diseases. It is estimated that malnutrition is not only the direct cause of about one-fifth of the overall deaths in childhood, but is also an associated factor in over half of childhood deaths.¹⁹ Malnutrition aggravated by parasitic infection also leads to physical and mental disability and thereby perpetuates a cycle of unproductive labour, poverty and impairment.²⁰ Other factors may also contribute to the huge burden of communicable diseases among children, including exposure to vectors and environmental hazards (such as polluted water), overcrowding, and the lack of access to healthcare services. Pneumonia provides an example of this complex interaction. Undernourished children run a higher risk of developing pneumonia; environmental factors such as living in crowded homes and being exposed to parental smoking or indoor air pollution may also play a role in increasing children's susceptibility to pneumonia. Prevention is as important as cure in reducing child deaths from pneumonia.²¹ The key preventive measures for children are adequate nutrition (including exclusive breastfeeding and

vitamin A supplementation), reduced indoor pollution and increased immunization coverage with vaccines that either prevent infections that directly cause pneumonia, such as *Haemophilus influenzae* type b (Hib), or prevent infections that can lead to pneumonia as a complication, for example, measles and pertussis. The hospital supported the implementation of the expanded programme on immunization, the schedule of which includes pentavalent vaccine (diphtheria, pertussis, tetanus, Hib and hepatitis B) as well as measles vaccine.

Malaria is still among the leading causes of admission and in-hospital death at Wolisso Hospital. However, effective antimalarial interventions have been implemented over the past 3 years, including the use of artemisinin combination therapy as first-line treatment for falciparum malaria, complemented by the distribution of nearly 20 million insecticide-treated nets (ITNs) to provide each household in malaria-endemic areas with two ITNs.²² Following these interventions, reductions in malaria outpatient morbidity (of 48%), inpatient morbidity (54%) and mortality (55%) were observed in a sample of Ethiopian facilities in 2007 compared to the baseline period 2001–2004.²³ In this context, Wolisso acted not only as a referral hospital for severe malaria cases, but was also in charge of training and supportive supervision of peripheral health units.

These patterns of morbidity and mortality highlight that most of the disease burden is attributable to a limited number of conditions for which either preventive or curative interventions exist. Therefore, a priority for the health system is to achieve effective delivery of these interventions and to integrate preventive and curative services. It is for this reason that a comprehensive public-health approach has been implemented by the hospital in its catchment area, including immunization, health education and outreach services, as well as support for primary care in the community and development of the referral system. An integrated approach is also effective in addressing diseases that affect mainly adults. The example of TB illustrates the public-health importance of curative services and the relationship between prevention and treatment. In fact, the best way to prevent TB is to provide effective treatment to patients with active pulmonary TB so as to interrupt the chain of transmission; good treatment programmes are the best prevention programmes.²⁴

An integrated approach was also implemented for AIDS, with a continuum of care from household to outpatient and inpatient care. In particular, a complex set of interventions was put in place, including health education, voluntary counselling and testing services, prevention of mother-to-child transmission of HIV and provision of free ART for people living with HIV/AIDS. As a result, AIDS was not among the leading causes of admission during the study period; however, due to its severity, AIDS was the fifth leading cause of in-hospital death, showing a high CFR (19.7%).

Non-communicable diseases accounted for about one-third of admissions and in-hospital deaths; four non-communicable diseases were already among the top ten causes of admission, while three were among the leading causes of death. These patterns are consistent with the early stages of epidemiological transition, with injury and non-communicable diseases already accounting for 27% of the total burden of disease in Africa. But these

non-communicable diseases and injuries tend to be overshadowed by other headline-grabbing illnesses such as HIV/AIDS and are given low priority and few resources.²⁵

Injuries were the leading cause of death and the second most frequent cause of admission, accounting also for the highest number of bed days. This was mainly due to road-traffic accidents, reflecting the presence of a high-traffic road in Wolisso. Violence and other intentional injuries were also major contributors to the high rates of admission and death due to injury. Based on this evidence the hospital management decided to open an orthopaedic ward in 2007 to provide specialist services for trauma cases and to address the high demand for care; moreover, two operating theatres were dedicated to orthopaedic surgery, training courses were delivered to staff working in the emergency room and a program for the development of orthopaedic services in the Oromiya Region was set up in collaboration with government hospitals (starting from Asella Hospital) within the framework of a public-private partnership. Of note is the fact that trauma-related cases represent a burden on health services, not only in terms of bed days and surgical services, but also in the form of primary care, outpatient care, and rehabilitation needs, given that injuries may require complex interventions and that more serious injuries are associated with significant disabilities and long-term care. It is estimated that the healthcare costs for injuries are among the highest for all diseases, as is the loss of productivity, due to the youth of the age group primarily affected.²⁶ In fact, young adult males were the most affected group, being not only at higher risk of trauma from road-traffic accidents, but also from other causes including occupational accidents, interpersonal violence and individual risk-taking behaviours, such as alcohol consumption.²⁷

Other non-communicable diseases are expected to account for an increasing share of the disease burden, rising from 43% in 1998 to 73% by 2020 worldwide. In particular, a 'hidden epidemic' of cardiovascular disease is rapidly evolving and the burden of disease is shifting, with twice as many deaths from these causes occurring in developing countries as in developed countries.²⁸ Cardiovascular diseases (including hypertension, ischaemic heart disease and cerebrovascular disease) are already the fourth leading cause of death at Wolisso Hospital. It is for this reason that the hospital hired an experienced cardiologist to provide specialist services in the medical ward, where two beds were fully equipped for cardiology services; moreover, a small intensive care unit was set up for emergency cardiology care.

The overall disease burden highlights the interplay between poverty, inequality and health. Most of this burden results from diseases the occurrence of which could be dramatically reduced by low-cost preventive and curative measures, including malaria, diarrhoea and respiratory infections. In other words, the marginal social and economic return from investment in health is highest in avoiding these premature deaths. Moreover, a double burden of disease is already emerging at the early stage of the epidemiological transition, with a mix of persistent, emerging and re-emerging infectious diseases and increasing prevalence of chronic conditions and injuries. This will lead to fundamental changes in the volume and composition of demand for healthcare, with a more complex case mix and more costly service utilization patterns.

The hospital has attempted to address this double burden of disease by further stretching its limited resources, e.g. maintaining high bed occupancy with a relatively short length of stay, taking into account the complexity of the case mix, and by targeting the most vulnerable groups in order to ensure equity of access. Of note is the fact that a relatively short duration of hospital stay with high bed occupancy enables turnover rates to increase and thus allows hospital benefits to be extended to a greater number of people. This increases the cost-effectiveness of services by reducing the average cost per admission for specific treatments,¹⁰ while the quality of services is monitored through regular use of quality-of-care and outcome indicators as well as peer review of key sentinel events.²⁹

From this perspective, monitoring disease and service utilization patterns is essential and the cost of obtaining health information has to be weighed against its usefulness. Using inputs based on readily available data may ensure sustainability of the information system and support evidence-based health practice. It is not because countries are poor that they cannot afford good health information; it is because they are poor that they cannot afford to be without it.³⁰

Authors' contributions: SA, NK, PF, SD, VR, AS and FM developed the study concept and design; SA, NK, PF, SD, VR, AS and FM contributed to the execution of the study and interpretation of data; SA, PF and FM performed the data analysis; SA, PF, and FM drafted the manuscript. All authors critically revised the manuscript and read and approved the final version. SA and FM are guarantors of the paper.

Acknowledgements: We wish to thank all the hospital staff members who participated in data entry, analysis and interpretation. We would also like to express our appreciation to Gaetano Azzimonti, Rino Bregani, Elaine Kohls and Mary Church for their insightful comments.

Funding: None.

Conflicts of interest: None declared.

Ethical approval: Management and ethical committee of St Luke Hospital, Wolisso, Ethiopia.

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