

Costing alcohol-related injuries presenting to St Vincent's Hospital Emergency Department – A methodological note

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The purpose of this bulletin is to describe a methodology for calculating the short-term costs associated with alcohol-related injuries presenting to St Vincent's Emergency Department (ED). This costing analysis was part of a larger study undertaken at St Vincent's ED in 2004/05, which examined the role of alcohol in injury events. The NSW Bureau of Crime Statistics and Research has published the substantive findings from this research in an accompanying Alcohol Studies Bulletin (see Poynton et al. 2005). The current bulletin provides the methodological detail that underpinned the calculations used to derive the costing estimates in this emergency department investigation.

INTRODUCTION

The study reported in detail in Poynton et al. (2005) aimed to answer two specific research questions:

- (1) What proportion of injuries presenting to St Vincent's ED are alcohol-related?
- (2) What is the short-term financial cost associated with these alcohol-related injuries?

To answer these questions, two four-week audits of emergency department presentations were conducted on two separate occasions at St Vincent's Hospital in September 2004 and February 2005. During these periods a research assistant was located at the ED 24 hours a day, seven days a week in order to identify injury presentations and

to collect information on alcohol consumption prior to the event from the patient or from their medical records. Overall, 4,878 cases presented to St Vincent's during the two 28-day audit periods and 1,345 of these (27.6%) were identified as injuries relevant to the study. A further 66 cases identified during the audit periods involved patients who were seeking treatment for alcohol intoxication.¹

To determine alcohol-involvement in injury cases presenting during the two audit periods, three data sources were used; (1) self-report data on the amount of alcohol consumed in the six hours preceding the injury (n=817), (2) Blood Alcohol Concentration (BAC) data from blood tests ordered by the attending medical officer (n=92) and (3) subjective ratings of intoxication (n=167). Each of

these sources of data indicate that a substantial proportion of injuries presenting to St Vincent's ED can be classified as alcohol-related. One-third of all injured patients interviewed for the study reported consuming alcohol in the six hours preceding the injury. One-fifth of all injury cases, where alcohol involvement was known, involved a person who had been drinking at high-risk levels or who had a BAC above 0.1g/100ml.

COSTING METHODOLOGY

Costing estimates derived from previous ED research undertaken by Erwich-Nijhout, Bond and Baggoley (1997) were used to calculate the costs associated with alcohol-related injuries presenting to

St Vincent's ED. The study conducted by Erwich et al. measured patient-specific cost data for almost 18,000 ED presentations at Flinders Medical Centre (FMC) in Adelaide, South Australia, over a five-month period. A range of costs was measured for each patient, including staff time (doctors, nurses and allied health professionals) and the use of equipment and consumables. On the basis of these data, the authors assessed the extent to which several different case-mix classification systems were able to account for cost variance in patient treatment. These case-mix classifications included; Urgency Related Groups and Age Groups (URAGs), Urgency Related Groups (URGs), Urgency Disposition Age Groups (UDAGs) and Urgency Disposition Groups (UDGs).

Ideally, the St Vincent's study would have utilised the case-mix classification that could account for the greatest reduction in cost variance (i.e. Urgency Related Groups and Age Groups, or URAGs). However, Erwich-Nijhout et al. (1997) assessed the clinical relevance of the 102 groups resulting from the URAG case-mix classification to be limited and as a consequence, do not report the mean costs for these groups in any detail. The second most efficient predictor of patient-specific costs (Urgency Related Groups or URGs) also could not be used in this study given that age is a significant predictor of cost and there are substantial differences between St Vincent's ED and the FMC ED in terms of the age of patients treated. As reported below, St Vincent's ED treats very few patients under the age of 15 years, while the FMC's ED routinely treats these younger patients.²

For these reasons, Urgency Disposition Age Groups (UDAGs) were used to estimate patient-specific costs in the St Vincent's study. This classification system is based on Triage Category (five

categories of urgency),³ Outcome/Disposition (admitted to a ward/died/dead on arrival, non-admitted or did not wait)⁴ and Age Group (<=14, 15-34, 35-64, >=65). The resulting 32 UDAGs were found, in the FMC study, to account for 51.2 per cent of the variance in total treatment cost. This is only slightly lower than the cost variance accounted for by the Urgency Related Group (URG) case-mix classification (55.3%; the second most efficient predictor of costs).

Data additional to those collected in the interviews and the medical record checks were necessary before the injury cases identified during the audits could be allocated to one of the 32 Urgency Disposition and Age Groups (UDAGs). To this end, upon completion of each audit, the ED's Administration and Systems Manager provided Project Staff with a download from the St Vincent's Emergency Department Information System (EDIS) which contained data on the Triage Category, Outcome, age, gender and medical diagnosis for all cases flagged during the two audit periods. Using the patients' Medical Record Number (MRN) as a unique identifier, these data were subsequently merged with the interview or medical record data collected by the research assistants.

Based on the data collected in the FMC study, a mean cost of patient treatment has been calculated by Erwich-Nijhout et al. (1997) for each of the 32 different UDAG classifications. These average patient-specific costs include those that were directly measured in the FMC study (e.g. doctor time, nurse time, allied health professional time, procedures, investigations, drugs & intravenous fluids) and some non-measured patient-related costs (e.g. linen used within ED). ED overhead costs and hospital overhead costs apportioned to the ED are also included. To apply these mean cost estimates from the 1995/96 FMC study to alcohol-related injuries presenting to

St Vincent's ED in 2004/05 an inflator factor of 1.28 is used. This inflator factor comes from national Final Consumption Expenditure (FCE) indices for hospital/nursing home care costs relative to 2002 (see Table 37 of *Health Australia Expenditure 2002-03*, Australian Institute of Health and Welfare, Canberra). These indices are used to deflate/inflate the cost of most institutional health services and facilities that are provided by or purchased through the public sector and are recommended for use by the Department of Health and Ageing. The FCE index is calculated by dividing the FCE index for the current year (i.e. 2005) by the index for the year in which the Flinders study was conducted (i.e. 1996). From the estimated cost of alcohol-related injury attendances in September 2004 and February 2005, an average annual cost of alcohol-related injuries to St Vincent's ED can be calculated.

The validity of this costing method relies on two important assumptions being met:

- (1) that the current pattern of clinical practice in St Vincent's ED in 2004/05 is not substantially different from that at the Flinders Medical Centre (FMC) in 1995/96.
- (2) that the subset of alcohol-related injuries within any particular case-mix class are not substantially different (in severity or type) to other injuries/conditions in that class.

Additional data were therefore obtained both from EDIS and from a major trauma study being conducted at St Vincent's ED to determine whether these assumptions are realistic.

The ED costs estimated from the FMC study are also supplemented by further cost analyses using estimates from the 'NSW Costs of Care Standards' report for the 2004/05 financial year (NSW Health 2004). This report presents estimated cost weights for 11 different Urgency Disposition Groups (UDGs) and

estimated average costs of ED care across these classes for different NSW Hospitals. This costing method, which will be described in greater detail in a later section, is also used in the current study in order to provide a range of cost estimates for alcohol-related injuries presenting to St Vincent’s ED.

COSTING RESULTS

As discussed above, two methods were used to estimate the costs associated with alcohol-related injuries presenting to St Vincent’s ED. Firstly, Triage Category, Outcome and Age Group were used to allocate each patient with an alcohol-

related injury to relevant UDAGs and inflated average costs from the FMC study were then applied to each UDAG. Secondly, Triage Category and Outcome were used to allocate each patient with an alcohol-related injury to relevant UDGs and average costs from the NSW Costs of Care Standards were then applied to each UDG.

Upper and lower bound estimates were used to define an injury as alcohol-related. The upper bound estimate (Estimate 1) being any case where the patient reported drinking alcohol in the six hours prior to the injury, or recorded a positive BAC from the blood test⁵ or was showing two or more visible signs of

intoxication. The lower bound estimate (Estimate 2) being any case where the patient reported drinking at risky/high-risk levels⁶ or recorded a BAC at 0.05g/100ml or over. The costs associated with non-injury alcohol intoxication cases were also included in these estimates and these overall costs were then adjusted for missing data. The cases included in each of the costing estimates are shown in Figures 1 and 2.

ESTIMATED COSTS FOR UDAGS FROM THE FMC STUDY

The first step in the costing analysis was to apply the mean total costs, estimated from the FMC study, to each injury case

Figure 1: Data included in costs calculations for the Upper Bound estimate (Estimate 1)

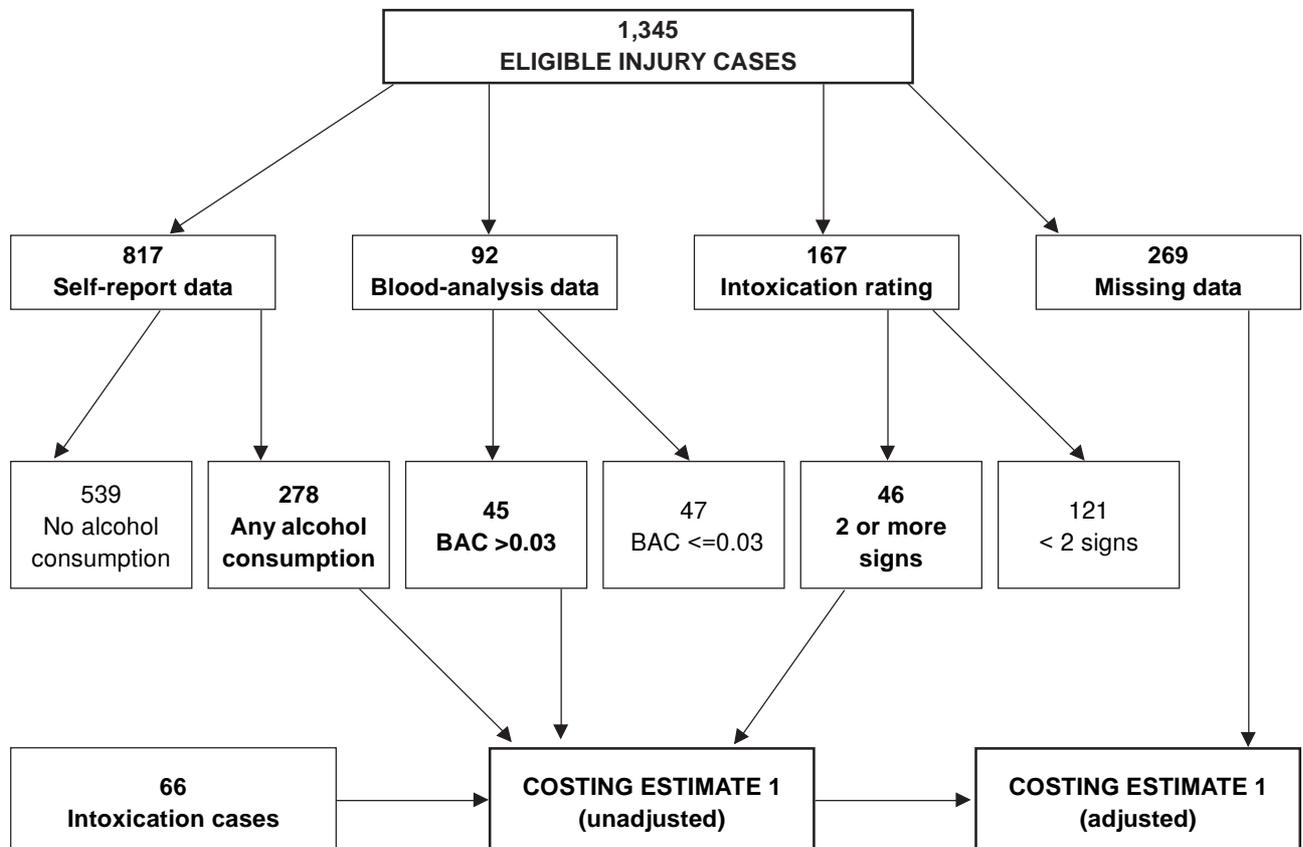
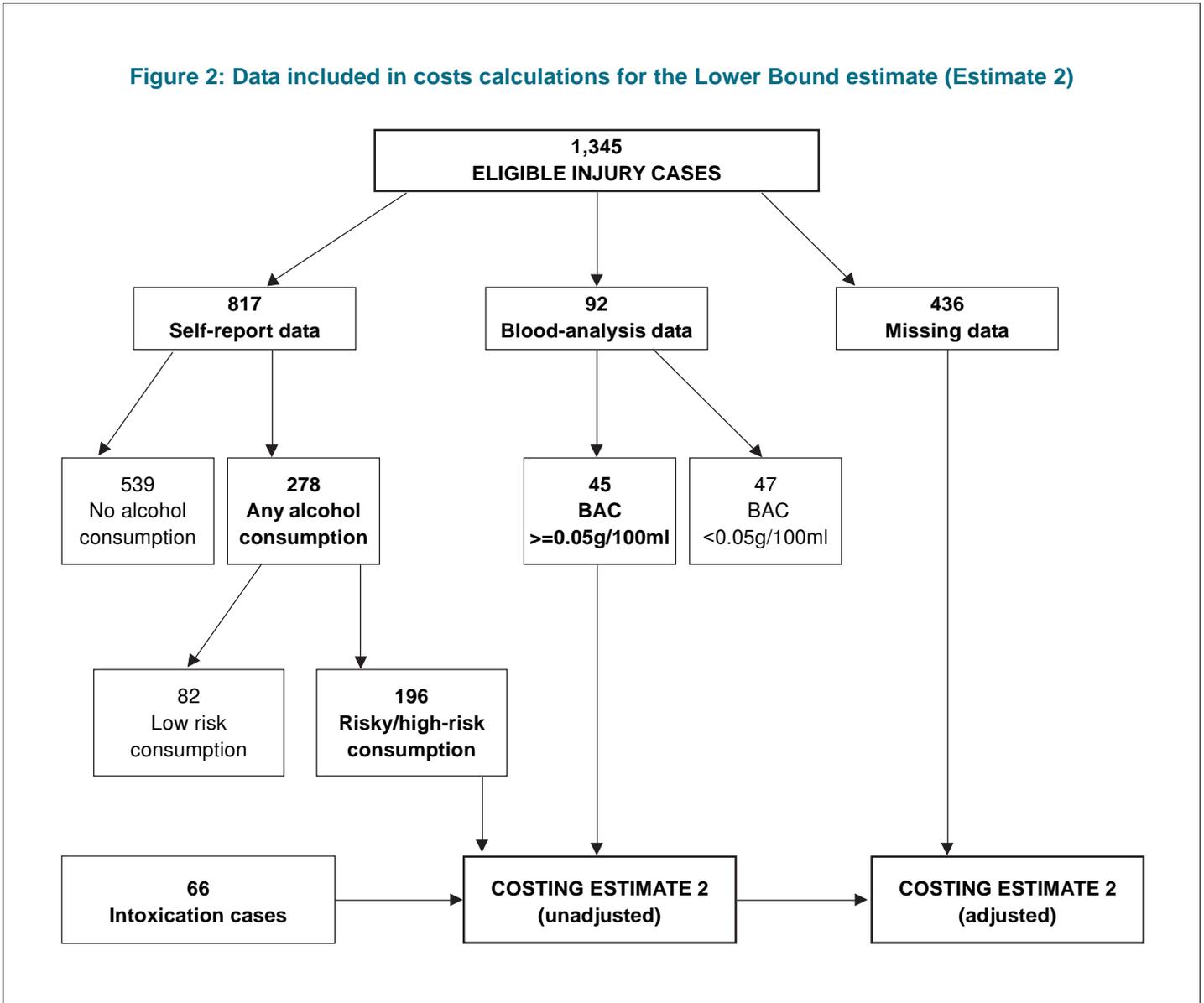


Figure 2: Data included in costs calculations for the Lower Bound estimate (Estimate 2)



identified as alcohol-related, on the basis of the UDAG case-mix classifications. Table 1 shows the breakdown of alcohol-related injuries by UDAG category for both the upper and lower bound estimates and also the associated costs. As seen in this table, the total cost of alcohol-related injuries presenting during the two audit periods ranged between \$63,530 and \$93,547, depending on which criteria was used to identify injuries as alcohol-related. To represent the cost of alcohol-related injuries to the ED over a 12-month period, the costs estimated from the two 28-day audit periods were divided by 56 (the number of days of data

collection) and multiplied by 365. Doing this reveals that alcohol-related injuries cost St Vincent's ED somewhere between \$414,079 and \$609,726 in 2004/05.

An additional cost of alcohol to the ED, which was identified in this study, related to patients presenting to the ED for treatment associated with alcohol intoxication. As mentioned previously, 66 of these cases were flagged during the two audit periods. While some of these cases may not have met the strict definition of an injury they are included in the total estimated costs given that they represent an important component of ED costs related to alcohol.

The breakdown of these 66 cases by UDAG classification and the associated costs are presented in Table 2. As seen here, the total estimated cost of alcohol intoxication cases presenting to the ED during the audit periods was \$14,522, extrapolating this over a 12-month period reveals that these cases cost the ED an estimated \$94,652 in 2004/05.

Thus, in total, the cost of treating patients with alcohol-related injuries, or patients who are intoxicated by alcohol, at St Vincent's ED was estimated to be between \$508,731 and \$704,378 in 2004/05.

Table 1: Emergency Department cost estimates for alcohol-related injuries by UDAG, Sep 2004 and Feb 2005

| UDG | Age group | UDAG | Inflated mean cost ⁱ | Upper Bound (Estimate 1) | | Lower Bound (Estimate 2) | |
|--------------|-----------|------|---------------------------------|--------------------------|--------------------|--------------------------|--------------------|
| | | | | n | Total cost | n | Total cost |
| 1 | <=14 | 1 | \$733.52 | 0 | \$0.00 | 0 | \$0.00 |
| | 15-34 | 2 | \$710.85 | 11 | \$7,819.35 | 10 | \$7,108.50 |
| | 35-64 | 3 | \$597.76 | 5 | \$2,988.80 | 4 | \$2,391.04 |
| | >=65 | 4 | \$485.07 | 0 | \$0.00 | 0 | \$0.00 |
| 2 | <=14 | 5 | \$256.03 | 0 | \$0.00 | 0 | \$0.00 |
| | 15-34 | 6 | \$433.24 | 8 | \$3,465.92 | 5 | \$2,166.20 |
| | 35-64 | 7 | \$359.18 | 8 | \$2,873.44 | 7 | \$2,514.26 |
| | >=65 | 8 | \$385.74 | 2 | \$771.48 | 0 | \$0.00 |
| 3 | <=14 | 9 | \$217.06 | 0 | \$0.00 | 0 | \$0.00 |
| | 15-34 | 10 | \$329.55 | 13 | \$4,284.15 | 11 | \$3,625.05 |
| | 35-64 | 11 | \$357.48 | 17 | \$6,077.16 | 13 | \$4,647.24 |
| | >=65 | 12 | \$388.03 | 3 | \$1,164.09 | 1 | \$388.03 |
| 4 | <=14 | 13 | \$203.89 | 0 | \$0.00 | 0 | \$0.00 |
| | 15-34 | 14 | \$276.19 | 11 | \$3,038.09 | 10 | \$2,761.90 |
| | 35-64 | 15 | \$294.35 | 5 | \$1,471.75 | 1 | \$294.35 |
| | >=65 | 16 | \$348.36 | 0 | \$0.00 | 0 | \$0.00 |
| 5 | All | 17 | \$294.62 | 0 | \$0.00 | 0 | \$0.00 |
| 6 | All | 18 | \$306.39 | 11 | \$3,370.29 | 5 | \$1,531.95 |
| 7 | <=14 | 19 | \$197.17 | 0 | \$0.00 | 0 | \$0.00 |
| | 15-34 | 20 | \$258.38 | 15 | \$3,875.70 | 12 | \$3,100.56 |
| | 35-64 | 21 | \$268.68 | 4 | \$1,074.72 | 1 | \$268.68 |
| | >=65 | 22 | \$272.79 | 0 | \$0.00 | 0 | \$0.00 |
| 8 | <=14 | 23 | \$178.47 | 0 | \$0.00 | 0 | \$0.00 |
| | 15-34 | 24 | \$233.88 | 59 | \$13,798.92 | 40 | \$9,355.20 |
| | 35-64 | 25 | \$244.02 | 23 | \$5,612.46 | 16 | \$3,904.32 |
| | >=65 | 26 | \$260.08 | 6 | \$1,560.48 | 2 | \$520.16 |
| 9 | <=14 | 27 | \$170.68 | 0 | \$0.00 | 0 | \$0.00 |
| | 15-34 | 28 | \$190.45 | 98 | \$18,664.10 | 68 | \$12,950.60 |
| | 35-64 | 29 | \$190.89 | 35 | \$6,681.15 | 22 | \$4,199.58 |
| | >=65 | 30 | \$212.98 | 7 | \$1,490.86 | 2 | \$425.96 |
| 10 | All | 31 | \$154.24 | 4 | \$616.96 | 2 | \$308.48 |
| 11 | All | 32 | \$118.62 | 24 | \$2,846.88 | 9 | \$1,067.58 |
| TOTAL | | | | 369 | \$93,546.75 | 241 | \$63,529.64 |

(i) Mean costs are the trimmed costs supplied by Erwich et al. (1997) inflated by 1.28 to represent 2004/05 costs. These costs have been rounded to the nearest cent.

So far, we have estimated the costs only for those injury cases where there was information available on alcohol consumption either from the interview or blood test, or from the research

assistant/triage nurse's assessment of intoxication. However, for Estimate 1, these data were not available for 269 cases (20.0%) that presented during the audit periods and for Estimate 2, these

data were not available for 436 cases (32.4%). The estimated cost of these injury cases, where no alcohol information was available, ranged from \$64,672 (Estimate 1) to \$106,702 (Estimate 2), based on UDAG case-mix classifications and the inflated mean cost estimates from the FMC study (this equates to an annual cost of \$421,523 and \$695,468 respectively). Thus, ignoring these cases would mean that the range of cost estimates for alcohol-related injuries provided in Tables 1 and 2 is a significant underestimate of the actual cost of treating alcohol-related injury cases within the ED.

The simplest way to account for these missing data is to generate further ED costs estimates in which it is assumed that the rate of alcohol-related injuries amongst the cases with missing data is the same as the rate of alcohol-related injuries amongst cases where alcohol-involvement was directly confirmed by the interviews/medical record checks. The percentage of known cases meeting the alcohol-related criteria for Estimate 1 was 34.3 per cent and for Estimate 2 was 26.5 per cent. Applying these proportions to the estimated costs of injury cases where no alcohol information was available, results in an additional alcohol cost of between \$22,182 (Estimate 1) and \$28,276 (Estimate 2) for the two audit periods. Multiplying these estimates up and adding them to the 12-month estimates for injury cases where alcohol-involvement was confirmed reveals that the total cost of treating patients with alcohol-related injuries, and patients who are intoxicated by alcohol, at St Vincent's ED was between \$693,030 and \$848,957 in 2004/05.⁷

The ED resources consumed by alcohol-related injury and intoxication cases can also be expressed in terms of the amount of staff time that is spent dealing with these patients. This was one of the measures on which the average mean costs estimated in the FMC study was

Table 2: Emergency Department costs estimates for intoxication cases by UDAG, Sep 2004 and Feb 2005

| UDG | Age group | UDAG | Inflated mean cost ⁱ | n | Total cost |
|--------------|-----------|------|---------------------------------|-----------|--------------------|
| 1 | 15-34 | 2 | \$710.85 | 1 | \$710.85 |
| 3 | 35-64 | 11 | \$357.48 | 3 | \$1,072.44 |
| 3 | >=65 | 12 | \$388.03 | 1 | \$388.03 |
| 4 | 15-34 | 14 | \$276.19 | 2 | \$552.38 |
| 4 | 35-64 | 15 | \$294.35 | 1 | \$294.35 |
| 6 | All | 18 | \$306.39 | 1 | \$306.39 |
| 7 | 15-34 | 20 | \$258.38 | 3 | \$775.14 |
| 7 | 35-64 | 21 | \$268.68 | 2 | \$537.36 |
| 8 | 15-34 | 24 | \$233.88 | 7 | \$1,637.16 |
| 8 | 35-64 | 25 | \$244.02 | 11 | \$2,684.22 |
| 8 | >=65 | 26 | \$260.08 | 1 | \$260.08 |
| 9 | 15-34 | 28 | \$190.45 | 11 | \$2,094.95 |
| 9 | 35-64 | 29 | \$190.89 | 6 | \$1,145.34 |
| 9 | >=65 | 30 | \$212.98 | 1 | \$212.98 |
| 10 | All | 31 | \$154.24 | 2 | \$308.48 |
| 11 | All | 32 | \$118.62 | 13 | \$1,542.06 |
| TOTAL | | | | 66 | \$14,522.21 |

(i) Mean costs are the trimmed costs supplied by Erwich et al. (1997) inflated by 1.28 to represent 2004/05 costs. These costs have been rounded to the nearest cent.

Table 3: Estimated annual cost (based on UDAGs) of alcohol-related injuries and alcohol intoxication to St Vincent’s ED by alcohol-related criteria, 2004/05

| Alcohol-related criteria | Estimated annual cost |
|---|-------------------------|
| Drinking 6 hrs prior or positive blood test or showing 2 or more signs of intoxication (<i>Upper Bound</i>) and cases of alcohol intoxication | \$848,957 ⁱ |
| Risky/high-risk consumption prior or Blood test >=0.05 (<i>Lower Bound</i>) and cases of alcohol intoxication | \$693,030 ⁱⁱ |

(i) Based on data from 369 alcohol-related injury cases and 66 intoxication cases. Costs adjusted for missing data.

(ii) Based on data from 241 alcohol-related injury cases and 66 intoxication cases. Costs adjusted for missing data.

based and Erwich-Nijhout, Bond and Baggoley (1997; see pp. 15 of the Appendices) report this variable by the 32 applicable UDAG classifications. Applying these average staff time estimates (both doctors and nurses) to the injury cases identified as alcohol-related in our study and to the alcohol intoxication cases, we calculate that over

the two audit periods, ED staff spent, on average, between 530 hours (Estimate 2) and 721 hours (Estimate 1) treating these patients. This would equate to between 3,454 and 4,699 hours of staff time, respectively, in 2004/05, and once missing cases are taken into account, approximately 4,666 and 5,638 staff hours.

Validating the FMC costing estimates

Two important assumptions need to be met in order for the estimated costs from the 1995/96 FMC study to be valid for alcohol-related injuries presenting to St Vincent’s ED in 2004/05:

- (1) that the current pattern of clinical practice in St Vincent’s ED in 2004/05 is not substantially different from that at the Flinders Medical Centre in 1995/96
- (2) that the subset of alcohol-related injuries within any particular case-mix class are not substantially different (in severity or type) to other injuries/conditions in that class

To test these assumptions, further data were obtained from EDIS and from a trauma study being undertaken at St Vincent’s ED in 2004.

Table 4 summarises part of these data. Specifically, it lists the volume and types of patients that presented to the FMC ED from 1 November 1995 through 31 March 1996 (Erwich-Nijhout, Bond & Baggoley 1997) and the equivalent St Vincent’s data for the same five-month period in 2003/04. Note that no comparative data on the average amount of care provided, in terms of investigations and procedures, could be obtained at the aggregate-level for patients presenting to St Vincent’s ED during this period.

As seen from Table 4, both the FMC ED and the St Vincent’s ED service metropolitan areas 24 hours a day, seven days a week but St Vincent’s Hospital is located closer to the city centre. St Vincent’s ED also has a slightly lower patient volume than Flinders ED, which reflects both the fact that St Vincent’s Hospital is a smaller facility, with overall fewer staff (approx. 2,000 v. approx. 2,500) and fewer inpatient beds (326 v. 441), and that St Vincent’s ED does not usually receive paediatric cases; as evidenced by the small percentage of St Vincent’s patients who were aged 14 years or under.

Table 4: Case-mix classification of patients presenting to Flinders Medical Centre ED between 1 Nov 1995 and 31 Mar 1996 and St Vincent's ED between 1 Nov 2003 and 31 Mar 2004

| <i>Characteristic of ED</i> | <i>Flinders Medical Centre ED 1995/96</i> | <i>St Vincent's Hospital ED 2003/04</i> |
|---|---|---|
| <i>Location:</i> | 12kms from Adelaide city centre | 2kms from Sydney CBD |
| <i>Operational hours:</i> | 24hrs/7 days | 24hrs/7 days |
| <i>Total number of patients presenting during the study period:</i> | 18,078 | 13,620 |
| <i>Number of attendances per day:</i> | (Summer) 125 | (Summer) 90 |
| <i>Triage Category:</i> | | |
| 1 | 1.1% | 3.0% |
| 2 | 12.6% | 12.2% |
| 3 | 27.4% | 44.9% |
| 4 | 54.6% | 35.6% |
| 5 | 4.3% | 4.3% |
| <i>Outcome:</i> | | |
| Admitted to ward | 28.9% | 25.7% |
| Non-admitted | 68.2% | 64.9% |
| Did not wait | 2.8% | 8.5% |
| Died in ED | 0.0% | 0.1% |
| Dead on arrival | 0.1% | 0.8% |
| <i>Age of patients:</i> | | |
| <=14 years | 21.1% | 0.7% |
| 15 – 34 years | 31.2% | 43.2% |
| 35 – 64 years | 27.2% | 36.9% |
| >= 65 years | 20.0% | 19.1% |
| <i>Mean number of investigations:</i> | | |
| Procedures per patient | 4.1 | - |
| Investigations | 2.5 | - |
| Drugs or fluids | 2.4 | - |

Comparisons between the case-mix classifications of patients presenting to the two emergency departments indicated that a greater percentage of St Vincent's patients were triaged at higher classifications (most notably Triage 1 and Triage 3) than FMC patients. This increased urgency of cases presenting to St Vincent's ED is consistent with the area being serviced by this hospital (i.e. an inner-city area with a relatively high drug-user population and crime rate, and a high density of late-night entertainment venues). The two emergency

departments also differed in terms of patient Outcomes, with a slightly smaller percentage of St Vincent's ED patients being admitted to a ward, and a larger percentage leaving before treatment completion. One possible reason for the difference in patients who 'did not wait' may be that with more patients triaged at a higher level, the waiting times for less serious cases were longer at St Vincent's ED, and therefore more people decided to leave before treatment became available.

The higher urgency and lower admission rate at St Vincent's ED compared to FMC does, however, seem somewhat incongruent. It should be noted that a significant percentage of patients at St Vincent's ED (15.5%) received the disposition classification of 'admitted and discharged as an inpatient within the ED'. This disposition category refers to patients who are admitted as an inpatient, and thus are under specialist care, but are not transferred to a ward bed (i.e. they do not leave the ED). The FMC ED was not using this specific disposition classification at the time that the costing study was undertaken. A short stay ward was in operation at that time, and some patients were admitted via this route, but we were informed that it was not working efficiently during the study period (personal communication with Professor Baggoley on 14 April 2005). Therefore, to maintain consistency, these 'admitted and discharged' cases were classified in the current study as 'non-admitted'. However, St Vincent's ED staff advised us that these patients are often treated for relatively serious conditions (and thus likely to be coded as more urgent) and can remain in the ED for several days. Furthermore, it is possible that some of these patients would have been admitted to a ward had a bed been available at the time.

This explanation of the higher urgency and lower admission rate at St Vincent's ED would suggest some bias downwards in our costing calculations. Cases classified as 'non-admitted' were allocated a lower mean cost than similar cases that were admitted to a ward. Given the length of time that some of the 'admitted and discharged' patients remained in the ED, however, a proportion of these cases may actually have been just as costly as an admission in terms of staff time and resources consumed.

The differences in case-mix classifications between the two facilities may also reflect broader changes in clinical practice within emergency departments that have taken place since the FMC study was undertaken. For example, more complex cases might now be treated solely in the ED rather than being transferred to a ward or more complex interventions might now be implemented in the ED component of the stay, whereas previously the patient would have had to be transferred elsewhere (NSW Health 2001). More refined cost estimates may therefore need to be applied to cases presenting to St Vincent's Hospital in 2004/05 to account for these changes in clinical practice. This issue is addressed in more detail below.

A further assumption of the costing analysis is that alcohol-related injuries do not generate higher costs than non alcohol-related injuries within the same class of injury. To examine this

possibility, a supplementary analysis of certain injury types was undertaken. Specifically, the case-mix classification of alcohol-related head injuries, identified during the audit periods, were compared with the case-mix of non alcohol-related head injuries.⁸ Note that Estimate 2 is being used here to identify injuries as alcohol-related since this is the more conservative criterion. These data are shown in Table 5. This table also presents data on the mean number of investigations, procedures, days in an Intensive Care Unit (ICU) and days on ventilation for alcohol and non alcohol-related injuries. This additional information was obtained from a trauma study being undertaken at St Vincent's ED at the same time as the current study. The data reported here are for moderate to severe injuries that presented to the ED between January and June 2004 (n=78), and alcohol-related is defined as any injury where a positive BAC was recorded from a blood test (n=19).

As seen from this table, a slightly higher percentage of patients with alcohol-related head injuries were triaged at Category 3 and a higher percentage were admitted to a ward, compared to patients treated for non alcohol-related head injuries. While the number of cases shown here is relatively small, thus precluding statistical tests, this would suggest that alcohol-related injuries might be more severe than non alcohol-related injuries. Data from the trauma study provide further support for this conclusion. As seen in Table 5, patients with alcohol-related injuries, on average, had more investigations ordered by the attending medical officer, and also spent longer in intensive care and/or on ventilation than other trauma patients. Together these data suggest that alcohol-related injuries might generate higher costs than other types of injuries (at least in cases of major trauma), which would imply that the costs presented in the previous section underestimate the actual cost of treating these types of injuries.

Table 5: Case-mix classification for alcohol and non alcohol-related head injuries, Sep 2004 and Feb 2005, and treatment information for alcohol and non-alcohol related injuries included in St Vincent's trauma study Jan – Jun 2004

| | <i>Alcohol-related</i> | <i>Non alcohol-related</i> |
|-------------------------------------|------------------------|----------------------------|
| <i>Triage Category:</i> | | |
| 1 | 20.0% (n=3) | 12.5% (n=3) |
| 2 | 20.0% (n=3) | 25.0% (n=6) |
| 3 | 46.7% (n=7) | 41.7% (n=10) |
| 4 | 13.3% (n=2) | 20.8% (n=5) |
| 5 | 0.0% | 0.0% |
| <i>Outcomes:</i> | | |
| Admitted to ward | 60.0% (n=9) | 41.7% (n=10) |
| Non-admitted | 40.0% (n=6) | 58.3% (n=14) |
| Died in ED | 0.0% | 0.0% |
| Did not wait | 0.0% | 0.0% |
| <i>Mean number of:</i> ⁱ | | |
| Investigations ⁱⁱ | 4.7 (1.6) (n=19) | 3.6 (3.4) (n=42) |
| Operations | 0.6 (1.2) (n=6) | 0.6 (1.2) (n=18) |
| Days on ventilation | 4.4 (7.4) (n=9) | 1.8 (8.5) (n=12) |
| Days in Intensive Care | 5.5 (7.9) (n=12) | 2.5 (8.8) (n=19) |

(i) Standard deviations are shown in brackets.

(ii) This includes CT scans, x-rays, ultrasounds and angiographs.

ESTIMATED COSTS USING NSW COSTS OF CARE STANDARDS

Given the differences identified above between cases presenting to St Vincent's ED in 2004/05 and those presenting to the FMC ED in 1995/96, further consideration was given to the use of other costs estimates generated by different methods in order to present a range of ED costs. To this end, average costs and cost weights from the 2004/05 NSW Costs of Care Standards report were used to generate costs for alcohol-related injuries and intoxication cases (NSW Health 2004).

Since 1996, NSW Health has collected annual data on the cost of acute care services, and the results of these studies have been used to determine the Acute Care Standard costs for NSW public hospitals. In 1997/98 the scope of these Standards was expanded to include estimates of the costs of emergency

department presentations, and in 2004, NSW Health reported these costs estimates for the 2004/05 financial year (NSW Health 2004). Specifically, the Standards provide cost weights for case-mix classifications to represent the value of groups within a classification relative to a base value (usually the average costs of care across all groups).

For emergency departments, the case-mix classification adopted was a modified version of the Urgency and Disposition Groups (UDG): the classification used by Erwich-Nijhout et al. (1997) in the FMC study (as well as other researchers, for example Jelinek 1992). This modified version uses the five standard Triage Categories in combination with the three disposition classes of 'subsequently admitted', 'ED only' and 'did not wait'. The 'ED only' classification refers to an episode where the patient is treated solely in the ED (whether as an ambulatory or an admitted patient). 'Subsequently admitted' refers to an episode in which the patient is treated in the ED and subsequently admitted to a ward, either at the same hospital or another. These three disposition classes were selected because of the inconsistency across NSW hospitals in whether patients, who are treated solely in the ED, are admitted or not. The cost weights for each UDG category have been recalibrated from original UDG weights estimated in the FMC study (Erwich-Nijhout et al. 1997) so that they are applicable to the mix of ED presentations in New South Wales (see NSW Health 2001 for further explanation of these costing weights). Average costs (or base values) for three different hospital classes (or ED Peer Groups) have been determined from expenditure data reported in the 2002/03 NSW Unaudited Annual Return and activity data recorded on the NSW Health Information Exchange. Peer group classification is based predominantly on the hospital's inpatient activity as measured by the DRG classifications and consists of three

groups (Peer Group A = 15 hospitals, B = 22 hospitals, C = 7 hospitals). St Vincent's Hospital falls within Peer Group A. The resulting mean costs for each UDG classification, applicable to St Vincent's Hospital ED in 2004/05, are shown in Table 6.

Table 6 shows the number of injuries meeting the two alcohol-related criteria used in the analysis, broken down by UDG, as well as the total costs associated with each of these categories. As seen here, using the NSW Costs of Care estimates, the total cost of

Table 6: Emergency Department cost estimates for alcohol-related injuries by UDG, Sep 2004 and Feb 2005

| UDG | Weighted mean cost ⁱ | Upper Bound (Estimate 1) | | Lower Bound (Estimate 2) | |
|--------------------------------|---------------------------------|--------------------------|---------------------|--------------------------|---------------------|
| | | n | Total cost | n | Total cost |
| Subsequently admitted Triage 1 | \$1,007.00 | 16 | \$16,112.00 | 14 | \$14,098.00 |
| Subsequently admitted Triage 2 | \$630.04 | 18 | \$11,340.72 | 12 | \$7,560.48 |
| Subsequently admitted Triage 3 | \$568.86 | 33 | \$18,772.38 | 25 | \$14,221.50 |
| Subsequently admitted Triage 4 | \$508.82 | 16 | \$8,141.12 | 11 | \$5,597.02 |
| Subsequently admitted Triage 5 | \$501.98 | 0 | \$0.00 | 0 | \$0.00 |
| ED only Triage 1 | \$522.12 | 11 | \$5,743.32 | 5 | \$2,610.60 |
| ED only Triage 2 | \$449.92 | 19 | \$8,548.48 | 13 | \$5,848.96 |
| ED only Triage 3 | \$381.14 | 88 | \$33,540.32 | 58 | \$22,106.12 |
| ED only Triage 4 | \$320.34 | 140 | \$44,847.60 | 92 | \$29,471.28 |
| ED only Triage 5 | \$262.96 | 4 | \$1,051.84 | 2 | \$525.92 |
| Did not wait | \$187.72 | 24 | \$4,505.28 | 9 | \$1,689.48 |
| TOTAL | | 369 | \$152,603.06 | 241 | \$103,729.36 |

(i) An average cost applicable to ED Peer Group A1 Hospitals has been used here with relevant cost weights from the NSW Costs of Care Standards 2004/05 applied. These costs have been rounded to the nearest cent.

Note that 'dead on arrival' is assigned a cost weight equivalent to 'subsequently admitted Triage 5'

Table 7: Emergency Department cost estimates for intoxication cases by UDG, Sep 2004 and Feb 2005

| UDG | Weighted mean cost ⁱ | n | Total cost |
|--------------------------------|---------------------------------|-----------|--------------------|
| Subsequently admitted Triage 1 | \$1,007.00 | 1 | \$1,007.00 |
| Subsequently admitted Triage 2 | \$630.04 | 0 | \$0.00 |
| Subsequently admitted Triage 3 | \$568.86 | 4 | \$2,275.44 |
| Subsequently admitted Triage 4 | \$508.82 | 3 | \$1,526.46 |
| Subsequently admitted Triage 5 | \$501.98 | 0 | \$0.00 |
| ED only Triage 1 | \$522.12 | 1 | \$522.12 |
| ED only Triage 2 | \$449.92 | 5 | \$2,249.60 |
| ED only Triage 3 | \$381.14 | 19 | \$7,241.66 |
| ED only Triage 4 | \$320.34 | 18 | \$5,766.12 |
| ED only Triage 5 | \$262.96 | 2 | \$525.92 |
| Did not wait | \$187.72 | 13 | \$2,440.36 |
| TOTAL | | 66 | \$23,554.68 |

(i) An average cost applicable to ED Peer Group A1 Hospitals has been used here with relevant cost weights from the NSW Costs of Care Standards 2004/05 applied. These costs have been rounded to the nearest cent.

alcohol-related injuries presenting during the two audit periods ranged between \$103,729 and \$152,603, depending on which alcohol-related criteria is used. Multiplying this estimate up to calculate the costs to the ED over a 12-month period reveals that alcohol-related injuries cost St Vincent’s ED somewhere between \$676,091 and \$994,645 in 2004/05.

Table 7 presents the break down of intoxication cases by UDG and the associated costs from the NSW Costs of Care Standards. As seen here, the total estimated cost of alcohol intoxication cases presenting to the ED during the audit periods was \$23,555, extrapolating this over a 12-month period reveals that these cases cost the ED \$153,528 in 2004/05. Adding the cost of intoxication cases to the cost of alcohol-related injuries, we estimate the total costs of alcohol-related injuries and intoxication to St Vincent’s ED to have been between \$829,619 and \$1,148,173 in 2004/05.

Once more, we need to consider injury cases where data on the involvement of alcohol were not available. Based on the UDG case-mix classification and the average costs for NSW EDs, the estimated cost of the 269 cases in Estimate 1 with missing data is \$105,453 and the estimated cost of the 436 cases in Estimate 2 with missing data is \$173,255. Applying the respective alcohol-related proportions of 34.3 per cent and 26.5 per cent to these estimated costs results in an additional alcohol cost of \$36,170 for Estimate 1 and \$45,913 for Estimate 2, across the two audit periods. Multiplying these estimates up and adding them to the 12-month estimates for injury cases where alcohol involvement was confirmed reveals that the total cost of treating patients with alcohol-related injuries, and patients who are intoxicated by alcohol, at St Vincent’s ED was between \$1,128,873 and \$1,383,924 in 2004/05. Thus, the upper and lower bound estimates, derived from the mean cost

estimates generated by the NSW Costs of Care Standards, are as shown in Table 8.

SUMMARY

This bulletin described the two methodological approaches used by Poynton et al. (2005) to estimate the annual cost of treating patients with alcohol-related injuries and patients who are intoxicated by alcohol, at an inner-Sydney ED. The first approach involved allocating injuries identified as alcohol-related and cases of alcohol intoxication to an Urgency Disposition and Age Group (UDAG) case-mix classification and applying inflated mean costs estimated from the Flinders Medical Centre (FMC) study. The second approach involved these same cases being assigned to relevant Urgency Disposition Group (UDG) categories and average weighted costs, based on 2004/05 cost weights in

the NSW Costs of Care Standards report, being applied. The results from these analyses are summarised in Table 9. Included in this table are the average, estimated costs for cases meeting each of the two different definitions of alcohol-related (Estimates 1 and 2) as previously described in this bulletin.

It is clear that these different approaches result in somewhat different cost estimates. The reasons for these discrepancies as well as the limitations of the costing methodologies used in this analysis are discussed in greater detail in Poynton et al. (2005). Despite this variability however, these estimates are consistent with the conclusion that the financial costs of alcohol-related injuries to this inner-Sydney ED are substantial. The implications of these findings are discussed further in the accompanying Alcohol Studies Bulletin (Poynton et al. 2005).

Table 8: Estimated annual cost (based on UDGs and NSW Costs of Care Standards) of alcohol-related injuries and alcohol intoxication to St Vincent’s ED by alcohol-related criteria, 2004/2005

| <i>Alcohol-related criteria</i> | |
|---|---------------------------|
| Drinking 6 hrs prior or positive blood test or showing 2 or more signs of intoxication (<i>Upper Bound</i>) and cases of alcohol intoxication | \$1,383,924 ⁱ |
| Risky/high-risk consumption prior or Blood test ≥ 0.05 (<i>Lower Bound</i>) and cases of alcohol intoxication | \$1,128,873 ⁱⁱ |

(i) Based on data from 369 alcohol-related injury cases and 66 intoxication cases. Costs adjusted for missing data.

(ii) Based on data from 241 alcohol-related injury cases and 66 intoxication cases. Costs adjusted for missing data.

Table 9: Estimated annual cost of alcohol-related injuries and alcohol intoxication to St Vincent’s ED by alcohol-related criteria and costing method 2004/05

| <i>Costing Methodology</i> | <i>Lower Bound (Estimate 2)</i> | <i>Upper Bound (Estimate 1)</i> |
|------------------------------------|---------------------------------|---------------------------------|
| FMC – UDAGs | \$693,030 | \$848,957 |
| NSW Costs of Care Standards – UDGs | \$1,128,873 | \$1,383,924 |

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NOTES

- 1 These cases are described in greater detail in Poynton et al. (2005).
- 2 Note also that there were difficulties in allocating some injury cases to appropriate Medical Diagnostic Categories, which would also imply that the UDAG estimates are more valid for the current dataset. This recording issue is discussed in greater detail in Poynton et al. (2005).
- 3 Triage category is a standardised national scale which indicates the urgency of patient treatment in an ED. Category 1 = Resuscitation: Immediate (within seconds); Category 2 = Emergency: Within 10 minutes; Category 3 = Urgent: Within 30 minutes; Category 4 = Semi-urgent: Within 60 minutes; Category 5 = Non-urgent: Within 120 minutes.
- 4 The outcome categories used by St Vincent's Hospital include (1) Dead on arrival, (2) Admitted died in ED, (3) Admitted to critical care ward, (4) Admitted via operating suite, (5) Admitted transferred to another

hospital, (6) Admitted to a ward not critical care, (7) Admitted and discharged as an inpatient within the ED, (8) Departed treatment completed, (9) Departed transfer to another hospital, (10) Departed left at own risk, (11) Departed for another facility, (12) Departed did not wait. For our purposes categories 1 to 6 were classified as 'admitted to ward/died/DOA', categories 7 to 11 as 'non-admitted' and category 12 as 'did not wait'. This is consistent with the classifications used in the FMC study (personal communication with Professor Chris Baggoley on 14/04/2005).

- 5 The blood analysis results did not report the actual BAC reading if less than 0.03g/100ml. A BAC of 0.03g/100ml was therefore considered to be equivalent to a zero BAC.
- 6 The National Health and Medical Research Council (2001) guidelines being used here are those for risk of harm in the long-term rather than the guidelines for risk of harm in the short-term. Even at these lower levels of episodic consumption (i.e. more than two drinks for females and more than four drinks for males), however, the risk of injury is twice that of no consumption, controlling for other factors (McLeod et al. 2000).
- 7 It is possible that the proportion of 'missing' cases that were alcohol-related was not equivalent to the proportion of cases where alcohol involvement was confirmed, particularly in the light of the fact that tests of blood alcohol concentration are not routinely requested for all trauma patients at St Vincent's ED, but are ordered only if the medical officer considers it relevant for patient treatment (i.e. often in cases where alcohol involvement is suspected). As a result, these adjusted annual figures may be a slight overestimate of the actual cost of alcohol-related injuries.
- 8 Head injuries were selected for analysis so that the injury cases (from the alcohol study) being examined were comparable with those included in the trauma study. Data from the

trauma study refer only to patients who have incurred moderate/severe injuries.

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