

Incidence and outcome of injury in Ghana: a community-based survey

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Injury is an increasingly significant health problem in most low-income countries. However, strategies for preventing injury have not been well addressed. The present study was carried out to measure the incidence and outcome of various mechanisms of injury in Ghana in order to provide data for use in developing priorities for injury prevention efforts. For this purpose, using two-stage cluster sampling and household interviews, we surveyed 21 105 persons living in 431 urban and rural sites. During the preceding year, 1609 injuries resulting in one or more days of loss of normal activity were reported. Injury-related mortality was slightly higher in the urban (83 per 100 000) than in the rural area (53 per 100 000). However, the burden of disability from nonfatal injuries, as assessed by disability days, was higher in the rural (4697 disability days per 1000 person-years) than in the urban area (2671 days per 1000 person-years). Based on incidence rates and disability times, the major types of injury in the urban area were transport-related injury and falls. In the rural area, agricultural injuries predominated, followed by falls and transport-related injury. In rural and urban areas combined, 73% of motor vehicle-related injuries involved commercial vehicles. In this and other similar developing-country settings, injury prevention efforts should focus on falls and on transport safety in both urban and rural areas, with special attention being paid to commercial vehicles. In rural areas, agricultural injuries contributed the largest burden of morbidity, and should be a priority for prevention efforts.

Keywords: accidents, traffic; cost of illness; disability evaluation; Ghana; wounds and injuries, epidemiology and etiology.

Voir page 962 le résumé en français. En la página 963 figura un resumen en español.

Introduction

Injury is recognized as a major health problem in most high-income countries. It is also an important cause of death and disability in most low-income countries. This is especially the case in those countries that have experienced recent increases in industrialization and motorization, such as countries of east Asia and Latin America (1, 2). Even in the lower income countries, such as those of south Asia and Africa, injury is one of the leading causes of adult mortality and a major contributor to disability in most age groups (1–4).

Injury currently accounts for 14% of all disability-adjusted life year (DALY) losses for the world's entire population, and is expected to increase as a health problem globally. WHO and the World Bank project that injury is likely to account for 20% of all DALY losses for the world's population by 2020, with road traffic accidents alone being the third-leading cause of DALY losses (3). Despite this increasingly significant burden of death and disability, limited attention has been paid to injury as a health problem globally and particularly in low-income countries.

In many high-income countries, injury mortality rates have decreased in recent decades through a combination of prevention and better treatment (5). Development of effective injury prevention efforts depends on reliable, detailed information on the incidence and outcome of specific mechanisms of injury. In high-income countries, such data usually come from vital statistics registries and from health care records. In low-income countries, such sources of data are of limited value. Many deaths are never reported to the governments and information on cause of death is limited and unreliable, while many ill or injured persons never receive formal medical care, making health care records an incomplete source of data (1, 2, 6). These limitations apply to other diseases in low-income countries. However, for many of

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these, particularly infectious diseases and health conditions related to maternity or childhood (7), existing secondary data sources have been supplemented by community-based surveys to obtain more direct data on disease occurrence. Similar efforts to study injury in low-income countries have been infrequent, especially in sub-Saharan Africa.

The goal of the current study was to provide more accurate and complete data on injuries in Ghana. By so doing, we hoped to provide information that would be useful for the development of realistic and effective injury prevention efforts, aimed at those mechanisms of injury that lead to the largest societal burdens.

Methods

Study setting

The study setting included an urban (Kumasi) and a rural area (Brong-Ahafo Region) of Ghana (population, 17 000 000; per capita gross national product, US\$ 325). The city of Kumasi has a population of 650 000 and the rural area included all or portions of four contiguous districts in Brong-Ahafo Region: Berekum, Jaman, Wenchi and Dormaa (combined population 425 000).

Sampling strategy

Persons selected to be interviewed were chosen using two-stage cluster sampling, with probability proportional to population. This sampling methodology has been used extensively in low-income countries, where accurate listings of individual households are not available (8–10).

In the first stage of the sampling process, a subset of enumeration areas in Kumasi and the village and towns in the rural area was randomly selected with probability proportional to their population. In the second stage, a random location within each selected enumeration area or village/town was chosen and the nearest household selected to begin the interview process. Adjacent households were added as needed to ensure a minimum of 30 persons at each site or “cluster.”

Interview process

Information was sought on any injury that resulted in death or at least one day of lost activity involving any persons who had been living in the surveyed house during the preceding year. Demographic information on all members of the household was obtained.

For those who had suffered an injury, a six-page questionnaire was administered verbally in the vernacular language (Ashanti Twi). The questionnaire was developed specifically for this study and covered the mechanism of injury, injury sustained, treatment received, cost of treatment, economic consequences of the injury to the individual and his/her family, and length of disability. A day of disability was defined as a day during which the injured person

could not carry out his/her usual activity because of the injury. Information was obtained from either the injured persons themselves or from their relatives if the injured person was absent or was a child.

Field workers took a minimum of 2 h to survey the minimum of 30 persons at each site. Larger numbers were included at each site if time permitted. A total of 10% of sites were chosen randomly and revisited by the principal investigator (CNM) to confirm the findings of the field workers for quality assurance purposes. Data were gathered from May to November 1995. The study was approved by the Ministry of Health of Ghana.

Data management

The survey asked about any injury that had occurred during the preceding year. However, analyses of the survey data showed that interviewees' memories were not accurate over this recall period (11). Compared with an annual injury incidence rate derived from a one-month recall period, estimated annual injury incidence rates declined by 72% when a one-year recall period was used. Such memory decline was most notable for less severe injuries. Recall involving injuries resulting in less than 30 days of disability resulted in a 76% decline in estimated rates when a 12-month rather than a one-month recall period was used. Injuries resulting in ≥ 30 days of disability showed minimal decline (11).

We therefore categorized nonfatal injuries into minor (<30 days of disability) or major (≥ 30 days of disability). Two annual incidences were estimated for each mechanism of injury: a minor injury rate was estimated from the most recent month of recall time; and a major injury rate was estimated from 1 year of recall time.

To assess the impact of a given type of injury further, we recorded the period of disability resulting from each such injury. The overall societal impact of the different mechanisms of injury was thus gauged by estimating the days of disability per 1000 person-years. This was done separately for minor and for major injuries. Finally, an overall estimate of total disability days was calculated as the sum of minor and major injury disability days. Fatal injuries were considered separately.

Incidences, disability times, and their respective standard errors were calculated using Stata software (Stata Corporation, Stata Statistical Software: Release 5.0; College Station, TX, 1998), taking into account the cluster sampling strategy (10, 12, 13). Analyses of incidences and disability times used weights that were inversely proportional to the number of individuals sampled per cluster (8, 14).

Results

Denominator surveyed and injuries reported

Among the households initially approached for the survey, 0.6% refused to participate and for 4.1% no

one was at home when the interviewers called. Data were gathered on a total of 21 105 persons living in 431 sites (clusters). The urban sample included 11 663 persons in 263 clusters, and the rural sample, 9442 persons in 168 clusters. In the year preceding the interview, there were 1596 reported nonfatal injuries involving 1532 persons. This included 673 injuries to 651 persons in the urban sample and 923 injuries to 881 persons in the rural sample. There were also 13 fatal injuries reported (8 urban; 5 rural).

To calculate the incidences of nonfatal injuries, we used data only on the 443 minor injuries (160 urban; 283 rural) reported during the preceding recall month and on the 445 major injuries (200 urban, 245 rural) reported during the preceding recall year. In all, 313 reported urban injuries and 395 reported rural injuries were not used in the calculation of incidences. Data on all injuries were used to provide descriptive details of the mechanisms of injury.

Data on the days of disability resulting from the injury were missing for 4.8% of urban nonfatal injuries and for 0.5% of rural nonfatal injuries. Of those injuries which had disability times reported and which were used for the calculation of incidences, 30% of persons with minor injuries and 25% of persons with major injuries were still disabled at the time of the interview, with no difference between urban and rural settings. For these persons, the disability period was taken to be the length of time from the injury.

Mechanism-specific incidences for nonfatal injury

Mechanism-specific incidences for nonfatal injury for each study population are shown in Table 1. The incidences give some idea of the societal burden caused by each of the mechanisms. As injury severity differed by mechanism, the importance of each mechanism is also reflected by the number of disability days.

In the urban area, based on incidences alone, falls were the predominant nonfatal injury. However, transport-related injuries accounted for nearly as many disability days. In the rural area, nonintentional lacerations (accounting for 40% of all injury-related disability) stood out as the leading mechanism of injury, judged by both incidence and disability time. The majority (69%) of these lacerations were sustained during agricultural work. Falls were the second-leading cause of disability and transport-related injuries the third.

The overall rate of injury-related disability was higher in the rural (4697 disability days per 1000 person-years) than in the urban area (2671 disability days per 1000 person-years). The urban-rural difference was primarily due to the high rate of agricultural injuries in the rural area. Disability days were similar for falls, transport-related injuries and assaults in both areas.

Sex- and mechanism-specific incidences

Men had higher incidences of disability than women in both study locations (Table 2); however, the male predominance was more pronounced in the rural area.

In the urban area, male predominance was most notable for assaults. Females had higher rates of burn-related disability. In the rural area, males predominated in all classes of injury mechanism except for burns and assaults. It is notable that victims of assaults in the urban area were primarily men, but in the rural area, primarily women.

Age- and mechanism-specific incidences

Injury disability incidences were higher among older people, in both locations (Tables 3 and 4). In the urban area, falls were the leading mechanism of injury in younger (age < 15 years) and older (age > 45 years) people. Transport-related injuries were the leading mechanism in younger working-age adults (age 15–44 years). However, rates of disability from transport injuries were actually higher in older adults. Burns were mainly a problem among those aged under 5 years, where they were the second leading mechanism.

In the rural area, nonintentional lacerations were the leading contributor to morbidity for all those aged >5 years. As noted above, lacerations were primarily (69%) due to agricultural injuries. Transport-related injuries were highest among working-age adults (age 15–59 years). Falls were highest among the oldest group (age ≥ 60 years). Burns were primarily a problem among young children.

Details of mechanisms of injury

Information was used on all 1596 nonfatal injuries reported in the study.

Transport. In the urban area, the most frequent transport injuries were motor vehicle crashes and pedestrian injuries, while in the rural areas the commonest mechanisms were bicycle and motor vehicle crashes (Table 5). In both locations, the mean age of injured pedestrians and bicyclists was lower than that of persons injured by other mechanisms. Half of all injured pedestrians were children aged <15 years, as were 30% of bicyclists, compared with only 5% for all other transport-related injuries. Although bicycle crashes predominated in the rural area, these injuries resulted in shorter disability periods. In both locations, motor vehicle crashes and pedestrian injuries resulted in the longest disability periods.

In both locations combined, 111 injuries involving motor vehicles were reported. Most of these (73%) involved commercial vehicles, principally buses/minibuses (38%) and taxis (24%). Half (49%) of all motor vehicle-related injuries involved occupants in crashes of commercial vehicles and 24% involved pedestrians struck by such vehicles. Further details of transport-related injuries from this study have been published elsewhere (15, 16).

Table 1. Mechanism-specific incidences for accidents in the urban and rural study samples

Mechanism	Minor injuries		Major injuries		Total disability days
	Incidence ^a	Disability days ^b	Incidence ^a	Disability days ^b	
Urban (<i>n</i> = 11 663)					
Transport	16.6 (7.5, 25.8) ^c	167 (53, 281)	5.2 (3.7, 6.9)	575 (358, 793)	742 (497, 987)
Burn	6.5 (1.2, 11.7)	35 (2, 69)	1.2 (0.5, 1.8)	70 (27, 113)	105 (51, 160)
Assault	12.6 (5.2, 20.1)	86 (23, 149)	1.6 (0.8, 2.4)	112 (44, 180)	198 (105, 290)
Laceration	34.6 (21.8, 47.4)	152 (87, 216)	2.2 (1.3, 3.0)	103 (56, 149)	254 (175, 334)
Fall	64.2 (47.1, 81.3)	382 (250, 514)	6.0 (4.3, 7.6)	470 (302, 638)	852 (638, 1066)
Other	43.7 (30.4, 56.9)	250 (138, 363)	3.2 (2.0, 4.4)	269 (136, 402)	519 (345, 694)
Total	178.2 (146.1, 210.3)	1072 (820, 1323)	19.4 (16.1, 22.7)	1599 (1275, 1922)	2671 (2261, 3080)
Rural (<i>n</i> = 9442)					
Transport	35.0 (20.7, 49.3)	259 (129, 388)	3.3 (2.1, 4.6)	259 (133, 385)	518 (337, 698)
Burn	19.1 (9.7, 28.6)	125 (43, 208)	1.4 (0.4, 2.4)	129 (24, 234)	255 (122, 386)
Assault	7.8 (1.5, 14.0)	53 (13, 104)	1.5 (0.7, 2.3)	172 (49, 295)	225 (92, 357)
Laceration	167.1 (132.2, 202.0)	1235 (942, 1527)	10.6 (8.2, 13.0)	648 (485, 811)	1883 (1548, 2217)
Fall	93.1 (71.2, 115.1)	529 (372, 686)	5.0 (3.6, 6.5)	404 (241, 567)	933 (706, 1159)
Other	61.1 (42.2, 80.0)	447 (267, 627)	5.9 (4.1, 7.7)	437 (272, 599)	884 (642, 1126)
Total	383.2 (333.3, 433.3)	2648 (2209, 3088)	27.7 (23.7, 31.8)	2049 (1680, 2418)	4697 (4124, 5271)

^a Events per 1000 person-years.

^b Days lost per 1000 person-years.

^c Figures in parentheses are 95% confidence intervals.

Table 2. Sex- and mechanism-specific rates for disability days in the urban and rural study samples

Mechanism	Disability days ^a	
	Females	Males
Urban^b		
Transport	718 (413, 1023) ^c	773 (427, 1119)
Burn	131 (45, 216)	73 (14, 131)
Assault	78 (0, 155)	351 (166, 537)
Laceration	228 (120, 336)	288 (154, 422)
Fall	848 (552, 1144)	858 (570, 1146)
Other	471 (246, 696)	581 (270, 892)
Total	2475 (1985, 2967)	2926 (2291, 3562)
Rural^d		
Transport	307 (104, 509)	756 (449, 1063)
Burn	356 (123, 590)	138 (33, 242)
Assault	354 (122, 586)	72 (-19, 163)
Laceration	1633 (1160, 2106)	2151 (1631, 2670)
Fall	725 (467, 983)	1162 (774, 1150)
Other	640 (363, 916)	1156 (765, 1548)
Total	4015 (3270, 4760)	5437 (4536, 6339)

^a Days lost per 1000 person-years.

^b No. of females = 6555; no. of males = 5083. Sex details were missing for 25 persons, who were excluded from the analysis.

^c Figures in parentheses are 95% confidence intervals.

^d No. of females = 5014; no. of males = 4424. Sex details were missing for 4 persons, who were excluded from the analysis.

Burns. The epidemiology of burns in urban and rural locations was almost identical. These were primarily injuries involving children under 5 years of age. Taking both areas together, 63% of all burns

(*n* = 67) were scalds. Nearly half of these scalds (41%) involved children aged <5 years. Similarly, 63% of burns in this age group involved scalds.

A total of 22% of burn injuries (*n* = 23) were caused by hot objects, the most common of which were pressing irons (*n* = 6). Only 16% of burns were caused by fires, none of which were housefires.

Assaults. The assault mechanisms were nearly identical in both environments, with the majority of assaults (86%) involving blunt instruments. Only 13% involved stab wounds and only 1% gunshot wounds.

Lacerations. In the urban area, 35% of lacerations were occupationally related, with 15% involving agriculture, 6% carpentry, and 14% other work. Among the nonoccupational injuries, a variety of household and environmental hazards were involved, including nails (24%), knives (23%), broken glass (21%), and dog bites (7%).

In the rural area, 69% of lacerations were related to agricultural work. In the study area, agriculture was almost exclusively non-mechanized. The proportion of lacerations due to agricultural work was similar for both sexes but varied with age (Table 6). Even among children aged 5–9 years, 21% of lacerations were related to agricultural work. This proportion rose to over 75% throughout most of adulthood and remained high, even among the elderly.

Of the rural agricultural lacerations, most (70%) were caused by machetes, known locally as cutlasses. The remainder were caused by sharp sticks or other vegetation (21%), hoes (3%), or miscellaneous causes (6%). The most common farming

Table 3. Age- and mechanism-specific rates of disability days for urban^a study samples

Mechanism	Disability days ^b				
	0–4 years (n = 1310)	5–14 years (n = 3137)	15–44 years (n = 5802)	45–59 years (n = 856)	≥ 60 years (n = 551)
Transport	50 (–48, 149)	197 (64, 331)	946 (541, 1352)	1698 (349, 3047)	1770 (405, 3136)
Burn	394 (81, 708)	116 (–11, 243)	46 (4, 88)	95 (–92, 282)	0
Assault	31 (–30, 93)	104 (9, 199)	268 (117, 419)	239 (–230, 708)	302 (–286, 890)
Laceration	127 (–53, 306)	322 (138, 505)	249 (141, 357)	264 (–19, 547)	211 (–94, 516)
Fall	1654 (751, 2556)	720 (443, 997)	479 (270, 688)	1840 (422, 3258)	2057 (367, 3747)
Other	49 (–48, 146)	236 (90, 381)	684 (376, 992)	1157 (–119, 2433)	471 (–190, 1133)
Total	2309 (1249, 3370)	1695 (1274, 2115)	2675 (2077, 3272)	5294 (2937, 7651)	4812 (2534, 7089)

^a Age data missing for 7 persons, who were excluded from the analysis.

^b Days lost per 1000 person-years.

Table 4. Age- and mechanism-specific rates of disability days for rural^a study samples

Mechanism	Disability days ^b				
	0–4 years (n = 1227)	5–14 years (n = 2698)	15–44 years (n = 4087)	45–59 years (n = 693)	≥ 60 years (n = 735)
Transport	326 (–169, 821)	173 (29, 317)	784 (426, 1142)	965 (250, 1679)	177 (–168, 521)
Burn	636 (114, 1157)	254 (–40, 548)	135 (–8, 279)	468 (–219, 1154)	108 (–103, 318)
Assault	0	27 (–10, 64)	382 (113, 651)	696 (–172, 1564)	0
Laceration	17 (–16, 50)	1418 (889, 1948)	2044 (1555, 2534)	2690 (1262, 4117)	4852 (2790, 6915)
Fall	659 (232, 1085)	826 (496, 1157)	729 (399, 1059)	466 (–209, 1142)	3257 (1432, 5083)
Other	117 (–20, 253)	571 (284, 858)	1133 (687, 1580)	613 (75, 1152)	2086 (848, 3324)
Total	1754 (906, 2602)	3272 (2492, 4052)	5208 (4275, 6141)	5898 (3633, 8164)	10 480 (7513, 13447)

^a Age data missing for 2 persons, who were excluded from the analysis.

^b Days lost per 1000 person-years.

activities associated with injuries were weeding or clearing land (63%) and planting or harvesting crops (20%).

Falls. For those falls for which details were known, those in the urban area were more likely to be from a height (41%) than were rural falls (24%). Among falls from heights in the urban area, those involving open street-side gutters (12% of all urban falls) and stairs (8%) were the most common. In the rural area, trees were the most common hazards (8% of all rural falls). Of the falls at ground level, most were at sporting events in both locations, accounting for 8% of all urban falls and 14% of all rural falls.

Other. Of the 125 miscellaneous injury mechanisms in the urban area, the two most common injury causing events were nonintentional kicks or blows received in sporting events (20%) and hand injuries sustained while using a mortar and pestle during food preparation (16%).

Of the 169 miscellaneous injury mechanisms in the rural area, the most common (34%) was envenomation caused by poisonous snakes (83%), scorpions (14%) and other animals (3%). Most (68%) envenomations occurred during agricultural work. Other mechanisms involved falling trees or wood, usually during cutting of trees to obtain firewood, (9% of other injuries) and hand injuries sustained while using a mortar and pestle during food preparation (8%).

Injury mortality

Eight deaths were reported in the urban population, giving an annual injury mortality rate of 83 per 100 000 (95% confidence interval (CI) = 26–140). The sample size was not sufficient to allow meaningful estimates to be made of mechanism-specific or age-specific mortality rates. However, case fatality rates can be calculated using the combined fatal and nonfatal injuries reported in the study. In the urban area, there were six transport-related deaths, one due to burns, and one due to assault. Hence, the case fatality rate for transport-related injuries (5.5%) was higher than that for all other mechanisms combined (0.4%).

In the rural population, there were five deaths reported: two due to assault, two transport-related, and one agricultural injury. The annual injury mortality rate was 53 per 100 000 (95% CI 4–93). The case fatality rates for assaults (6.1%) and transport-related injuries (2.3%) were higher than for all other mechanisms combined (0.1%).

The age distributions of deaths reported in this study were similar in both locations (urban location: mean, 43.3 ± 11.2 years; median, 39 years; range, 31–62 years; rural location: mean, 42.8 ± 17.2 years; median, 50 years; range, 24–64 years).

Discussion

The goal of this study was to provide information that would be useful for planning realistic and effective

Table 5. Mechanisms for the transport-related injuries in the urban and rural study areas

Mechanism	Urban			Rural		
	<i>n</i> = 104 (%)	Mean age (years)	Mean no. days of disability	<i>n</i> = 86 (%)	Mean no. (years)	Mean no. days of disability
Motor vehicle crash	45	35.1 (15.6) ^a	86.9 (92.8)	24	32.8 (14.5)	55.4 (65.5)
Motorcycle crash	4	39.5 (8.1)	14.8 (11.9)	5	30.0 (8.1)	10.5 (4.7)
Pedestrian	39	22.2 (19.8)	50.7 (56.0)	14	20.7 (20.8)	57.3 (93.2)
Bicycle	6	23.2 (14.1)	21.0 (34.0)	51	22.3 (13.0)	19.0 (26.3)
Other	6	31.3 (19.0)	55.8 (42.3)	6	26.2 (15.0)	26.8 (37.1)
Total	100	29.9 (18.1)	64.0 (76.0)	100	25.5 (15.0)	33.3 (53.7)

^a Figures in parentheses are standard deviations.

Table 6. Proportion of nonintentional lacerations due to agricultural work, by age group, for the rural sample

Age group (years)	No. of lacerations	% of lacerations due to agricultural work
0–4	4	0
5–9	29	21
10–14	48	40
15–19	48	56
20–29	87	75
30–39	69	84
40–49	45	93
50–59	25	92
≥60	54	74
Total	409	69

injury prevention efforts in low-income countries. In particular, we sought to identify those mechanisms of injury that lead to the highest societal burden in Ghana. Before drawing conclusions from these data, however, the limitations of the study methodology must be addressed.

- First, the study relied on self-reporting by respondents. The veracity of their answers on the occurrence of injury events or the duration of the resultant disability could not be independently verified. There is probably a tendency to under-report sensitive events such as suicides and assaults.
- Second, some injured persons had not yet recovered from their injury at the time of the interview. Most of these would have experienced a longer period of disability, and some, perhaps, permanent disability. Furthermore, the survey evaluated only injuries during the recall year. Hence, the burden of disability due to older injuries causing permanent impairment was not evaluated. This factor, along with the above-noted underreporting of sensitive mechanisms of injury, suggests that the impact of injury reported in this study is an underestimate.
- Third, disability time was the only measure of severity used to assess nonfatal injuries. Anatomical severity of the initial injury could not be

assessed by retrospective self-reporting. Furthermore, in the assessment of the overall burden of individual mechanisms (Table 1), the disability times reflected the sum of all age groups. No priority was given to any age group. Most likely, however, a given disability day among adults of working age is likely to have greater economic consequences than among other age groups.

- Finally, the sample size of this survey was not large enough to allow estimates to be made of mortality rates by sex, age, or mechanism.

Nonetheless, this study allows some conclusions to be drawn about which mechanisms contributed most significantly to the societal burden of injury in the study areas. In the urban area, falls were the single largest contributor to disability days. However, transport-related injuries stood out as the second largest contributor to disability and the largest source of injury-related mortality. Transport-related injuries were the leading contributor to disability days for younger adults of working age (15–44 years), suggesting a significant economic impact as well.

In the rural population, the leading contributor to disability was agricultural injuries. Falls were also a significant contributor. The incidences and disability times resulting from falls were similar in both urban and rural locations.

Assaults were infrequently reported in both locations. As discussed above, the household interviews used in this survey probably underestimated the incidence of assaults. Burns were primarily a problem of young children in both locations, with the most frequent scenario being a scald injury.

Our findings agree, in part, with studies in other low-income countries. These studies show a tremendous burden of death and disability from road traffic injuries, especially in those societies that have undergone recent increases in motorization, such as Latin America and East Asia. Injuries are now the leading cause of death in persons aged 1–44 years in many such countries, including China, Mexico, and Thailand. Transport-related mechanisms are the leading causes of such injury-related mortality (1, 2, 17, 18).

A high rate of morbidity from agricultural injuries has also been reported by community-based surveys. In rural India in 1962, Gordon et al. found a preponderance of agricultural injuries (19). In a more recent study in rural India, Mohan reported a high incidence of extremity injuries from locally manufactured, mechanized farm equipment (20). There have only been a few other such surveys of injuries in low-income countries, mostly in Asia (2) and Latin America (21).

Similar population-based surveys for sub-Saharan Africa have been rare and focused on burns (22, 23). However, hospital-based data suggest that transport-related injuries are among the leading causes of more severe injuries, especially in urban environments. In one Nigerian city, Elechi & Etawo found injuries to be the leading cause of deaths in hospitals (10%) and the main reason for emergency visits (29%). Road traffic injuries accounted for 26% of such injury-related emergency visits, but for 68% of injury-related deaths (24).

In a previous hospital-based study carried out in the urban area, we reported transport-related mechanisms to be the leading cause of injury-related admissions for children (40%), followed by falls (27%). However, transport accounted for over half (54%) of the injury-related mortality in that study, followed by burns (27%), and falls (8%) (25). This corroborates findings from the present study, showing that although falls are a significant contributor to nonfatal injuries, transport is the most important contributor to mortality.

A previous hospital-based study carried out in the rural area (26) reported that the leading mechanism of injury among admitted patients was transport (26%). The largest single contributor to mortality was also transport (41%).

Based on the burden of death and disability demonstrated in this study and elsewhere, prevention measures in the urban population in Ghana should make transport-related injuries and falls a priority. In the rural population, the priorities should include agricultural injuries, falls and transport-related injuries.

Clearly, prevention priorities will vary between countries. For the prevention of transport-related injuries in low-income countries, in general, and in Ghana in particular, some of the preventive strategies that have been successful in developed countries might be useful. However, the transport systems in today's low-income countries differ so much from those of past or present high-income countries that blanket adoption of safety measures from high-income countries should not be viewed as the solution (27). Consideration must be given to the financial restrictions of low-income countries, as well as the local culture and characteristics of the transport system (28). Transport-related injuries in Ghana are very different from those in high-income countries, where crashes of privately owned passenger vehicles predominate, and are also different from some other low-income countries, where crashes of motorcycles

predominate (2). The major mechanisms that must be focused upon in Ghana and other similar low-income countries include the following: crashes of publicly used vehicles, driven by commercial drivers, in both urban and rural areas; and pedestrian injuries, especially children struck by taxis and other commercial vehicles, in the urban area.

Many specific risk factors need to be assessed for their potential contribution to transport-related injuries and their potential role in road safety efforts in low-income countries. These include anti-drink-drive measures, speed control, vehicle inspection, licensing requirements, use of seatbelts and infrastructural changes (29, 30). In view of the rapid growth of motorization in many low-income countries and the critical role of transport in economic development, solutions to road safety problems are not likely to be easy. Progress will be aided by the development of a core of traffic safety and injury prevention professionals in each country, confronting the particular problems of their own environments.

As in the current study, injuries from falls in high-income countries involve the extremes of age. However, a different set of environmental risk factors is probably at play. In high-income countries fall-prevention efforts aimed at the elderly have included assessment of medications causing postural hypotension, exercise programmes, use of hormone or calcium supplements to prevent osteoporosis, and modification of the home environment, including safety devices such as grab bars next to the bath or toilet. Fall-prevention efforts aimed at young children have included window guards and safety gates at the tops of stairways (28, 31, 32). Similar efforts in Ghana and other low-income countries need to be based on a better understanding of the epidemiology of falls in these environments.

The huge burden of disability resulting from agricultural injuries stands out as one of the major findings of the study. Injuries sustained during nonmechanized farming have received scant attention worldwide, despite their probable effect on food production. Suchman & Munoz addressed injuries from machetes among sugar cane workers in Puerto Rico (33). Such injuries were primarily to the hands and arose from one repetitive action in harvesting the sugar cane. These factors enabled prevention efforts to focus on the development of protective metal gloves (33). However, in Ghana the situation is more complex, with multiple different crops being grown and injuries being sustained in a variety of different activities.

Other injuries that were less common, but none the less important, included burns and assaults. In high-income countries burn prevention has emphasized housefires and scald injuries from hot tap water. The risk factors for burns in the current study would obviously not be addressed by such efforts. Further work is needed to elucidate the risk factors that could be addressed in Ghana (28).

Prevention of injuries from assaults has traditionally been viewed as the role of law enforcement agencies, and violence prevention in public health is still in its infancy. In high-income countries the latter has included teaching conflict resolution skills to those at highest risk for injuries from interpersonal violence, i.e. urban youth. Controversy has arisen over efforts to limit the availability of means of violence, especially firearms (31). Before addressing similar violence prevention efforts in a location such as Ghana, considerable research would be needed to address the social and psychological factors that predispose to violence in that environment.

Finally, a major impediment to the development of effective injury prevention strategies in many low-income countries is lack of acknowledgement of their importance by the public and by many policy-makers. Data on the consequences of injuries, as briefly reported in this study, need to be brought to light on a wider scale. There is sufficient evidence of the significance of injury as a health problem, however, that increased attention should be paid to

it by national governments and organizations involved in international health (1, 34–36). ■

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Résumé

Enquête en communauté sur l'incidence et l'issue des traumatismes au Ghana

On constate que même si les traumatismes représentent un problème de santé publique croissant dans la plupart des pays à faible revenu, les mesures visant à les prévenir laissent à désirer. La présente étude a pour objectif de recueillir des données sur l'incidence et l'issue des traumatismes d'origine diverse au Ghana. Nous espérons que les informations ainsi fournies permettront de fixer des priorités en matière de prévention et d'identifier les sources de traumatisme qui pèsent le plus lourdement sur la collectivité.

Une zone urbaine (Kumasi) et une zone rurale (Brong-Ahafo) ont été retenues pour l'étude. Un échantillon a été sélectionné par tirage au sort dans chacune de ces zones conformément à la méthode de sondage en grappe à deux degrés, avec une probabilité de tirage proportionnelle à la taille. Nous avons procédé à des enquêtes et entretiens domiciliaires sur 21 105 personnes habitant 431 sites urbains et ruraux. Durant l'année qui a précédé l'étude, il y a eu 1609 traumatismes responsables d'au moins une journée de perte d'activité normale. La mortalité d'origine traumatique était légèrement plus élevée en zone urbaine (83 pour 100 000) qu'en zone rurale (53 pour 100 000); en revanche, la charge des incapacités dues à des traumatismes non mortels, mesurée en journées d'incapacité (journées de perte d'activité), était plus élevée en zone rurale (4697 journées d'incapacité pour 1000 personnes-année) qu'en zone urbaine (2671 journées d'incapacité pour 1000 personnes-année).

Si l'on considère les taux d'incidence, les périodes d'incapacité et les chiffres de la mortalité, on constate que ce sont les moyens de transport et les chutes qui sont les principales sources de traumatismes en zone urbaine.

Dans la population rurale, ce sont les blessures involontaires qui prédominent, représentant 40% de l'ensemble des incapacités d'origine traumatique. Le travail agricole manuel est à l'origine de la plupart (69%) de ces blessures, les chutes et les moyens de transport suivant de près.

En zone rurale comme en zone urbaine, les véhicules utilitaires étaient responsables de 73% des traumatismes impliquant des véhicules à moteur. L'incidence des chutes et des brûlures et les journées d'incapacité qui leur étaient imputables étaient analogues dans les deux zones, les chutes concernant essentiellement des personnes très âgées et des tout petits, et les brûlures — par ébouillantage — de jeunes enfants. De même, l'incidence des agressions et les journées d'incapacité qu'elles avaient entraînées étaient les mêmes dans les deux zones où l'on recensait principalement des agressions avec blessures par contusion et quelques blessures pénétrantes intentionnelles.

Les gouvernements de même que les organisations travaillant dans le domaine de la santé internationale doivent se préoccuper davantage des traumatismes en tant que problème de santé publique dans les pays à faible revenu. Au Ghana et dans d'autres pays où la situation est analogue, en zone urbaine comme en zone rurale, il faut s'efforcer de prévenir les chutes et de rendre les moyens de transport plus sûrs, notamment les véhicules utilitaires. Dans la population rurale, ce sont les traumatismes liés au travail agricole manuel qui contribuent le plus à la charge de morbidité; et c'est sur eux que les efforts de prévention devront porter en priorité.

Resumen

Estudio comunitario de la incidencia y los resultados de los traumatismos en Ghana

Aunque los traumatismos constituyen un problema sanitario de creciente importancia en la mayoría de los países de bajos ingresos, no se han desarrollado estrategias adecuadas para la adopción de medidas encaminadas a prevenirlos. El objetivo del presente estudio consistió en aportar datos sobre la incidencia y los resultados de diversas causas de traumatismo en Ghana. Confiábamos así en proporcionar información que ayudase a establecer prioridades para la prevención de traumatismos, identificando las causas que conllevaran la mayor carga para la sociedad.

El estudio llevado a cabo comprendió una zona urbana (Kumasi) y una zona rural (Brong-Ahafo) de Ghana. En cada zona se eligió una muestra al azar mediante una técnica de muestreo por conglomerados en dos etapas con probabilidad proporcional al tamaño. Mediante visitas a los hogares y entrevistas, estudiamos a 21 105 personas de 431 sitios urbanos y rurales. Durante el año previo al estudio se habían producido 1609 traumatismos de gravedad suficiente para obligar a interrumpir las actividades normales durante uno o más días. La mortalidad asociada a traumatismos fue ligeramente superior en la zona urbana (83 por 100 000 habitantes) que en la rural (53 por 100 000); sin embargo, la carga de discapacidad por traumatismos no mortales, determinada en función de los días de discapacidad (días de inactividad), fue mayor en la zona rural (4697 días de discapacidad por 1000 personas-año) que en la zona urbana (2671 días de discapacidad por 1000 personas-año).

Considerando las incidencias, los días de discapacidad y la mortalidad, las principales causas de traumatismo en la zona urbana fueron los medios de transporte y las caídas. En el ámbito rural predominaron

las laceraciones involuntarias, que representaron el 40% de la discapacidad asociada a traumatismos; la mayoría (69%) de esas laceraciones se produjeron durante la realización de tareas agrícolas no mecanizadas. Otros mecanismos frecuentes en el mundo rural fueron las caídas y el transporte.

En las localidades rurales y urbanas, del total de traumatismos en que intervinieron vehículos de motor, el 73% eran vehículos comerciales. La incidencia de caídas y los días de discapacidad por esa causa fueron similares en las dos zonas y afectaron fundamentalmente a los grupos de edad extremos. La incidencia de quemaduras y los días de discapacidad asociados fueron similares en las dos zonas, y en este caso las víctimas fueron sobre todo los niños pequeños, por escaldamiento con líquidos calientes. Asimismo, la incidencia de agresiones y los días de discapacidad por ese motivo fueron similares en las dos zonas, y la causa fueron principalmente heridas no penetrantes, pues se notificaron pocas lesiones intencionales con penetración.

Los gobiernos y las organizaciones con influencia en la salud internacional deberían prestar más atención al problema sanitario que suponen los traumatismos en los países de bajos ingresos. En Ghana y en otros entornos parecidos, las medidas de prevención de traumatismos deberían centrarse en las caídas y en la seguridad del transporte, tanto en las zonas urbanas como en las zonas rurales, y dedicar especial atención a los conductores de vehículos comerciales. En las zonas rurales, los traumatismos sufridos durante tareas agrícolas no mecanizadas representaron con mucho la mayor contribución a la carga de morbilidad, y por consiguiente deberían ser objeto de una mayor atención a la hora de desarrollar medidas de prevención.

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