Abstract

Objectives: to estimate the extent, preventability and consequences of adverse clinical events in elderly and non-elderly patients.

Design: a two-stage structured, retrospective, patient case-note review.


Population: a random sample of 1,006 non-psychiatric patients.

Main Outcome Measures: proportion of patients with adverse events, the proportion of preventable adverse events and the types and consequences of adverse events in patients ≥75 and under 75 years old.

Results: forty five [13.5%; 95% confidence interval (CI) 10–17] of 332 patients ≥75 years and 42 (6.2%; 95% CI 4–8) of 674 patients <75 years had at least one adverse event. There was a significantly raised risk of experiencing an adverse event with increasing age [odds ratio (OR) = 1.03 adverse events per year of life, \( P<0.001 \)]. There was no statistically significant difference in preventability of adverse events and also in experiencing disability or death as a result of an adverse event by age after adjustment for potential confounders.

Conclusion: adverse events are significantly more common in non-psychiatric elderly inpatients than younger patients. There is little evidence that adverse events in older patients are more preventable and lead to disability or death more frequently.

Keywords: adverse events, case-note review, prevention, older people, patient safety

Introduction

There is widespread concern over the level of adverse events associated with medical care. An adverse event can be defined as any unintended injury or complication to a patient, which results in harm, and is caused at least partly by health care, rather than the disease process itself [1, 2]. Previous studies have shown that a significant proportion of hospital admissions result in an adverse event [1–5]. These studies have also shown that adverse events are more frequent in elderly patients [1–5]. The types, preventability and consequences of adverse events may be different in elderly patients [6]. Thomas and Brennan [6] and Wilson et al. [2] have compared the incidence, preventability and consequences of adverse events between patients of ≥65 years and those <65 years old in the United States and Australia. This study compares the incidence, preventability, types and consequences of adverse events between elderly patients (of ≥75 years) and those <75 years old in a large NHS hospital.

Methods

The study was carried out in a large NHS hospital trust between January and June 2005. Detailed information about the methods is presented elsewhere [5, 7]. A sampling frame of all admissions lasting more than 24 h between January and May 2004 was obtained. A stratified random sample of 1,006 admissions (excluding psychiatry and obstetrics) was selected from eight specialties: surgery, urology, orthopaedics, general medicine, medicine for the elderly, oncology, ENT and ophthalmology. Ethics and research approval were obtained. All data were anonymised and kept confidential.
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A retrospective two-stage case-note review was conducted on this sample, using methods employed and validated previously [1, 2, 5, 7]. In the first stage, patient records were screened by five trained nurses using a tool (RF1) consisting of a list of 18 explicit criteria (see Table in Appendix 1 in the supplementary data on the journal website http://www.ageing.oxfordjournals.org/). Identification of one or more positive criteria was used as an indicator of a potential adverse event and the medical record was subject to further scrutiny in stage two (Figure 1). To assess inter-rater reliability, the RF1 screening form was completed independently by two nurse reviewers for 107 records (Figure 1).

Stage two of the case-note review involved three Specialist Registrars in Internal Medicine and General and Elderly Medicine (all with more than 3 years of experience) reviewing the records that had at least one positive criterion in stage one. The doctors were trained in the use of a structured case-note review form (RF2) to judge if there was an adverse event, and to assess the nature, consequence and preventability. If the reviewer was confident that (i) there was an unintended event, (ii) the event resulted in patient harm and (iii) it was caused at least partly by healthcare rather than by disease process alone, it was considered as an adverse event. Any possible disagreements were resolved by discussion or by consulting with a third reviewer. A team of senior hospital consultants in the specialties was available for advice. In addition, 90 medical records were independently reviewed to assess inter-rater reliability (Figure 1).

A six-point scale was used to assess the raters’ confidence of the likelihood of a causation link between the event and the injury. A similar six-point scale was used to assess the likelihood of preventability of the adverse event, this was on the basis of the standard of care expected from an senior hospital consultants in the specialties was available for discussion or by consulting with a third reviewer. A team of senior hospital consultants in the specialties was available for advice. In addition, 90 medical records were independently reviewed to assess inter-rater reliability (Figure 1).

The number of adverse events that resulted in disability or death was calculated. A multivariate logistic regression model was used to assess the effect of age on adverse events after controlling for the effect of other factors (e.g. length of hospital stay). To remove the effect of adverse events on hospital stay, the number of extra bed days resulting from an adverse event was deducted from the total number of hospital stay days and the regression models were run using this variable. Further information about how adjustment was made is presented elsewhere [8].

Many elderly care departments in NHS hospitals across the UK operate mainly on an age-defined admissions policy, commonly around 75 years old (although this varies significantly) [9]. The proportion of admissions with adverse events and the preventability and consequences of these were therefore calculated for patients ≥75 years of age and for those <75 years. Similar to studies from the United States and Australia, we also carried out a sensitivity analysis using a 65 year cut-off point to assess the impact on the results [2, 6].

Results

Of the 1,006 patients, 332 were ≥75 years of age. This included 180 (54.2%) patients in elderly medicine, 49 (14.8%) in general surgery, 38 (11.4%) in orthopaedics, 34 (10.2%) in general medicine, 23 (6.9%) in urology and 8 (2.4%) in other specialties (Table 1).

Of the 332 patients aged ≥75 years, 45 experienced at least one adverse event (13.5%, 95% CI 9.8–17.2) compared to 42 in 674 patients aged <75 years (6.2%; 95% CI 4.4–8.0); (Pearson chi-square = 15.1, df = 1, P<0.001). Using 65 years as the threshold for classifying the patients, the difference was still statistically significant (P<0.001). There was a 3% increase in odds of an adverse event for each year of life, (OR = 1.03, 95% CI 1.016–1.043, P<0.001). After adjusting for the effect of potential confounders (e.g. length of hospital stay) the difference was still statistically significant (OR = 1.028, 95% CI 1.014–1.045; P<0.001). (Table in Appendix 2 in the supplementary data on the journal website http://www.ageing.oxfordjournals.org/). The agreement among doctors on the presence of adverse events was 86% (κ = 0.64).

In 7 of the 45 patients aged ≥75 years (15.5%) the adverse event was considered preventable, compared to 20 of the 42 patients aged <75 years (47.6%); (Pearson chi-square=10.4, P = 0.01); though not statistically significant when using the threshold of 65-year olds (P = 0.6). Also, when used as a continuous variable, patient age had no statistically significant effect on odds of a preventable adverse event (OR = 0.99; 95% CI 0.96–1.016, P = 0.4). After adjusting for the effect of potential confounders, there was still no statistically significant difference on odds of a preventable adverse event (OR = 1.02; 95% CI 0.99–1.05, P = 0.4). (see Table in Appendix 3 in the supplementary data on the journal website http://www.ageing.oxfordjournals.org/). The agreement among doctors on the presence of preventable adverse events was 83% (κ = 0.44).

In 9 (20.0%) of the 45 patients of ≥75 years of age and 14 (33.3%) of the 42 patients aged <75 years, an adverse event led to a disability that lasted more than 6 months or contributed to patient death (P = 0.15); and P = 0.4 when using the threshold of 65-year olds. When used as a continuous variable, patient age still had no statistically significant effect on odds of such an outcome. This was not affected by adjusting for the effect of potential confounders (OR = 1.008; 95% CI 0.976–1.041, P = 0.61). The speciality ‘elderly’ also showed no statistically significantly raised risk of a greater disability effect of the adverse effect compared to other specialities (P = 0.78) (see Table in Appendix 4 in the supplementary data on the journal website http://www.ageing.oxfordjournals.org/).
Hospital acquired infection and patient fall were more common and other operative complications were less common in patients who were ≥75 years old ($P = 0.03$), (Table 2).

**Discussion**

This study found a significantly higher number of adverse events in older patients (13.5% in patients ≥75 years old, compared to 6.2% in those <75 years old). This is compatible with results of other studies in the United States [1, 6], Australia [2] and New Zealand [3] which suggest that adverse events are more common in older age.

We found no statistically significant difference in experiencing a disability or death as a result of an adverse event in elderly patients and those admitted under an elderly medicine speciality compared with non-elderly patients.
and those admitted in other specialities. Because only 23 patients experienced a disability or death as a result of an adverse event, the study might have been too small and thus underpowered to detect any potentially significant difference between older and younger patients; hence the wide confidence intervals in the table in Appendix 4.

Our study also found that the apparent lower preventability of adverse events in older patients (15.5%) than younger ones (47.6%) was eliminated after adjustment for the effects of potential confounders, particularly length of hospital stay. The US [6] and Australian [2] studies also found that the association between patient age and the preventability of adverse events was no longer statistically significant after adjustment. Patients with a longer hospital stay are likely to receive more interventions and consequently more likely to develop adverse events. On the other hand, a patient developing an adverse event may have a longer hospital stay [5]. Older patients are more susceptible to hospital acquired infections and other adverse events (e.g. falls, drug errors), the risk thus increasing the longer they are in hospital and exposed to the risks.

McDonald et al. [10] and Hayward et al. [11] suggest that the proportion of preventable adverse events, particularly preventable deaths, has been overestimated in previous studies of general patient safety. However, it is also possible that there may be some bias in assessing the preventability of adverse events in elderly patients because it could be assumed that poorer outcomes were more likely to occur because of their age and the associated complexity of their condition [12]. This argument does not mean, however, that critically ill patients or those in the last stages of disease should not receive optimal care, or that their death as a result of medical error is unimportant [12].

The accuracy of the estimates of adverse events and their preventability and consequences is highly dependent on the reviewers’ judgement and may vary according to reviewer training, adequacy of medical records and the degree of confidence expressed by the clinical reviewers [2, 8]. In this study, the agreement among doctors on the presence of an adverse event was high ($\kappa = 0.64$) but agreement on the preventability of adverse events was only moderate ($\kappa = 0.44$) as found in other studies [2, 6, 10]. Further research is needed to improve the reliability of the assessment of preventability of adverse events, particularly in older patients who are more likely to have complex conditions [10, 12].

This study was carried out in one large NHS hospital, which may limit the generalisability of its findings. Nevertheless, the overall rate of adverse events and preventable adverse events we found were comparable to other similar studies from the United Kingdom [4] and elsewhere [13, 14].

The implications of these results for the quality of care of older hospital patients are unclear. Admission avoidance strategies in patients with chronic diseases was a key priority in the 2004 NHS improvement plan [15] and increasingly uncomplicated acute deteriorations in older people are now managed by community teams. This arguably leaves a larger proportion of frail patients with multiple co-morbidities (and often at the end stages of their disease) in the acute hospital setting. A recent study identified 69% of patients in one hospital as having complex needs with multiple medical conditions requiring multidisciplinary care [16]. It is likely that these complex patients are, therefore, more susceptible to adverse events. The National Service Framework for Older People has raised awareness of the special needs of older patients, but there is still a concern that systems of acute hospital care are poorly developed and not specifically designed to the needs of this vulnerable and complex group [17]. These factors may also be contributing to the higher number of adverse events in older patients. More sophisticated research using case mix adjustment is needed to explore the impact of complexity on the risk of adverse events. However, it should not be assumed that adverse events should be accepted with more complex patients; the ways in which such care is delivered and the training of staff for such complexity may need attention.

This study has shown that using detailed case-note review with structured training of reviewers is a reliable method for detecting adverse events. It has previously been reported that a large proportion of incidents identified by case-note review would otherwise go unreported, as voluntary hospital reporting systems generally do not provide an accurate picture of the extent and severity of adverse incidents [7, 18] and may detect only 5% of incidents resulting in patient harm [7]. Case-note review could, therefore, be used within hospital departments to identify and monitor adverse events, potentially allowing the opportunity to improve the quality of patient care. Adverse events identified by case-note review could be discussed at clinical governance meetings, thus promoting increased awareness among staff and identifying learning points for departments. Case-note review offers

### Table 2. Types of adverse events and patient age

<table>
<thead>
<tr>
<th>Types of adverse events</th>
<th>Age &lt;75 years</th>
<th>Age ≥75 years</th>
<th>Total n = 1,006</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Number (%)</td>
<td>Number (%)</td>
<td>n = 674</td>
</tr>
<tr>
<td>Hospital acquired infection</td>
<td>2 (3.8)</td>
<td>10 (18.5)</td>
<td>12 (11.2)</td>
</tr>
<tr>
<td>Post-operative infection</td>
<td>13 (24.5)</td>
<td>10 (18.5)</td>
<td>23 (21.5)</td>
</tr>
<tr>
<td>Other complications</td>
<td>17 (32.1)</td>
<td>6 (11.1)</td>
<td>23 (21.5)</td>
</tr>
<tr>
<td>Diagnostic AE</td>
<td>2 (3.8)</td>
<td>1 (1.9)</td>
<td>3 (2.8)</td>
</tr>
<tr>
<td>Drug AE</td>
<td>8 (15.1)</td>
<td>8 (14.8)</td>
<td>16 (15.0)</td>
</tr>
<tr>
<td>Fall</td>
<td>0 (0)</td>
<td>2 (3.7)</td>
<td>2 (1.9)</td>
</tr>
<tr>
<td>Procedural AE</td>
<td>4 (7.5)</td>
<td>8 (14.8)</td>
<td>12 (11.2)</td>
</tr>
<tr>
<td>Clinical AE</td>
<td>4 (7.5)</td>
<td>4 (7.4)</td>
<td>8 (7.5)</td>
</tr>
<tr>
<td>Other types of AE</td>
<td>1 (1.9)</td>
<td>0 (0)</td>
<td>1 (0.9)</td>
</tr>
<tr>
<td>Total</td>
<td>53 (100)</td>
<td>54 (100)</td>
<td>107 (100)</td>
</tr>
</tbody>
</table>

Fisher’s exact test = 16.5; $P = 0.03$. 

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the opportunity to promote issues around the extent and severity of adverse events among staff, helping to shift the culture away from individual blame to one of active learning. The benefits of more widespread use of case-note review, however, are limited by several factors: it is time consuming; requires structured training; and requires adequately experienced staff. Reviewers need to know if the adverse incident was not solely a consequence of the disease process itself and also when assessing preventability they need to be familiar with the standard of care expected from an average practitioner in that area.

Conclusions

This study confirms that adverse events in elderly inpatients are common and often a source of serious harm to patients. Increasing age is an independent risk factor for an adverse event in hospital. Age is, however, not strongly related to the preventability of adverse events and disability or death resulting from adverse events.

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Key points

- Adverse events in elderly inpatients are more common and lead to more disability and death, than in younger patients.
- There is no strong independent association between patient age and preventability of adverse events.
- Case-note review is potentially a useful tool for investigating and identifying learning points from adverse events.

Conflicts of interest declaration

None declared.

Declaration of sources of funding

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Ethics approval

Reference number: 04/Q1108/7

Supplementary data

Supplementary data for this article are available online at http://ageing.oxfordjournals.org.

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