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Article in *The American journal of tropical medicine and hygiene* · March 2001

DOI: 10.4269/ajtmh.2001.64.214 · Source: PubMed

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## IMPACT OF INSECURITY, THE AIDS EPIDEMIC, AND POVERTY ON POPULATION HEALTH: DISEASE PATTERNS AND TRENDS IN NORTHERN UGANDA

SANDRO ACCORSI, MASSIMO FABIANI, MATTHEW LUKWIYA, MAURIZIO RAVERA, ANDREA COSTANZI, LAWRENCE OJOM, ENRICA PAZE, FABIO MANENTI, PATRICK ANGUZU, MARIA G. DENTE, AND SILVIA DECLICH FOR THE ITALIAN-UGANDAN AIDS COOPERATION PROGRAMME\*

*Laboratory of Epidemiology and Biostatistics, Istituto Superiore di Sanità, Rome, Italy; St. Mary's Hospital Lacor, Gulu, Uganda; Petra Study, Istituto Superiore di Sanità, Kampala, Uganda; Associazione Volontari per il Servizio Internazionale, St. Joseph Hospital, Kitgum, Uganda; Kitgum District Health Services, Kitgum, Uganda; Associazione Volontari per il Servizio Internazionale, Dr. Ambrosoli Memorial Hospital, Kalongo, Uganda; Collegio Universitario Aspiranti Medici Missionari, St. Kizito Hospital, Matany, Uganda; Hoima Hospital, Hoima, Uganda*

**Abstract.** A retrospective analysis of the discharge records of 186,131 inpatients admitted to six Ugandan hospitals during 1992–1998 was performed to describe the disease patterns and trends among the population of Northern Uganda. In all hospitals, malaria was the leading cause of admission and the frequency of admissions for malaria showed the greatest increase. Other conditions, such as malnutrition and injuries, mainly increased in the sites affected by civil conflict and massive population displacement. Tuberculosis accounted for the highest burden on hospital services (approximately one-fourth of the total bed-days), though it showed a stable trend over time. A stable trend was also observed for acquired immunodeficiency syndrome (AIDS), which is in contrast to the hypothesis that AIDS patients have displaced other patients in recent years. In conclusion, preventable and/or treatable communicable diseases, mainly those related to poverty and poor hygiene, represent the leading causes of admission and death, reflecting the socioeconomic disruption in Northern Uganda.

### INTRODUCTION

In recent years, large areas in sub-Saharan Africa have been affected by war, socioeconomic disruption, poverty, the acquired immunodeficiency syndrome (AIDS) epidemic, and breakdowns in the health system. Consequently, in providing health care, increasingly difficult choices need to be made among competing demands, and information is crucial for identifying priorities and for decision-making. However, in most cases, major information gaps exist, and the few data available have been provided from scattered surveys and from incomplete reporting systems. In this context, readily available information collected using standardized procedures, such as data from hospital discharge records, becomes extremely important, in that these data can provide useful indications on the health situation at a low cost, in a long-term, sustainable way.

The objective of the present study was to use hospital discharge records to create a health profile of the population of Northern Uganda, in order to determine the impact of insecurity, poverty, and the AIDS epidemic in terms of morbidity and mortality. To this end, districts affected by these circumstances to varying degrees were analyzed and compared in terms of disease patterns and time trends.

### METHODS

To determine the trends in hospitalization over time, we analyzed discharge records for 1992–1998 from three hos-

pitals located in three districts (Gulu, Moroto, and Hoima Districts); two of them (Gulu and Moroto) are located in Northern Uganda. The Gulu District has been affected by civil war, population displacement (over 50% of the population living in protected camps), and a high prevalence of human immunodeficiency virus (HIV). The Moroto District, though not undergoing civil war, has been affected by insecurity due to ethnic conflicts and cattle rustling and has a low-level HIV prevalence. The Hoima District, considered for comparative purposes, is located in Western Uganda; this district has been experiencing a peaceful situation and sustained economic development, and has a medium-level HIV prevalence.

In addition to monitoring trends over time, we also attempted to obtain further information on the current situation in terms of hospitalization; to this end, we analyzed discharge records for the year 1998 in three additional hospitals, all located in the Kitgum District of Northern Uganda, which has also been affected by civil war, population displacement, and high HIV prevalence.

Six hospitals were included in the study (see Table 1 for their characteristics): St. Mary's Hospital-Lacor (Lacor Hospital) in the Gulu District; St. Kizito Hospital-Matany (Matany Hospital) in the Moroto District; Hoima Hospital in the Hoima District; and three in the Kitgum District: Dr. Ambrosoli Memorial Hospital-Kalongo (Kalongo Hospital), St. Joseph Hospital-Kitgum (Kitgum St. Joseph Hospital), and Kitgum Governmental Hospital.

The four districts differ in terms of their epidemiological situation, ethnic make-up, and socioeconomic level. Four of the hospitals are private, non-profit hospitals and two are government hospitals. All six hospitals have general medicine, surgery, pediatric, and obstetric-gynecology wards, with a capacity ranging from 155 to 457 beds; the number of hospital admissions ranged from 6,000 to 15,000 in 1998. No change in admission policy was reported in any of the hospitals during the study period.

All hospitals routinely collect data according to the hos-

\* The Italian-Ugandan AIDS cooperation programme: D. Greco and T. Rosolen (Laboratory of Epidemiology and Biostatistics, Istituto Superiore di Sanità, Rome); P. Corti, B. Corrado, and J. Amone (St. Mary's Hospital Lacor, Gulu); F. Ciantia (Associazione Volontari per il Servizio Internazionale, Kampala); M. Murru (Collegio Universitario Aspiranti Medici Missionari, Kampala); D. Giusti (Collegio Universitario Aspiranti Medici Missionari, St. Kizito Hospital, Matany); A. Aloï (Directorate General for Development Co-operation, Ministry of Foreign Affairs, Rome, Italy); and A. Cosulich (Italian Embassy, Kampala, Uganda).

TABLE 1  
Characteristics of six Ugandan hospitals involved in the study

District	Hospital	Type of hospital	No. of beds	Study period	No. of discharge records analyzed
Gulu	Lacor	Private non-profit	356 (1992) 446 (1993–1997) 457 (1998)	1992–1998	84,570
Moroto	Matany	Private non-profit	215 (1992–1998)	1992–1998	34,514
Hoima	Hoima	Public	106 (1992–1993) 116 (1994–1996) 155 (1997–1998)	1992–1998	46,066
Kitgum	Kalongo	Private non-profit	320	1998	8,356
Kitgum	Kitgum St. Joseph	Private non-profit	277	1998	6,354
Kitgum	Kitgum Governmental	Public	180	1998	6,271

pital information system of the Ugandan Ministry of Health. Specifically, diagnoses at discharge are coded according to the current reporting system, which is based on the International Classification of Diseases (10th revision, ICD 10),<sup>1</sup> and are recorded in computerized databases. Data collection procedures in the six hospitals were standardized in the framework of projects of the Italian Cooperation supporting Ugandan Hospitals and these procedures remained consistent over time. No external sources of data validation were available.

Data analysis was based on the first diagnosis at discharge only and was developed as part of the project “Global Support to the National Plan for HIV/AIDS Control in Uganda,” which has been co-funded by the Italian Ministry of Foreign Affairs and the Istituto Superiore di Sanità (the National Health Institute of Italy).<sup>2</sup> Approval from hospital management and ethical committees was obtained for the use of the hospital data.

#### RESULTS

Tables 2, 3, and 4 show the number and percentage of admissions and of bed-days, and the average length of stay (ALOS) for the ten leading causes of admission in the three hospitals that provided data for the 1992–1998 period. Malaria was the leading cause of admission in all three hospitals for the overall 1992–1998 period. In Lacor Hospital, malaria

showed an almost three-fold increase during the study period, up from about 1,500 admissions in 1992–1994 to about 4,000 in 1997–1998 (Figure 1), accounting for 27.9% of the total number of admissions in 1998. In Matany Hospital, the number of admissions for malaria was also highest in 1998 ( $n = 1,690$ ), accounting for 27.7% of 1998 admissions. In Hoima Hospital, a steep upward trend in admissions for malaria was observed in 1997 and 1998, accounting for 2,724 admissions (33.2%) in 1998, due in part to the increase in the number of hospital beds, from 106 beds in 1992 to 155 in 1997. Admissions for malaria in 1998 represented 38.9% of total admissions in the Kalongo Hospital, 25.3% in the Kitgum Governmental Hospital, and 23.3% in the Kitgum St. Joseph Hospital (Table 5).

A three-fold increase in admissions for pneumonia was observed between 1995 and 1998 in Lacor Hospital (Figure 1), reaching 1,143 admissions in 1998 (8.0% of the total number of admissions), whereas a slower upward trend was observed in Matany Hospital (from 315 admissions in 1992 to 557 in 1998). No evident trend was observed in Hoima Hospital. Admissions patterns also differed by hospital: pneumonia was the second cause of admission to Matany Hospital, the fourth cause to Lacor Hospital, and the eleventh cause to Hoima Hospital (Tables 2, 3, and 4).

In the areas of malnutrition and trauma (Figure 2), a steep increase was observed in 1996 and 1997 in Lacor Hospital for both conditions; in particular, a steady increase in trauma

TABLE 2  
Distribution of admissions, bed-days, and average length of stay (ALOS) for the ten leading causes of admission (Lacor Hospital, 1992–1998)

Cause	No. of admissions	%	No. of bed-days	%	ALOS (days)
1. Malaria	19,296	22.8	91,055	7.5	4.7
2. Labor and delivery	5,417	6.4	22,404	1.9	4.1
3. Tuberculosis	5,117	6.1	295,668	24.4	57.8
4. Pneumonia	4,413	5.2	36,429	3.0	8.3
5. Malnutrition	4,171	4.9	76,147	6.3	18.3
6. Measles	2,989	3.5	23,432	1.9	7.8
7. Diarrhea	2,530	3.0	15,931	1.3	6.3
8. Trauma (injuries, wounds)	2,324	2.7	52,711	4.4	22.7
9. Meningitis	2,279	2.7	16,350	1.4	7.2
10. Septicemia	1,721	2.0	11,880	1.0	6.9
Other	34,313	40.6	568,284	47.0	16.6
Total	84,570	100	1,210,291	100	14.3

TABLE 3

Distribution of admissions, bed-days, and average length of stay (ALOS) for the ten leading causes of admission (Matany Hospital, 1992–1998)

Cause	No. of admissions	%	No. of bed-days	%	ALOS (days)
1. Malaria	6,887	20.0	34,381	7.2	5.0
2. Pneumonia	3,300	9.6	20,417	4.3	6.2
3. Tuberculosis	2,570	7.4	167,687	35.2	65.2
4. Anemia	1,724	5.0	9,079	1.9	5.3
5. Labor and delivery	1,649	4.8	6,544	1.4	4.0
6. Diarrhea	1,352	3.9	8,724	1.8	6.5
7. Malnutrition	786	2.3	12,289	2.6	15.6
8. Septicemia	767	2.2	5,637	1.2	7.3
9. Trauma (injuries, wounds)	671	1.9	13,158	2.8	19.6
10. Skin infection	640	1.9	8,625	1.8	13.5
Other	14,168	41.1	189,341	39.8	13.4
Total	34,514	100	475,882	100	13.8

(mainly war-related injuries), reaching 744 admissions in 1997, was due to the increase in rebel activities.<sup>2</sup> A decrease for both conditions was observed in 1998, when security improved in the Gulu District. In Hoima Hospital, there was a slight increase in admissions for trauma during the period 1997–1998, whereas low and stable levels in admissions were found for malnutrition, reflecting this district's better socioeconomic situation (Figure 2). In Matany Hospital, fluctuations in admissions were observed for both malnutrition and trauma in the study period. The percentage of admissions for malnutrition in 1998 greatly differed among the six hospitals considered, ranging from 0.4% in Hoima Hospital to 11.9% in Kitgum St. Joseph Hospital. In the Kitgum area, malnourished children were mostly admitted to St. Joseph Hospital, or transferred there directly from Kitgum Governmental Hospital, accounting for the high percentage of admissions for malnutrition observed in St. Joseph Hospital and for the very low percentage (0.3%) at the Governmental Hospital (Table 5).

Admissions for tuberculosis (TB) and AIDS remained relatively stable over time; the only evident trend observed was a steady decrease in TB admissions in Matany Hospital (Figure 3). The percentage of TB admissions in 1998 ranged from 1.6% in Hoima Hospital to 5.3% in Kitgum Governmental Hospital and Lacor Hospital (Table 5). AIDS was not among the ten leading causes of admissions in any hospital during the period 1992–1998: it accounted for an average number of 237 yearly admissions to Lacor Hospital (range

= 152–304), 124 in Hoima Hospital (range = 99–140), and 66 in Matany Hospital (range = 36–138), without any evident trend in admissions over time.

The different morbidity patterns observed in the hospitals when comparing Northern Uganda with Western Uganda were reflected in the age distribution of patients. In particular, children aged 0–4 years accounted for about half of the admissions in the hospitals in Northern Uganda in 1998 (ranging from 59.2% in Kitgum St. Joseph Hospital to 47.0% in Matany Hospital), whereas in Western Uganda the percentage was much lower (26.8% in Hoima Hospital). Moreover, there has been an increase in the proportion of childhood admissions, accounting for, as in the case of Lacor Hospital, most of the steep upward trend in the number of admissions observed in recent years. According to the 1991 population census, children under five years of age represent only 16.3% of the population in Gulu District,<sup>3</sup> yet they accounted for 47.6% of the overall admissions (all ages included) to Lacor Hospital. The age distribution of patients showed striking differences when comparing Lacor Hospital to Hoima Hospital: the median age of admissions was 7 years in Lacor Hospital and 20 years in Hoima Hospital.

In Lacor Hospital, which is located in an area that has a high yet decreasing HIV prevalence (from 26.0% in 1993 to 16.1% in 1997) among antenatal clinic attendees aged 15–39 years<sup>4</sup> and with socioeconomic disruption due to civil strife, TB and malaria were the most important conditions in terms of the use of hospital services, followed by mal-

TABLE 4

Distribution of admissions, bed-days, and average length of stay (ALOS) for the ten leading causes of admission (Hoima Hospital, 1992–1998)

Cause	No. of admissions	%	No. of bed-days	%	ALOS (days)
1. Malaria	12,097	26.3	50,937	18.0	4.2
2. Labor and delivery	10,460	22.7	26,819	9.5	2.6
3. Diarrhea	1,831	4.0	8,760	3.1	4.8
4. Pregnancy (abortive outcome)	1,385	3.0	6,674	2.4	4.8
5. Abdominal hernias	1,288	2.8	11,891	4.2	9.2
6. Anemia	1,179	2.6	5,643	2.0	4.8
7. Complications of pregnancy	1,135	2.5	6,681	2.4	5.9
8. Trauma (injuries, wounds)	1,107	2.4	8,912	3.2	8.1
9. Complications of delivery	1,009	2.2	7,191	2.5	7.1
10. Measles	996	2.2	5,870	2.1	5.9
Other	13,579	29.5	143,053	50.7	10.5
Total	46,066	100	282,431	100	6.1

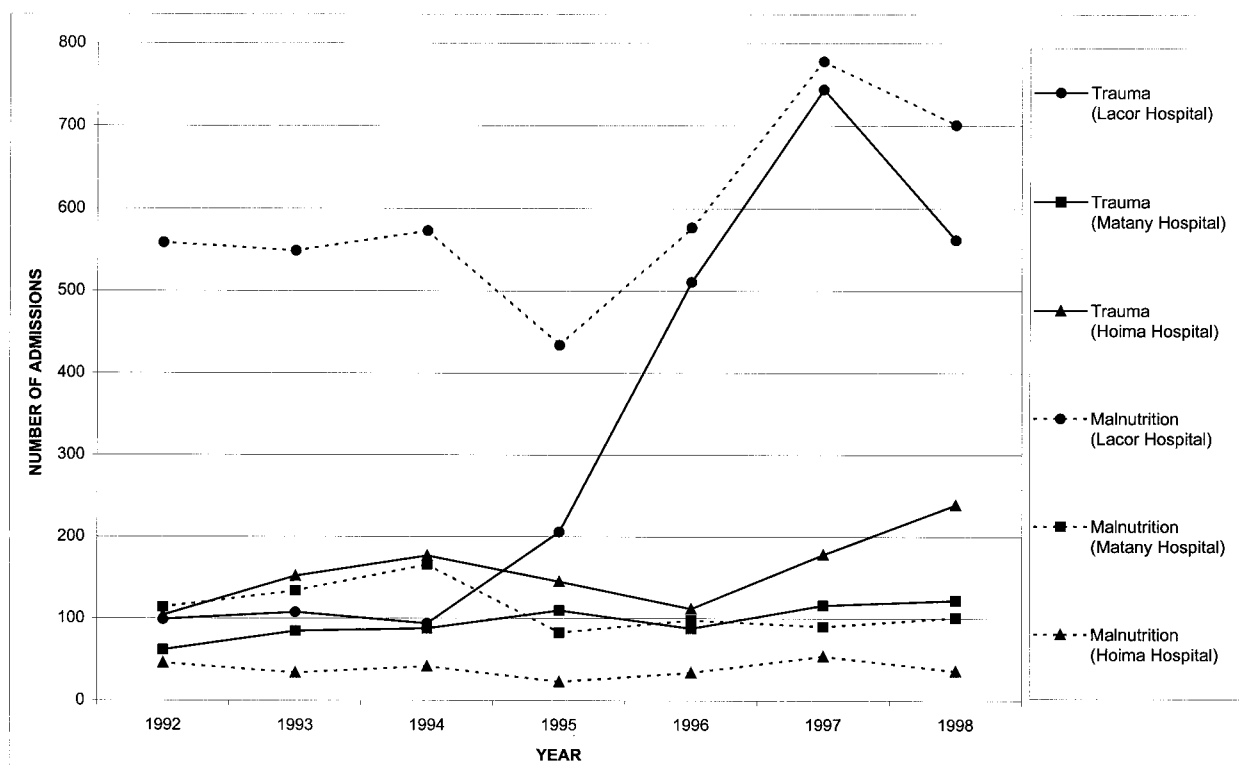


FIGURE 1. Trend of admissions for malaria and pneumonia (Lacor, Matany, and Hoima Hospitals, 1992–1998).

nutrition and trauma (mostly war-related injuries). Specifically, TB and malaria accounted for almost one-third of the total number of bed-days during the period 1992–1998 (Table 2). Tuberculosis has placed a particularly high burden on hospital services, accounting for 24.4% of hospital bed-days, as a result of the high frequency of admissions (6.1%) and the long ALOS (i.e., 57.8 days).

Tuberculosis and malaria were also the most important conditions in terms of use of hospital services in Matany

Hospital, which is affected by insecurity and is located in an area with a low HIV prevalence (ranging from 2.8% in 1993 to 1.3% in 1998 among antenatal clinic attendees).<sup>5</sup> Specifically, TB and malaria accounted for 42.4% of the total number of bed-days during the period 1992–1998 (Table 3). The heavy burden of TB (35.2%) was probably due to both managerial and epidemiologic factors, such as the referral of TB patients from neighboring districts (Matany Hospital, Tuberculosis Control Program, 1995, unpublished

TABLE 5

Distribution of admissions and bed-days for selected diseases (in ranking order of percentage of admissions) in six Ugandan Hospitals in 1998

Cause	Hospital	No. of admissions	%	No. of hospital bed-days	%
Malaria	Kalongo	3,250	38.9	21,719	22.0
	Hoima	2,724	33.2	10,371	24.5
	Lacor	3,991	27.9	20,131	10.3
	Matany	1,690	27.7	8,400	12.3
	Kitgum Governmental	1,586	25.3	9,892	16.3
	Kitgum St. Joseph	1,481	23.3	9,201	12.7
Malnutrition	Kitgum St. Joseph	754	11.9	18,267	25.2
	Kalongo	427	5.1	11,967	12.1
	Lacor	701	4.9	18,399	9.4
	Matany	101	1.7	2,109	3.1
	Hoima	36	0.4	259	0.6
	Kitgum Governmental*	17	0.3	140	0.2
Tuberculosis	Kitgum Governmental	331	5.3	19,175	31.5
	Lacor	765	5.3	46,040	23.5
	Matany	267	4.4	17,810	26.0
	Kitgum St. Joseph	258	4.1	10,506	14.5
	Kalongo	227	2.7	11,838	12.0
	Hoima	133	1.6	7,399	17.5

\* Malnourished children in Kitgum are primarily admitted or transferred to the Kitgum St. Joseph Hospital.

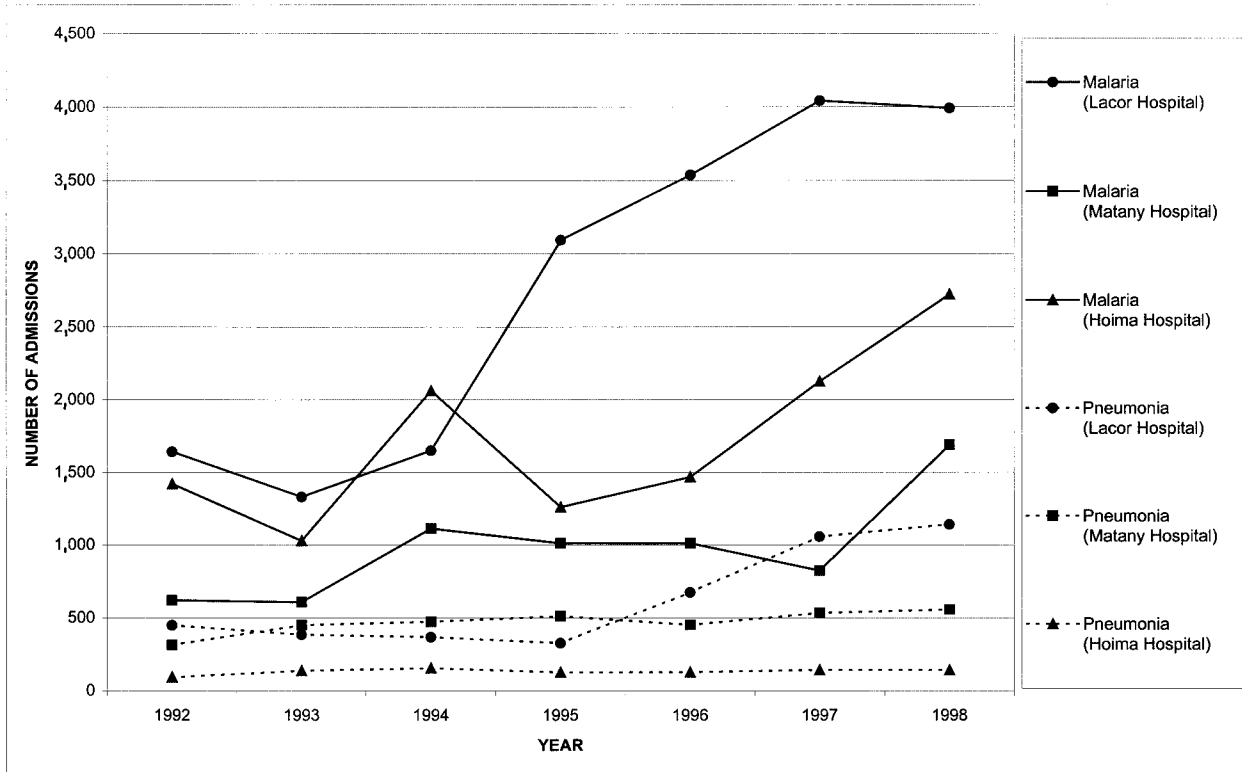


FIGURE 2. Trend of admissions for trauma and malnutrition (Lacor, Matany, and Hoima Hospitals, 1992–1998).

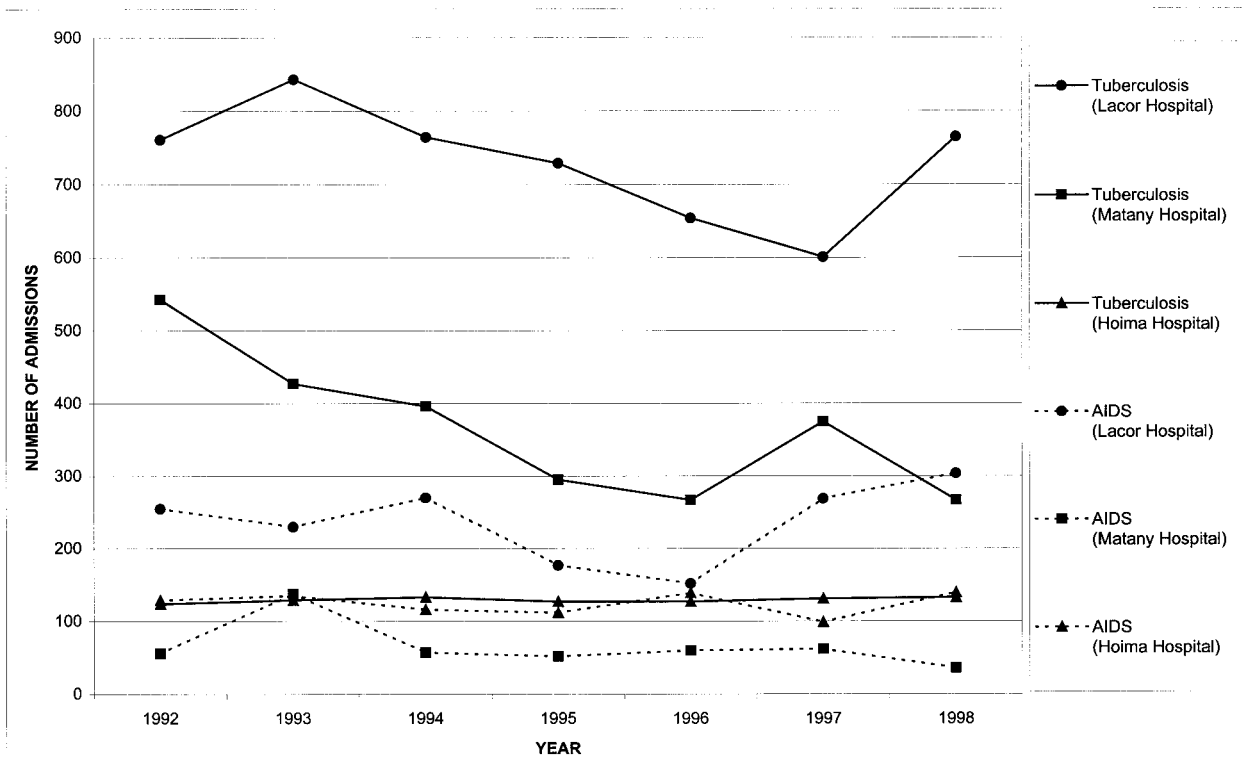


FIGURE 3. Trend of admissions for tuberculosis and acquired immunodeficiency syndrome (AIDS) (Lacor, Matany, and Hoima Hospitals, 1992–1998).

TABLE 6

Distribution of hospital deaths by cause in order of frequency in 20 Ugandan Hospitals (1990), in Lacor Hospital (1992–1998), and in Hoima Hospital (1992–1998)

20 Ugandan Hospitals (1990)		Lacor Hospital (1992–1998)		Hoima Hospital (1992–1998)	
Cause	PMR (%)	Cause	PMR (%)	Cause	PMR (%)
1. Malaria	14.2	1. Malnutrition	13.1	1. Malaria	26.8
2. AIDS	9.3	2. Malaria	11.9	2. Anemia	8.0
3. Diarrhea	8.7	3. Pneumonia	7.4	3. AIDS	7.4
4. Pneumonia	7.9	4. AIDS	7.3	4. Diarrhea	7.2
5. Anemia	7.3	5. Meningitis	6.6	5. Pneumonia	4.0
6. Meningitis	5.6	6. Measles	6.4	6. Measles	3.8
7. Malnutrition	5.4	7. Diarrhea	5.8	7. Malnutrition	2.9
8. Tuberculosis	4.5	8. Tuberculosis	5.7	8. Septicemia	3.1
9. Tetanus	3.3	9. Anemia	3.6	9. Meningitis	2.6
10. Trauma	3.1	10. Septicemia	3.4	10. Trauma	2.5
Other	30.6	Other	28.8	Other	31.7
Total	100.0	Total	100.0	Total	100.0

PMR = proportional mortality rate; AIDS = acquired immunodeficiency syndrome.

data) and the high prevalence of TB among nomadic Karajongs living in overcrowded huts without windows, with consequent low air circulation.

In Hoima Hospital, which is located in a peaceful and developed area with an intermediate HIV prevalence (decreasing from 12.7% in 1996 to 5.4% in 1998 among antenatal clinic attendees),<sup>5</sup> malaria was the condition with the heaviest burden on hospital services (18.0% of bed-days), followed by TB with 17.0% (twelfth cause of admission). Interestingly, in this hospital, four obstetrical conditions (9.5% for normal delivery, 2.5% for complications of delivery, 2.4% for complications of pregnancy, and 2.4% for pregnancies with abortive outcome) were among the ten leading causes of admissions overall (Table 4), accounting for 16.8% of the total number of bed-days during the period of 1992–1998.

In general, the trends in hospital bed-days reflected those in admissions: an increase for malaria and pneumonia was observed in all three hospitals (with the exception of pneumonia in Hoima Hospital); the trend was rather stable for AIDS and TB in all hospitals; a steep upward trend was observed for trauma and malnutrition only in Lacor Hospital, where, at the peak of rebel activity in the Gulu District in 1997, trauma and malnutrition accounted for 9.4% and 8.1%, respectively, of the total number of hospital bed-days.

In regard to mortality patterns (Table 6), malaria was the leading cause of death in Hoima Hospital (accounting for over one-fourth of the total number of hospital deaths that occurred in the period 1992–1998), followed by anemia (8.0%), AIDS (7.4%), and diarrhea (7.2%), whereas malnutrition was only the seventh cause of death (2.9%). Children under five years of age accounted for 45.7% of the hospital deaths. Among adults, malaria was also the leading cause of death, followed by AIDS, diarrhea, trauma, and TB. These patterns were similar to those observed in 20 Ugandan hospitals in 1990.<sup>6</sup>

In Lacor Hospital, malnutrition was the leading cause of death (13.1%), followed by malaria (11.9%), pneumonia (7.4%), AIDS (7.3%), and meningitis (6.6%). Children under five accounted for a much higher percentage (62.2%) of hospital deaths compared to Hoima Hospital, and malnutrition and malaria alone accounted for more than one-third (37.6%)

of childhood deaths. Among adults, AIDS and TB were the leading causes of death, accounting for 17.4% and 11.5% of hospital deaths. The different mortality patterns observed when comparing Northern Uganda (e.g., Lacor Hospital) with Western Uganda (i.e., Hoima Hospital) explains the differences in the median age of death (2 years in Lacor Hospital and 9 years in Hoima Hospital).

#### DISCUSSION

Hospital discharge records are an important source of data, especially in developing countries, because they are readily available in the health facilities and are useful not only for planning and evaluating hospital services<sup>7,8</sup> but also for epidemiological surveillance.<sup>9,10</sup>

However, hospital data also have limitations. Despite the attempts to ensure the comparability of data routinely collected in hospitals, problems can arise in their analysis and interpretation. In particular, hospital records are not designed for research but rather for patient care, and they may be incomplete, illegible, or missing. Furthermore, the diagnostic procedures may not be standardized and the quality of hospital data may differ among individual physicians and hospitals. Moreover, hospital-based studies are particularly prone to selection bias, in that individual hospitals can have different admission policies and referral patterns, and patients admitted to the hospitals may be not representative of all patients in the community.<sup>9</sup> It is well known that some conditions, such as AIDS, may be under-diagnosed and under-reported in hospital statistics, which fail to give a correct estimate of the magnitude of the disease in the community.<sup>11</sup> However, over time, the hospitals' medical staff has become increasingly more conscientious in performing AIDS diagnosis and reporting; there has also been a trend of increased HIV testing and counseling services. Moreover, hospital statistics on TB may fail to reflect the actual burden of the disease, due to the low level of case-findings in the community and the limited number of hospital beds for TB cases.<sup>12</sup> However, for monitoring trends, the low sensitivity of an information system may be acceptable if it remains consistent over time and across the spectrum of diseases.<sup>13</sup> Finally, hospital statistics are influenced by the differential

healthcare-seeking behaviors of the affected population and the accessibility of hospital services.

Concerning the epidemiologic profile of the population in Northern Uganda, some diseases showed consistent patterns in all hospitals. In particular, malaria was the leading cause of admission and showed the steepest upward trend in every hospital, whereas AIDS and TB showed a stable trend in admissions. Conversely, the admissions related to other diseases, such as malnutrition and trauma, showed a high variability in the different hospitals, reflecting the different epidemiologic and socioeconomic contexts of their respective catchment areas, as well as their differing involvement in the civil conflict.

In general, due to the high infant and childhood morbidity rates and the high percentage of children in the Ugandan population, a large proportion of the total illnesses occur in childhood, and a great amount of hospital services are therefore concerned with children. However, in Northern Uganda, childhood diseases accounted for a disproportionately high percentage (about half) of hospital admissions, and their trends were on the increase. This picture reflects a very difficult situation and an unhealthy environment, where many competing causes of illness or death, most of them preventable and/or treatable, shape the epidemiologic profile of the population. Although Uganda has been experiencing remarkable economic growth in recent years, Northern Uganda has benefited less from this growth, and human poverty is much more prevalent in Northern Uganda than in any of the other regions.<sup>14</sup> In fact, whereas less than one-third of the people in Central Uganda suffer from human poverty, this proportion exceeds 45% in Northern Uganda.<sup>15</sup> The Districts of Moroto, Kitgum, and Gulu are among the least developed, and according to the Human Poverty Index (HPI), represent three of the country's four poorest districts. Furthermore, whereas the percentage of people who do not have access to health services because they live beyond a 5 km radius from the nearest health facility is only 0.7% in the capital, Kampala, and 51% at the national level, it is much higher in these three districts (71.3% in Gulu, 75.7% in Moroto, and 91.1% in Kitgum). Compared to 38.4% at the national level, these districts also have a higher illiteracy rate (50.9% in Gulu, 60.3% in Kitgum, and 88.5% in Moroto).<sup>15</sup>

Concerning the disease burden on hospital services, TB is a labor-intensive, resource-consuming illness, accounting for the highest percentage of bed-days at the sites in Northern Uganda during the 1992–1998 period. The heavy burden of TB may in part be due to coinfection with HIV, as indicated by the high HIV prevalence (over 50%) observed among TB patients in HIV serosurveys carried out in the Lacor Hospital in 1994 and 1997.<sup>2</sup> In an attempt to alleviate this burden and to improve TB case management, plans are being made to implement the DOTS (Directly Observed Short-Course Therapy) strategy and other community-based support services for TB patients.

The stable trends in hospital use for HIV-related conditions could in part be due to several factors, including the decreasing trend in HIV prevalence observed in Uganda since 1993,<sup>16</sup> the shift from inpatient to outpatient care, the availability of alternative community-based services, the stable or decreasing ALOS, and the healthcare-seeking behavior of the affected populations.<sup>2</sup> For example, in recent years,

Lacor, Kitgum, and Hoima Hospitals have used an integrated approach, including inpatient, outpatient, and outreach home care, to provide a continuum of care to AIDS patients. This strategy may have contributed to relieving the pressure for admissions, improving the linkage with the community, and strengthening preventive and promotive AIDS interventions in the community. Different from other African hospitals where the increased demand for care of HIV-related conditions has resulted in health care resources being shifted away from non-HIV-related conditions,<sup>17,18</sup> in these sites in Northern Uganda, no evidence was found that HIV-negative patients have been displaced from admission to hospital wards by AIDS patients in recent years, nor has there been a reduction in the availability of hospital beds for non-HIV-related diseases.

Malaria was the second leading condition in terms of service utilization in all of the sites in Northern Uganda during the 1992–1998 period, accounting for a high and increasing percentage of hospital bed-days in all of the sites. In Hoima Hospital (Western Uganda), malaria was already the leading condition in terms of utilization of hospital services in the same period. Climatic and ecological factors, such as the 1997 *El Nino* phenomenon, may have contributed to the steep upward trend in malaria cases observed in recent years.<sup>19</sup> These findings point out the heavy burden that malaria places on population health in Uganda: malaria is the disease with the highest burden in terms of life years lost at the national level.<sup>20</sup> In the Gulu District, it has been estimated that almost one-fifth (18.8%) of the lost disability-adjusted-life years (DALY) which express years of life lost to premature death and years lived with a disability, adjusted for the severity of the disability, could be attributable to malaria (Gulu, District Health Services Work Plan, 1998–1999, unpublished data).

The significance of trauma reflects the difficult work, living, and civil conditions; moreover, the peak in the bed-days for trauma (mostly war-related injuries) observed in Lacor Hospital in recent years reflects the heavy burden of war on hospital services. War-related injuries accounted for most of the increase in major surgical interventions observed in the last three years in Lacor Hospital, reaching over 2,000 in 1998.

This situation has also influenced trends in service utilization for malnutrition, which accounted for a much higher percentage of bed-days in the hospitals located in Gulu and Kitgum Districts, which have been affected by the civil conflict in recent years.

Concerning mortality patterns, the distribution of the main causes of death in Hoima Hospital was similar to the mortality pattern observed in 20 Ugandan governmental and private non-profit hospitals in 1990; in both cases, malaria, AIDS, diarrhea, pneumonia, and anemia were among the leading causes of death (although in different ranking order), accounting for about half of the hospital deaths. Conversely, the leading cause of death in Lacor Hospital was malnutrition, reflecting the socioeconomic disruption in the Gulu District.

In conclusion, the retrospective analysis of the hospital discharge data reveals the heavy burden represented by preventable and/or treatable diseases, which constitute the major causes of admissions and hospital deaths, especially

among infants and children. In particular, the increasing trends of poverty- and hygiene-related diseases, such as malaria, diarrhea, and other communicable conditions, reflect the socioeconomic upheaval in Northern Uganda. For most of these diseases, cost-effective interventions are available.<sup>21,22</sup> Moreover, the war has placed an additional burden on already overwhelmed health services. In this context, health service research and applied epidemiology play an essential role in improving health care delivery, and using inputs based on readily available information (such as hospital discharge data) is crucial for health management and planning, as well as for the purposes of epidemiologic surveillance.

**Acknowledgments:** We thank all of the hospital staff members who participated in data entry, analysis and interpretation. We are indebted to Mr. Mark Kanieff for linguistic revision of the text. We would also like to express our appreciation to Mrs. Alessia Ranghiasci, who is responsible for data entry and documentation at the Istituto Superiore di Sanità (ISS), Rome and to Dr. Patrizia Tancredi, administrative officer at the ISS, Rome, for their valuable work in supporting this study.

**Financial support:** This study was supported by Progetto di Ricerca di Lotta all'AIDS in Uganda (Istituto Superiore di Sanità, Rome, Italy) and Appoggio al Programma Nazionale di Lotta all'AIDS in Uganda (Ministero degli Affari Esteri, Rome, Italy).

**Authors' addresses:** Sandro Accorsi, Massimo Fabiani, Maria G. Dente, and Silvia Declich, Laboratorio di Epidemiologia e Biostatistica, Istituto Superiore di Sanità, Viale Regina Elena 299, 00161 Rome, Italy. Matthew Lukwiya, St. Mary's Hospital Lacor, P.O. Box 180, Gulu, Uganda. Maurizio Ravera, Nsambya Hospital, P.O. Box 7146, Kampala, Uganda. Andrea Costanzi, Kitgum St Joseph Hospital, P.O. Box 31, Kitgum, Uganda. Lawrence Ojom, Kitgum District Health Services, P.O. Box 17, Kitgum, Uganda. Enrica Pazè, Kalongo Hospital, P.O. Box 47, Kalongo, Uganda. Fabio Manenti, St Kizito Hospital—Matany, c/o Comboni Missionaries, P.O. Box 3872, Kampala, Uganda. Patrick Anguzu, Hoima Hospital, P.O. Box 5, Hoima, Uganda.

**Reprint requests:** Silvia Declich, Laboratorio di Epidemiologia e Biostatistica, Istituto Superiore di Sanità, Viale Regina Elena 299, 00161 Rome, Italy. Telephone: +39-06-49902820; Fax: +39-06-49903111; E-mail: silvia@iss.it

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