

Using mortuary statistics in the development of an injury surveillance system in Ghana

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Objective To develop, in a mortuary setting, a pilot programme for improving the accuracy of records of deaths caused by injury.

Methods The recording of injury-related deaths was upgraded at the mortuary of the Komfo Anokye Teaching Hospital, Kumasi, Ghana, in 1996 through the creation of a prospectively gathered database.

Findings There was an increase in the number of deaths reported annually as attributable to injury from 72 before 1995 to 633 in 1996–99. Injuries accounted for 8.6% of all deaths recorded in the mortuary and for 12% of deaths in the age range 15–59 years; 80% of deaths caused by injury occurred outside the hospital and thus would not have been indicated in hospital statistics; 88% of injury-related deaths were associated with transport, and 50% of these involved injuries to pedestrians.

Conclusions Injury was a significant cause of mortality in this urban African setting, especially among adults of working age. The reporting of injury-related deaths in a mortuary was made more complete and accurate by means of simple inexpensive methods. This source of data could make a significant contribution to an injury surveillance system, along with hospital records and police accident reports.

Keywords Wounds and injuries/mortality; Accidents, Traffic/mortality; Cause of death; Mortuary practice; Data collection/methods; Ghana (*source: MeSH, NLM*).

Mots clés Plaies et traumatismes/mortalité; Accident circulation/mortalité; Cause décès; Pratique mortuaire; Collecte données/méthodes; Ghana (*source: MeSH, INSERM*).

Palabras clave Heridas y lesiones/mortalidad; Accidentes de tránsito/mortalidad; Causa de muerte; Prácticas mortuorias; Recolección de datos/métodos; Ghana (*source: DeCS, BIREME*).

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Introduction

Injuries are an increasingly significant cause of death and disability in many developing countries, with the burden of suffering being especially high among adults of working age and children (1, 2). Accurate information on the extent and nature of injuries is needed to formulate realistic and effective policies aimed at reducing this burden, in particular to compare the contribution made by injuries to death and disability with that made by diseases; identify which mechanisms of injury are the leading causes of death and disability and therefore require special attention for purposes of prevention; identify the risk factors for injury that should be targeted in prevention work; and understand the temporal patterns of death and the anatomical nature of injuries in order to develop cost-effective measures for improving treatment.

In developed countries the usual sources of data on injury include police accident reports, vital statistics, and hospital records (3). As well as being useful in one-off research investigations, these sources are of value when analysed on an ongoing basis in order to follow trends and assess the success or failure of safety policies. In the USA, for example, police

accident reports and vital statistics are combined in the Fatality Analysis Reporting System (FARS), a ongoing surveillance system for deaths related to transport (4).

Such sources of information are needed for similar reasons in developing countries; however, the usual sources in these countries have significant shortcomings that diminish their usefulness. Many accidents, and even injuries caused by violence, are not reported to the police. For example, a recent study in Ghana showed that only 10% of injuries sustained by pedestrians were included in police statistics (5). Furthermore, many injured persons may not receive formal medical care, and this limits the usefulness of records held by hospitals and other health facilities (6). Probably the most important types of injury that should be recorded accurately are those leading to fatalities. Unfortunately, vital statistics are often significantly underassessed (2, 7, 8). It has been estimated, for example, that only 20% of deaths in Ghana are officially registered and even when they are registered their causes are frequently recorded imprecisely or not at all (9).

There appeared to be scope for improving the situation inexpensively, at least with respect to injuries occurring in urban settings in developing countries, where overall registra-

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tion rates for deaths tended to be higher than in rural areas. This is especially true in Ghana because of the custom of keeping bodies in refrigerated storage while funeral arrangements are made. Furthermore, information on mechanisms of injury is often obtainable from mortuary attendants, even if it is not accurately recorded. We therefore felt that at least basic information on injury-related deaths would be fairly easy to obtain and record with minimal investments in personnel.

The aims of the study were to provide further information on the burden of mortality caused by injuries in relation to the mechanisms responsible for them and to conduct a pilot test of the usefulness of mortuary records in the development of an ongoing injury surveillance system.

Methods

Setting

The study was performed in Kumasi (population, 650 000), Ghana, at the Komfo Anokye Teaching Hospital, which has 800 beds and is the city's main hospital. The hospital's mortuary is a temporary holding area for the bodies of patients who die in the hospital and for those of persons who are dead on arrival. It is also used to store the remains of some persons who die outside the hospital until further arrangements can be made. Although the mortuary is mainly used for the bodies of persons who have resided and died in Kumasi, it is also used by surrounding communities to a variable extent.

Data collection

Before 1996, only limited data on the causes of death were available in the mortuary. The summary logbook indicated little more than the dates of entry into the mortuary, the ages of deceased persons, and whether they had been dead on arrival at the hospital. Subsequently, efforts were made to upgrade record-keeping in respect of deaths caused by injuries. Two nurses were employed for this purpose, each on a half-time basis. Their initial training consisted of two 2-h orientation sessions, which focused on the data elements desired, especially the mechanisms and anatomical characteristics of injuries. As the nurses were already working at the Komfo Anokye Teaching Hospital, they were familiar with the personnel in the departments involved in the study. Nurses were used in the project for the following reasons: they already had a relationship with and direct responsibilities to the supervisors on site (*CM*, *FAA* and *REQ*); they were familiar with the hospital environment; and their medical knowledge was of value in data extraction and coding.

The nurses visited the mortuary daily in order to review the logbook and discuss the causes of death with the mortuary staff, including doctors, record-keepers and labourers, who were often aware of the mechanisms of injury through contact with the victims' families.

For persons who had died in the hospital, supplemental information was obtained from the nurses' logbooks on the various wards and from medical records. The nurses' logbooks were also used in order to identify persons who had died from injuries that were not uncovered by surveillance at the mortuary.

Injured patients were initially assessed by junior doctors in the casualty ward, where resources were extremely limited. If urgent resuscitation was needed, patients were triaged to the intensive care unit adjacent to the casualty ward and to the emergency operating theatres. The intensive care unit also

served as the recovery room for the emergency operating theatres. The casualty ward, intensive care unit, and emergency operating theatres were all located in a polyclinic adjacent to the main hospital building. Patients who were considered stable were transferred from the casualty ward or the intensive care unit to the surgical wards in the main building. The wards in the main building and the polyclinic had different record-keeping systems, which influenced the subsequent official data on injury-related deaths in the hospital.

The research workers entered information derived from the above sources on a data sheet. Data were collected separately from the logbooks of the mortuary, the main hospital wards, and the polyclinic. Information was also obtained from the medical records. The data related to demographic matters, mechanisms of injury, sites of death, and anatomical details of injuries.

Quality assurance was provided by feedback from the supervisors on site, who reviewed the data sheets as they came in. For persons who had been treated in the hospital, validity and reliability checks were performed by comparing the information in the mortuary logbook with that in the medical records. Both data gathering and quality assurance were aided by the fact that the supervisors on site and the research workers were all actively involved in patient care at the hospital during part or all of the study period.

Data management

When there were sufficient data, injuries were graded in accordance with the Abbreviated Injury Scale (AIS) (10). This was used primarily to assign the region of principal injury, i.e. that with the highest AIS score. In the event that two regions had the same score, the region of principal injury was assigned by observing the following order of priority: head > spine > chest > abdomen > extremity > skin (11–13). Injuries to the head included those to the head, face, and neck, but excluded cervical spine injuries. Cervical, thoracic, and lumbar spinal injuries were grouped together. Injuries to the torso included those to both the chest and abdomen.

This study, which was approved by the Ministry of Health of Ghana, reports on data gathered between 1 August 1996 and 31 July 1999. The data were analysed using EpiInfo, Version 6.02 (Centers for Disease Control, Atlanta, GA, USA; 1994).

Results

Demographic data

During the three-year study period, 1898 injury-related deaths were recorded from the mortuary. This was equivalent to 633 deaths per year, in contrast to the 72 injury-related deaths per year officially recorded in the logbooks before 1996 (13).

Of these deaths, 67% were of males, 31% were of females, and 2% ($n = 41$) were of persons whose sex was not recorded or could not be determined. The mean age at death was 37 ± 18.9 years; 50% of the deaths involved the age range 15–44 years; and for 9% ($n = 179$) the age at death was not determined.

Mechanism of injury

Table 1 and Table 2 show the mechanisms of injury according to age and sex, respectively. Injuries that were transport related accounted for 88% of the deaths. Injuries to pedestrians accounted for half the injury-related deaths and were the primary

Table 1. Mechanisms of injury, by age, identified from the mortuary records, Komfo Anokye Teaching Hospital, Kumasi, Ghana, 1996–99

Mechanism of injury	Age group					Not known	Total
	0–4 years	5–14 years	15–44 years	45–59 years	> 60 years		
Motor vehicle crash	9 (16) ^a	9 (7)	285 (30)	144 (43)	106 (42)	97 (54)	650 (34)
Pedestrian	20 (35)	99 (75)	512 (54)	157 (47)	100 (40)	65 (36)	953 (50)
Other transport	3 (5)	11 (8)	39 (4)	12 (4)	5 (2)	4 (2)	74 (4)
Falls	2 (4)	7 (5)	10 (1)	5 (2)	6 (2)	0	30 (2)
Burns	18 (32)	1 (1)	4 (0.4)	0	5 (2)	0	28 (2)
Unintentional penetrating wounds	0	1 (1)	12 (1)	3 (1)	4 (2)	0	20 (1)
Violence	0	0	36 (4)	3 (1)	5 (2)	3 (2)	47 (3)
Miscellaneous	5 (9)	4 (3)	45 (5)	13 (4)	19 (8)	10 (6)	96 (5)
Total	57	132	943	337	250	179	1898

^a Figures in parentheses are percentages.

Table 2. Mechanisms of injury, by sex,^a identified from the mortuary records, Komfo Anokye Teaching Hospital, Kumasi, Ghana, 1996–99

Mechanism of injury	No. of males	No. of females
Motor vehicle crash	425 (33) ^b	200 (35)
Pedestrian	632 (50)	310 (53)
Other transport	52 (4)	20 (3)
Falls	21 (2)	9 (2)
Burns	20 (2)	8 (1)
Unintentional penetrating wounds	16 (1)	4 (0.7)
Violence	38 (3)	9 (2)
Miscellaneous	73 (6)	20 (3)
Total	1277	580

^a Sex not recorded in 41 cases.

^b Figures in parentheses are percentages.

mechanism of injury for both sexes and for all age groups except those over 60 years. Injuries to pedestrians accounted for the largest proportion of deaths attributable to injury in the age group 5–14 years (75%). However, the largest number of deaths of pedestrians were in the age group 15–44 years ($n = 512$). The second leading cause of death was injury to occupants in motor vehicles that crashed (34%). Other transport-related injuries, e.g. involving motorcycles and bicycles, accounted for only a small percentage of mortality. Burns were a significant source of mortality in the youngest age group but did not account for a large percentage of deaths overall. Males and females had similar distributions of mechanisms of injury.

The vast majority of transport-related injuries (87%) occurred on roadways, especially paved roads (Table 3); the next largest group of injuries occurred in the home (7%); and for 1.6% ($n = 31$) the place of injury could not be determined.

Injuries occurred at night in 55% of instances and during daytime in 43%; in 1.4% of cases ($n = 27$) the time of injury could not be determined. The majority of all types of injury other than falls and burns occurred at night (Table 4). Of the injuries to persons younger than 15 years, 66% occurred in

Table 3. Locations of persons when injured, identified from the mortuary records, Komfo Anokye Teaching Hospital, Kumasi, Ghana, 1996–99

Location	No. of persons
Paved road	1647 (87) ^a
Unpaved road	34 (2)
Home	141 (7)
Other building	17 (1)
Farm	19 (1)
Not known	40 (2)
Total	1898 (100)

^a Figures in parentheses are percentages.

daytime and 34% at night, whereas for people of all other ages the corresponding proportions were 42% in daytime and 58% at night. The times of injury did not vary between the sexes.

Types of injuries sustained

For 80% of the deaths ($n = 1520$) there was insufficient information to determine the region of principal injury: a total of 97% ($n = 1468$) of these deaths involved individuals who were dead on arrival at the hospital. Fig. 1 shows the regions of principal injury for the remaining 378 patients: for 87% ($n = 330$), treatment was given in the hospital and information was obtained from clinical records; and 13% ($n = 48$) were dead on arrival at the hospital and information on them was obtained from autopsies. For those deaths for which information on the region of principal injury was obtained, 66% involved head injuries and 12% injuries to the chest or abdomen.

Site and time of death

Of the fatally injured persons, 80% were dead on arrival in the hospital (Table 5). Of those who survived long enough to be treated, 78% ($n = 299/382$) died in the intensive care unit, which functioned as an extension of the emergency room, to which severely injured patients were initially triaged. Only 9.0% (35/382) died on the hospital wards proper.

Table 4. Mechanisms of injury, by time of day, identified from the mortuary records, Komfo Anokye Teaching Hospital, Kumasi, Ghana, 1996–99

Time of day ^b	Mechanism of injury ^a								Total
	MVC	Pedestrian	OT	Falls	Burns	UP	Violence	Misc	
Day	291 (45) ^c	394 (41)	25 (34)	22 (73)	16 (57)	5 (25)	20 (43)	49 (51)	822 (43)
Night	355 (55)	545 (57)	46 (62)	8 (27)	12 (43)	15 (75)	27 (57)	41 (43)	1049 (55)
Unknown	4	14 (1)	3 (4)	0	0	0	0	6 (6)	27 (1)
Total	650	953	74	30	28	20	47	96	1898

^a MVC = motor vehicle crash; OT = other transport related; UP = unintentional penetrating wounds; Misc = miscellaneous.

^b Day = 06:00 to 18:00; night = 18:00 to 06:00.

^c Figures in parentheses are percentages. Note: Percentages may not total to 100% because of rounding.

Fig. 1. Distribution of the regions of principal injury, identified from the mortuary records, Komfo Anokye Teaching Hospital, Kumasi, Ghana, 1996–99 (Regions of principal injury reported for 378 persons for whom there were sufficient data. For 1520 persons there were insufficient data for region of principal injury to be specified.) Torso: chest or abdomen. Hypovolaemia: hypovolaemic shock – site unspecified.

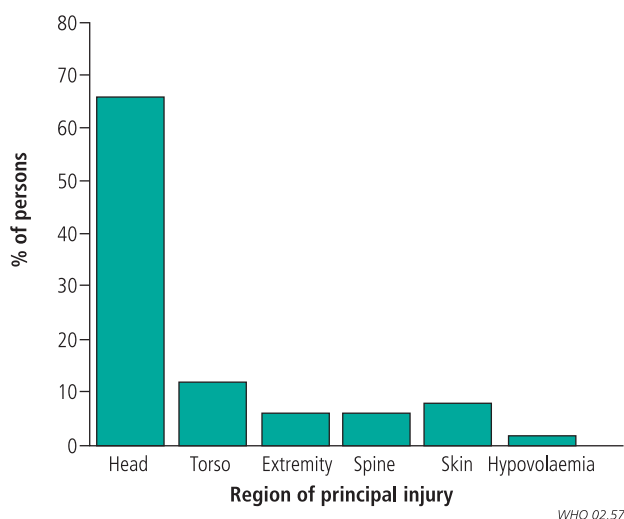


Fig. 2 indicates the distribution of the length of stay of patients in the hospital before death. Excluding those patients who were dead on arrival, 50% ($n = 190$) died within the first 24 hours, while an additional 27% ($n = 103$) died during the first week.

Injury as a proportion of overall mortality

Table 6 shows the proportion of all deaths attributable to injury. The denominators used were derived from mortuary logbooks. Injury-related deaths accounted for a higher proportion of those persons brought in dead than of those who died while hospitalized. Overall, injury-related deaths accounted for 8.6% of all deaths recorded in the mortuary. Injury was especially high among adults of working age, accounting for 11.3% of deaths among 15–44-year-olds and for 12.7% of deaths among 45–59-year-olds.

Incidence of mortality caused by injury

A rough estimate of the incidence of mortality attributable to injury was made by dividing the number of deaths caused by injury, as recorded at the mortuary, by the population of

Kumasi. The inclusion of non-Kumasi residents who died from injury in Kumasi or who died from injury outside Kumasi but were brought to the mortuary for temporary storage tended to produce an overestimate. The mortuary records contained listings of persons who had not resided in Kumasi but the places of residence were often not given or were imprecisely indicated. This made it difficult to restrict the analysis to Kumasi residents alone. On the other hand, several factors tended to produce an underestimate: Kumasi residents who died from injuries outside Kumasi and were not taken to the mortuary of the Komfo Anokye Teaching Hospital; Kumasi residents who died from injuries in Kumasi and were buried without having been taken to this mortuary; and fatally injured persons who were kept in the mortuary but for whom accurate information was not obtained.

Assuming that the factors tending to produce overestimation and those tending to produce underestimation were roughly in balance, the overall annual injury-related mortality rate in Kumasi was 633 deaths per 650 000, i.e. 97 per 100 000. The annual rate of transport-related mortality in Kumasi was 86 deaths per 100 000.

Discussion

The purpose of this study was to provide information on the burden of injury-related death in order to assist development of policies for injury prevention and improve the treatment of injured persons. We also sought to assess the feasibility of a pilot programme for improving the accuracy of reporting injury-related deaths in a mortuary. In this way we hoped to contribute to the creation of a nationwide injury surveillance system in Ghana.

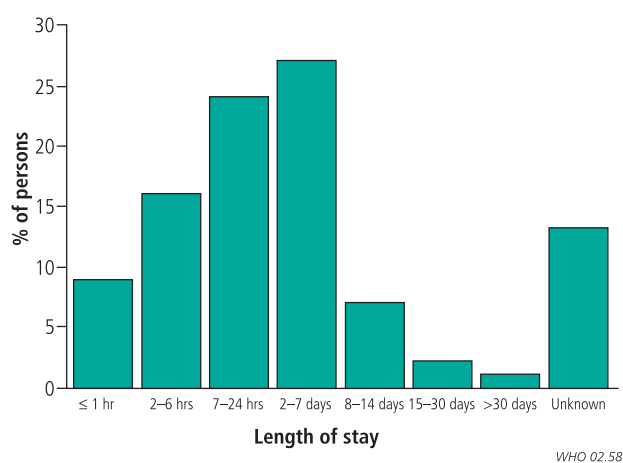
Limitations of the study methodology

It should be noted that the mortuary at the Komfo Anokye Teaching Hospital was not the only place where deaths were recorded in Kumasi. Two other mortuaries managed a small fraction of the cases handled by this hospital but did not usually deal with injury cases. In addition, an unknown number of people died outside the hospital and were buried without temporary storage at any mortuary. These deaths should all be registered with the Births and Deaths Registry of the Kumasi Metropolitan Assembly but this was probably not carried out very frequently: a previous study indicated that only 49 injury-related deaths were reported to the Births and Deaths Registry over a one-year period (13).

Table 5. Site of death, identified from the mortuary records, Komfo Anokye Teaching Hospital, Kumasi, Ghana, 1996–99

Site of death	No. of persons
Brought in dead	1516 (80) ^a
Intensive care unit	299 (16)
Hospital ward	35 (2)
Casualty ward	8 (0.4)
Not known	40 (2)
Total	1898 (100)

^a Figures in parentheses are percentages.

Fig. 2. Distribution of the length of stay in hospital for persons brought in alive ($n = 382$), identified from the mortuary records, Komfo Anokye Teaching Hospital, Kumasi, Ghana, 1996–99

Deaths at the mortuary of the Komfo Anokye Teaching Hospital were probably underreported, even after the system was upgraded. Together with the circumstances discussed above, this would lead to underassessment of the true number of deaths from injury. Consequently, the finding that 8.6% of all deaths were caused by injury was probably too low.

Autopsies were performed on only a few of the bodies of persons who had died from injuries if requested by the police or clinicians or if deemed necessary by the pathologist in charge of the mortuary. As a result autopsies were performed in only 2.5% of instances of death attributable to injury, and consequently there was a lack of anatomical detail on the majority of injuries sustained. This limited the extent to which recommendations could be made for improving the treatment of injuries. Information on mechanisms of injury was unaffected, however, and this allowed recommendations on prevention strategies to be made. In consequence it is now required that autopsies be performed in all instances of death caused by trauma.

It is possible that some mechanisms of injury were underreported more than others. For example, relatives or witnesses might be disinclined to volunteer information about suicides or homicides because of the social stigma attached to them or because of a desire to avoid contact with the authorities.

Table 6. Injury-related deaths as proportions of all mortuary cases, by age, identified from the mortuary records, Komfo Anokye Teaching Hospital, Kumasi, Ghana, 1996–99^a

	Age range			
	0–14 years	15–44 years	45–59 years	≥60 years
Total inpatient deaths	1719	3612	1374	1272
No. injury-related	72 (4.2) ^b	177 (4.9)	51 (3.7)	45 (3.5)
Total brought in dead	1935	4740	1281	4053
No. injury-related	117 (6.0)	766 (16.1)	286 (22.2)	205 (5.1)
Total deaths	3654	8352	2655	5325
No. injury-related	189 (5.2)	943 (11.3)	337 (12.7)	250 (4.7)

^a Note: 179 fatally injured persons of undetermined age are not included in totals.

^b Figures in parentheses are percentages.

Injury and transport-related deaths

Despite the above-mentioned limitations we are still able to draw some useful inferences and conclusions from the data. The overall annual burden of injury-related deaths was approximately 97 per 100 000; in the USA the corresponding figure is 60 per 100 000 (14). Moreover, 67% of all injury-related deaths in the current study were among persons of working age, i.e. 15–59 years, so that there were significant economic consequences.

The annual rate of transport-related mortality in Kumasi was 86 per 100 000, substantially higher than the corresponding rate of 20 per 100 000 in the USA (14) and dramatically higher than the rate of 6.5 per 100 000 reported by the National Road Safety Commission of Ghana. It is, of course, difficult to compare the rate derived from our study on an urban population with that for the predominantly rural population of the country as a whole, for which the rate would probably be lower (15).

It is useful to compare the rates of injury burden estimated in the present study with those based on a previous household survey in Kumasi. This survey yielded an overall estimate of 83 per 100 000 (95% confidence interval (CI): 26–140) for the injury-related mortality rate, slightly lower than the 97 per 100 000 that we estimated in the current study (16). The survey produced a transport-related mortality rate of 67 per 100 000 (95% CI: 14–120) in the city, also slightly lower than the 86 per 100 000 reported in the current study (15). Nonetheless, all estimates were considerably higher than the corresponding values reported in developed countries.

Motor vehicle crashes and injuries to pedestrians accounted for the overwhelming majority of deaths. This finding is consistent with the results of previous studies in Ghana and other developing countries (15, 17–20). Although 75% of all injury-related deaths among children aged 5–14 years were caused by injuries to pedestrians, far more adults than children were killed as a consequence of injuries to pedestrians.

These data make it clear that much greater attention should be given to road safety, for which specific recommendations have been made previously (15, 19, 21–25). Some of the issues that need to be considered include the following: development of a safer road infrastructure; improvement of driver training and licensing requirements; improvement of vehicle inspection; introduction and enforcement of anti-drink-driving measures; the use of seat belts; and the

enforcement of speed limits. Speed control is especially important in relation to lowering the pedestrian fatality rate in crowded urban areas. Furthermore, the high percentage of fatal injuries sustained by pedestrians at night indicates that it is necessary to improve street lighting and provide education on the wearing of conspicuous clothing. In view of the rapid growth of motorization in Ghana and many other developing countries, solutions to road safety problems are not likely to be easy. Progress would be aided by the development of a group of traffic safety and injury prevention professionals, in each country, who would confront the particular problems of their own environment.

Lessons related to treatment of injuries

Our findings provide some insight into ways in which the treatment of injuries might be improved. The majority of all injury-related deaths occurred outside the hospital, indicating the need for an emergency medical service. In Kumasi, injured persons are taken to hospital by relatives or bystanders, primarily using public transport such as taxis and buses (26). The development of a formal emergency medical service in urban areas has been considered by the Ministry of Health. However, plans are constrained by cost and infrastructural limitations, e.g. an inadequate telephone network. In the meantime, the death toll before arriving at the hospital might be reduced by improving the informal pattern of prehospital care. The Kwame Nkrumah University of Science and Technology, along with the Ghana Ministry of Health and the Ghana Red Cross, has recently instituted a pilot programme providing first aid training to commercial drivers, who predominate in the provision of prehospital transport (26, 27).

Half the deaths of patients who were alive when admitted to the hospital occurred within 24 hours after arrival, demonstrating that the initial period after injury was critical. In this connection it is to be expected that the improvement of facilities and training for the early care of injured patients would be cost-effective. For example, in the middle-income setting of Trinidad and Tobago the introduction of a continuing medical education programme on the initial evaluation and treatment of injured patients reduced mortality rates attributable to injuries (28). Adaptations of this programme to the more resource-constrained environments of low-income countries are being introduced (29–31).

It is noteworthy that 66% of all trauma deaths involved patients whose heads were the region of principal injury. Although all the surgical staff had received training and were experienced in the management of head injuries, there was no neurosurgeon at the study hospital. Furthermore, the facilities for the diagnosis, treatment and supportive care of patients with head injuries were extremely limited. Unfortunately, many of the diagnostic and therapeutic modalities needed to improve the prognosis of head injuries, such as computerized tomography and ventilators, neither of which was available at the hospital, are among the most expensive items in medical care. These capabilities are likely to be beyond the financial reach of the average injured person in low-income countries for the foreseeable future. A recent study in Papua New Guinea, in which head injuries accounted for the majority of trauma deaths, indicated that much mortality could have been prevented by better attention to airway management (32). This reflected the importance, already mentioned above, of improving the early care of injured patients.

Injury surveillance

This study also provides useful information for the development of an injury surveillance system in Ghana. A comparison of the numbers of deaths reported in the present study with those previously noted in the logbooks of the hospital mortuary clearly reveals that there has been gross underreporting of injury-related deaths (13). The problems in reporting are also evident in the hospital statistics (33). The hospital's 1988 report listed accidents as the fourth leading cause of outpatient attendance ($n = 12\ 257$) and the second leading cause of inpatient admissions ($n = 2071$). However, it did not list accidents or injuries among the top ten causes of death. The current study reported an average of 127 injury-related deaths per year in the hospital itself, a value intermediate between that for the most common officially reported cause of death (meningitis, 178 deaths) and that for the lowest of the top ten (diarrhoeal disease, 47 deaths). This reporting problem arose because only deaths on the hospital wards were reported in the official hospital statistics; deaths occurring in the polyclinic, i.e. in the intensive care unit and the casualty ward, were not included (Table 5). The deaths occurring in the polyclinic were overwhelmingly injury-related. Moreover, most injury-related deaths in the hospital occurred in the polyclinic. Consequently, injury-related deaths were selectively underreported in the official hospital statistics. On the basis of this finding the hospital's reporting system is being amended.

Our study shows that a mortuary can provide considerable information if a simple one-page data collection form is used and if a small investment is made in personnel, e.g. the equivalent of one nurse working full time. Substantial improvements in the completeness of reporting of injury-related deaths can result, together with an increase in the useful data obtained from the records. The information is best utilized in conjunction with other data sources in the format of a permanent injury surveillance system.

Injury surveillance in other developing countries

Approaches to injury survey systems in other developing countries have been addressed by various authors. For example, in Bangladesh the usefulness of several pre-existing data sources for the purpose of injury surveillance has been reported (8). Hospital discharge data, police reports, post-mortem reports, hospital emergency room records, medical practitioners' data, and newspaper reports were assessed. Each source was evaluated for its orientation towards prevention, completeness of reporting, and sustainability. No single source was adequate for the purposes of an injury surveillance system. It was considered that a surveillance system should combine data from several of these sources in order to compensate for the inadequacies of the individual sources and to improve the usefulness of the system. The most valuable sources were thought to be hospital discharge data, police reports, and postmortem reports.

In Uganda a one-page, 19-item registry form was piloted for routine use by nurses and medical assistants in the emergency departments of an urban tertiary hospital and a rural district hospital, with a view to developing an injury surveillance system (34). In both these settings it proved possible to train the staff in about four days and to incorporate the prospective data-gathering into routine functions without creating undue burdens for persons with clinical responsibilities.

Also in Pakistan the development of an injury-related information system has been investigated (7). It appeared that the use of police records, the mainstay of the established system, led to considerable underreporting. An increased role was advocated for the health sector in data collection and analysis as well as in the development of multisectoral partnerships for injury control and safety promotion.

It should be pointed out that inadequate information hampers other efforts to improve health in developing countries. Moreover, efforts to improve the prevention and management of other health problems have often included the development of better systems for the acquisition of reliable data on an ongoing basis. For example, record-keeping at ten health care facilities in the Kumasi area did not adequately cover obstetric complications and times of treatment (35), matters on which information was essential if maternal mortality was to be reduced; a programme costing US\$ 2000 for all ten facilities resulted in improved record-keeping. Similar low-cost improvements should also be possible in relation to injuries.

Application of the study methodology in other developing countries

Our study methodology could probably be used to improve injury surveillance in other low-income countries. The cost and personnel issues are probably fairly similar in different countries, and the value of the method in other settings would depend on the following: the proportion of trauma cases brought to a mortuary compared with those buried without any formal contact with government institutions; and the likelihood of obtaining reliable information about mechanisms of injury in cases brought to a mortuary.

The International Institute for Vital Registration and Statistics estimates that 20% of deaths in Ghana are registered with the government (range for sub-Saharan Africa, 5–60%). In most countries the proportion reported is higher in urban than rural areas (9). However, the study methodology would be less useful in circumstances where overall reporting were lower, e.g. below 10%. With regard to the likelihood of obtaining reliable information on mechanisms of injury, it should be noted that the study employed a variant of the technique of verbal autopsy — a technique that has been found

particularly reliable where injury is the cause of death (36). However, in most locations the completeness of reporting will probably be lower for more sensitive mechanisms, such as deaths from suicide, than for less sensitive mechanisms, such as road traffic accidents.

A similar methodology to that employed in the present study is being developed in South Africa. The South African National Non-Natural Mortality Surveillance System uses a short case report form that is completed by mortuary administrative personnel and forensic pathologists. There have been some difficulties associated with shortages of equipment and resistance among personnel but the system has largely proved simple, inexpensive, and timely. Its usefulness is evident from the numerous requests for data received from government departments, nongovernmental organizations, and the media (37).

Conclusions

Injury was a significant cause of mortality in Kumasi, especially among adults of working age. Transport-related mechanisms, especially those involving injury to pedestrians, accounted for the overwhelming majority of injury-related deaths. In a setting where data on the incidence and causes of death were limited, simple low-cost methods increased the completeness and accuracy of reporting of injury-related deaths in a mortuary. The expansion of this programme to other mortuaries could be a vital component of efforts to create an injury surveillance system, along with hospital records and police accident reports. ■

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Résumé

Utilisation des statistiques des morgues d'hôpital dans la mise au point d'un système de surveillance des traumatismes au Ghana

Objectif Mettre au point, dans le cadre d'une morgue d'hôpital, un programme pilote destiné à améliorer l'exactitude des enregistrements de décès par traumatisme.

Méthodes L'enregistrement des décès dus à des traumatismes a été amélioré à la morgue de l'hôpital universitaire Komfo Anokye de Kumasi (Ghana) grâce à la création, en 1996, d'une base de données prospective.

Résultats Le nombre de décès imputables à un traumatisme rapportés chaque année est passé de 72 avant 1995 à 633 en 1996-1999. Les traumatismes étaient à l'origine de 8,6 % de l'ensemble des décès enregistrés à la morgue et de 12 % des décès chez les 15-59 ans ; 80 % des décès dus à des traumatismes sont survenus en dehors de l'hôpital et n'auraient donc pas figuré dans

les statistiques hospitalières ; 88 % des décès par traumatisme étaient en rapport avec les transports et sur ce nombre, 50 % concernaient des piétons.

Conclusion Les traumatismes représentent une cause importante de mortalité dans ce contexte urbain d'Afrique, en particulier parmi les adultes en âge d'activité professionnelle. L'enregistrement à la morgue des décès par traumatisme est maintenant plus complet et plus exact grâce à l'application de méthodes simples et peu coûteuses. Cette source de données pourrait apporter une contribution notable à un système de surveillance des traumatismes, en s'ajoutant aux registres hospitaliers et aux rapports de police sur les accidents.

Resumen

Uso de estadísticas de depósitos de cadáveres para desarrollar un sistema de vigilancia de los traumatismos en Ghana

Objetivo Desarrollar un programa piloto destinado a mejorar la exactitud de los registros de las defunciones por traumatismos en un depósito de cadáveres.

Métodos Se procedió a mejorar el sistema de registro de las defunciones por traumatismos en la morgue del Hospital Docente Komfo Anokye, en Kumasi, Ghana, en 1996, procediendo para ello a crear una base de datos prospectivos.

Resultados Se observó un incremento del número de defunciones por traumatismos notificadas anualmente, de las 72 registradas antes de 1995 a las 633 de 1996–1999. Los traumatismos representaban el 8,6% de todas las defunciones registradas en la morgue, y el 12% de las defunciones registradas en el intervalo de 15 a 59 años; el 80% de las defunciones causadas por

traumatismos se produjeron fuera del hospital, y por tanto no aparecían reflejadas en las estadísticas hospitalarias. El 88% de las defunciones por traumatismos estaban relacionadas con el transporte, y en el 50% de los casos las víctimas eran peatones.

Conclusión Los traumatismos eran una causa importante de mortalidad en este entorno urbano de África, sobre todo entre los adultos en edad activa. Usando métodos sencillos y baratos se consiguió hacer más completa y precisa la notificación de las defunciones asociadas a traumatismos en un depósito de cadáveres. Esta fuente de datos podría ser una contribución importante a un sistema de vigilancia de los traumatismos, junto con los archivos hospitalarios y los informes de la policía sobre los accidentes.

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