The effect of recall on estimation of incidence rates for injury in Ghana

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Background
Injury is a major public health problem in many developing countries. Due to limitations of vital registry and health service data, surveys are an important tool to obtain information about injury in these countries. The value of such surveys can be limited by incomplete recall. The most appropriate recall period to use in surveys on injury in developing countries has not been well addressed.

Methods
A household survey of injury in Ghana was conducted. Estimated annual non-fatal injury incidence rates were calculated for 12 recall periods (1–12 months prior to the interview, with each successively longer period including the preceding shorter periods).

Results
There was a notable decline in the estimated rate from 27.6 per 100 per year for a one-month recall period to 7.6 per 100 per year for a 12-month recall period (72% decline). The extent of this decline was not influenced by age, gender, rural versus urban location, nor by type of respondent (in-person versus proxy). Rate of decline was influenced by severity of injury. Injuries resulting in <7 days of disability showed an 86% decline in estimated rates from a one-month to a 12-month recall period, whereas injuries resulting in ≥30 days of disability showed minimal decline.

Conclusions
In this setting, longer recall periods significantly underestimate the injury rate compared to shorter recall periods. Shorter recall periods (1–3 months) should be used when calculating the overall non-fatal injury incidence rate. However, longer recall periods (12 months) may be safely used to obtain information on the more severe, but less frequent, injuries.

Keywords
Developing country, injury, recall, survey

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In developing countries, infectious disease has traditionally been the leading cause of mortality. In recent decades, the mortality rates from such diseases have been decreasing, in part due to the success of public health programmes. However, injury related mortality and disability have been increasing as a result of factors such as increased motorized transport. Injury is now one of the leading causes of adult mortality in most developing countries. 1–3 It is also one of the leading causes of disability, accounting for 12% of all Disability Adjusted Life Years lost worldwide. 4

Efforts to combat the problem of injury in the developing world are hampered by lack of adequate information concerning its incidence and outcome. Vital statistics are often incomplete. Health service data may also be incomplete as a source of incidence data, as many injured people may not receive formal medical care. 3,5,6 Hence, population-based surveys emerge as an important tool to obtain information about injury in these environments.

Surveys on injury usually rely on retrospective self-report. Information may thus be subject to bias from inaccurate recall, primarily due to memory decay. 7–9 The extent of memory decay and the optimum recall period to use in surveys have been addressed for a variety of other health problems in developing countries. 10 These methodologic issues have also been addressed for surveys on injury in developed countries. 8,9 However, they have not been well addressed for injuries in developing countries.

The purpose of this study was to evaluate the extent of memory decay by using different recall periods to estimate the annual incidence rate for injuries in a developing country. We also sought to determine how memory decay would vary
among different sub-populations and with different injury characteristics. By so doing, we hoped to determine the best approach to handling incomplete recall in the collection and analysis of injury data obtained by surveys in developing countries.

Methods

Study setting

The study setting included an urban and a rural area in Ghana. This nation has a population of 17 000 000 and a per capita gross national product of $390. The urban area involved the Kumasi Metropolitan Area (population 654 000) and the rural area involved all or portions of four contiguous districts of the Brong-Ahafo Region: Berekum, Jaman, Wenchi and Dormaa (combined population of 425 000).

Sampling strategy

People selected to be interviewed were chosen using stratified, two-stage cluster sampling with probability proportional to size. This sampling methodology has been used extensively in developing countries, where accurate lists of individual households are not available. The methodology used in this study has been adapted from the World Health Organization’s Expanded Program on Immunizations.11–13

The urban and rural areas served as separate strata. In the first stage, subsets of the individual sections (Enumeration Areas) of Kumasi and of the villages and towns of the rural areas were randomly selected with probability proportional to their populations.11–13 In the second stage, research assistants visited each of the selected sites and selected a random group of households to be interviewed. Information was sought on all individuals living in the selected households.

Interview process

Information was obtained on any injury during the preceding year which had resulted in one or more days of lost activity. A six-page questionnaire was developed specifically for this study and was verbally administered in the vernacular language (Ashanti Twi). This questionnaire concerned the mechanism of injury, the anatomic location of the injury, the treatment obtained, the cost of treatment, and the outcome of the injury, including the resulting length of disability. Information was obtained from either the injured person or from their relatives, if the injured person was absent or was a child. Ten per cent of sites were randomly chosen and revisited by the principal investigator (CM) to confirm the findings of the field workers for quality assurance purposes. Data gathering was conducted from May to October 1995.

Data management

As cluster size was variable, weighting was performed. Weights were inversely proportional to the number of individuals per cluster.11,14 Annual injury incidence rates were calculated for recall periods ranging from 1 to 12 months, in one-month increments. Estimated annual rates based on a specific recall period were calculated as follows:

\[ I_x = \frac{n_x}{d_x} \]

where \( I_x \) = estimated annual incidence rate calculated from data using recall period of \( x \) months,

\( n_x \) = number of injuries reported as occurring during the preceding \( x \) months,

\( d_x \) = person-time in denominator for recall period \( x \) months.

Longer recall periods include injuries reported in preceding shorter recall periods. For example, all injuries reported in the one-month recall period are also included in the 2-month recall period. Calculation of injury incidence rates and their 95% confidence intervals (CI) was performed using SUDAAN Version 7.1 (Research Triangle Institute, Research Triangle Park, NC, 1996). The study was approved by the Ministry of Health of Ghana.

Results

Injury incidence and effect of recall period

Among the households initially approached for the survey, 0.6% refused to participate and in 4.1% no one was at home. Data were gathered on a total of 21 105 people living at 431 sites (clusters). The urban sample included 11 663 people in 263 clusters and the rural sample, 9442 people in 168 clusters.

During the previous year, there were 13 fatal injuries reported, for a trauma mortality rate of 69/100 000/year (95% CI : 30–108). There were 1596 non-fatal injuries occurring to 1534 people. The majority (98%) of respondents were able to provide an estimate of the time which had elapsed between the injury and the interview. Thirty-six (2%) stated that the injury had occurred sometime during the previous year, but could not provide more exact information.

Analysis of the effect of recall period was carried out for the non-fatal injuries. Figure 1 shows the estimated annual injury incidence rates for all 12 recall periods. There was notable decline in the rate over these periods. The rate declined from 27.6/100/year for a one-month recall period to 7.6/100/year for a 12-month recall period. This represented a 72% decline. The largest single decline (28%) occurred between the first and second month.

The annual injury rate estimated using all of the data, including that of the individuals who could only state that their injury occurred sometime during the prior year, was 7.8/100/year,
slightly higher than the rate estimated using a 12-month recall period.

The numerator of injury events includes more observations for the longer recall periods, which influences the precision of the estimates. It can be seen in Figure 1 that the CI are wider around the shorter recall period estimates (e.g. ±9.9% of the point estimate for the one-month recall period) than around the estimates of the longer recall periods (±5.2% of the point estimate for the 12-month recall period).

**Demographic characteristics**

Injury rates were higher for males than for females (Figure 2). However, the decline in estimated annual rates from one-month to 12-month recall periods was equal at 72%.

Variations in estimated injury rates by age are indicated in Table 1. Although injury rates varied, memory decay varied minimally among the different age groups. Decline in estimated rates ranged from 63% for the 40–49 year age group to 75% for children aged <5 years and aged 10–14 years, with no consistent pattern among the ages.

Injury rates were higher in the rural areas, however the decline of estimated rates was similar for both rural (75% decline) and urban (68% decline) locations (Figure 3).

**Severity of injury**

Decline in estimated annual rates was most notable for less severe injuries (Figure 5). Estimated rates for injuries with disability times of less than 7 days declined by 86% between a one-month and a 12-month recall period. Rates for injuries with disability times of between 7 and 29 days declined by 68%. Rates for the most severe group of injuries (disability of 30 or more days) varied minimally with different recall period. As the disability time of 30 days would not pertain to injuries occurring within the month immediately before the interview, analysis of recall for the most severe category begins with a 2-month recall period.

### Table 1  Age-specific estimated annual injury rates (per 100) for one-month versus 12-month recall periods. Data on age missing for nine members of the denominator

<table>
<thead>
<tr>
<th>Age (years)</th>
<th>No.</th>
<th>Incidence (95% CI) 1-month recall</th>
<th>Incidence (95% CI) 12-month recall</th>
<th>% decline</th>
</tr>
</thead>
<tbody>
<tr>
<td>0–4</td>
<td>2537</td>
<td>24.3 (17.1–31.6)</td>
<td>6.1 (4.9–7.3)</td>
<td>75%</td>
</tr>
<tr>
<td>5–9</td>
<td>2985</td>
<td>29.2 (21.8–36.6)</td>
<td>7.6 (6.6–8.6)</td>
<td>74%</td>
</tr>
<tr>
<td>10–14</td>
<td>2850</td>
<td>31.7 (24.3–39.1)</td>
<td>7.9 (6.9–8.9)</td>
<td>75%</td>
</tr>
<tr>
<td>15–19</td>
<td>2571</td>
<td>20.9 (15.2–26.6)</td>
<td>7.0 (5.8–8.2)</td>
<td>67%</td>
</tr>
<tr>
<td>20–29</td>
<td>3903</td>
<td>28.2 (21.5–34.9)</td>
<td>7.8 (6.8–8.8)</td>
<td>72%</td>
</tr>
<tr>
<td>30–39</td>
<td>2547</td>
<td>29.0 (21.7–36.3)</td>
<td>7.6 (6.4–8.8)</td>
<td>74%</td>
</tr>
<tr>
<td>40–49</td>
<td>1493</td>
<td>21.5 (13.1–29.9)</td>
<td>8.0 (6.4–9.6)</td>
<td>63%</td>
</tr>
<tr>
<td>50–59</td>
<td>924</td>
<td>25.2 (14.2–36.2)</td>
<td>7.8 (5.8–9.8)</td>
<td>69%</td>
</tr>
<tr>
<td>≥60</td>
<td>1286</td>
<td>40.7 (28.9–52.5)</td>
<td>10.7 (8.9–12.5)</td>
<td>74%</td>
</tr>
</tbody>
</table>
Discussion

In surveys, the accuracy of recall can be influenced by either memory decay, the tendency to forget and to underreport events, or by telescoping, the tendency to report events occurring outside the recall period as if they had occurred within it.7–9

The effect of recall has been addressed for surveys on injury in developed countries. In one of the most extensive analyses, Harel et al.8 used the data from Child Health Supplement to the National Health Interview Survey in the US. They examined differences in estimated annual rates using recall periods varying from one month to 12 months, in a similar fashion to the current study. They analysed injuries for which any medical treatment was sought or for which at least half a day of usual activity was lost. They found a decline in estimated rates from 24.4/100/year with a one-month recall period to 14.7/100/year with a 12-month recall period (40% decline). Decline was minimal with more severe injuries: those resulting in loss of at least one school day or with those requiring hospitalization or surgery, than with more minor injuries.8

In a similar study, Cash and Moss9 looked at recall of injuries resulting from motor vehicle crashes in North Carolina and used mention of injuries in police reports as the criterion to which self-reports were compared. Self-report of injuries decreased with longer recall period: 87% for <3 months; 79% for <6 months; and 73% for <12 months. Self-reporting of injuries was more complete for the more serious injuries: bleeding wounds, distorted limbs, or ambulance transport.9

In developing countries, the issues of memory decay and the appropriate recall period to use for surveys have been extensively addressed for a variety of entities, especially infectious diseases and maternal-child health problems, but not for injury.10

Population-based surveys on injury in developing countries have been scarce, and have primarily involved Asia,5,15–17 and Latin America8,19 In studies of agricultural injuries in rural India, Gordon et al.16 and Mohan et al.17 used 4-week recall periods with monthly visits. A study in Papua New Guinea utilized existing verbal autopsy data collected from vital registry surveillance, which was carried out with household visits using a one-month recall period. These data were supplemented by every third year censuses, which used a 3-year recall period.3 In a study utilizing both hospital and community-based data in four Latin American countries, Bangdiwala et al. used 2–3-month recall periods for less severe childhood injuries.18 Similar surveys for Africa have been rare and have focused mainly on burns. In a study by Courtright et al.20 on burns in all ages and a study by Forjuoh et al.21 on childhood burns, recall periods included lifetime experiences.

The extent of memory decay and the issue of what should be an appropriate recall period for surveys on injuries in developing countries has not been well addressed. The purpose of the current study was to obtain more complete information on injuries in an African nation and to assess the effect of recall in the resultant data.

Before drawing conclusions from the data, the constraints of the study must be addressed. The principal constraint is that the study relied on self-report of injury by respondents. There was no way to validate independently the veracity of their answers, as regards the occurrence of the injury nor the resulting disability period. It can be anticipated that there would be relative underreporting of sensitive mechanisms, such as domestic violence and suicide. Despite these limitations, the study nonetheless allows reasonable inferences to be drawn about the nature of memory decay in the study population.

The extent of memory decay, as manifested by the decline in estimated annual rates from one-month to 12-month recall periods was more pronounced in the data from Ghana (72% decline) than in similar data from the USA (40% decline).8 It might be postulated that part of the reason for the greater memory decay in the African data is a lower level of formal education and lower socioeconomic status. However, within Ghana, there was minimal variation in the extent of memory decay between urban and rural populations, although the overall level of education is higher in the former.
The differences in memory decay might be related to the different familial housing patterns. The National Health Interview Survey employs interviews with nuclear families. One respondent typically answers for their spouse and offspring. In Ghana, many people live in extended family groups. It is typical for respondents to answer on behalf of brothers and sisters and their respective offspring as well as their own ‘nuclear’ family. As a respondent might be answering on behalf of more individuals, underreporting as well as memory decay, might be more extensive. However, data on the number of in-person versus proxy respondents is not reported for the data from the USA. Moreover, in Ghana, the extent of memory decay was similar whether respondents were present or absent (Figure 4). Hence, if there were more use of proxy data in the Ghanaian survey, it might have lead to more underreporting, but is not likely to have contributed to greater memory decay.

Regarding determinants of memory decay, Harel et al. found that the decline in rates was most pronounced for younger children (aged 0–4 years, 70% decline). In the current study, although memory decay was highest for the rates for younger children (0–4 years), differences between the ages were less marked than in Harel et al.’s study. The most significant determinant of memory decay in all studies was the severity of the injury (Figure 5).

Harel et al.’s study was an increase in estimated rates with a 12-month recall period in comparison to 11- or 10-month periods, as might be expected if events occurring more than a year before were being reported as occurring within the recall year. Moreover, adding in data for individuals who could only remember that the injury had occurred during the past year, but not in a specific month, increased the estimated annual rate only minimally in the Ghanaian data.

Both Cash and Moss and Harel et al. concluded that shorter recall periods of 1–3 months should be used in surveys of non-fatal injuries. Given that the extent of memory decay in the current study was even more marked, it might be assumed that similar recommendations should pertain. However, surveys are used for somewhat different reasons in the environments of the developed versus the developing world. In developed countries, data on more serious injuries are fairly complete and obtainable from vital statistic registries and hospital records. Surveys are used to supplement such sources and to provide data on less serious, non-fatal, non-hospitalized injuries.

In developing countries, data on more serious injuries are less complete. Hence, surveys are needed to evaluate not only the less serious injuries, but also the more serious ones. For these more serious injuries, longer recall periods would be more appropriate. The more serious injuries are less common, and a longer recall period would capture more of such injuries for analysis. Moreover, memory decay is minimal for these serious injuries, and longer recall periods would lead to minimal bias in estimated rates.

For this particular nation and for other similar environments, it can be concluded that a one-year recall period is appropriate for studies in which information on more severe injuries is being sought. For estimation of overall non-fatal injury rate (including lesser as well as more severe non-fatal injuries), shorter recall periods should be used. For studies in which both goals are to be met, use of one-year recall period for data gathering, with subsequent re-analysis using a shorter recall period to estimate overall injury rate, is appropriate.

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References


