Monitoring the quality of primary care: use of hospital-based audit studies

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Abstract

Aim: To describe the prevalence, characteristics and impact of community-based adverse events severe enough to warrant hospital admission in New Zealand, to compare them to in-hospital adverse events (AEs) and to consider their potential as a tool to monitor the quality of primary care.

Methods: Two-stage retrospective review of 6,579 medical records, selected by systematic list sample from admissions for 1998 in 13 generalist hospitals providing acute care. After initial screening, medical records were reviewed by trained medical practitioners using a standardised protocol.

Results: Approximately 2.5% of all admissions (12,800 hospitalisations in 1998) to public hospitals in New Zealand may be associated with community-based adverse events. Nearly 20% of all AEs occurred in the community most often in a doctor's office, patient home, or rest home. Patients who sustained a community-based AE were usually elderly, and most frequently related to medications. System issues were important for both inpatient and community-based AEs. AEs regardless of location were most frequently related to the musculoskeletal system.

Conclusions: Community-based AEs are a significant public health and hospital workload issue in New Zealand and other Western countries. Urgent attention needs to be directed at developing systems to identify their presence and monitor the effect of interventions to prevent their occurrence. Hospital-based information systems can generate useful data about AEs in the community and can provide an important review of primary care prescribing. Compared to in-hospital events, community-based AEs were most often related to medications, and were more frequently preventable.

Introduction

Recently attention has been drawn to the need to detect adverse events (AEs) in primary care [1] and debate has started about the best methods to complete this task [17]. Comparing practice-based mortality rates have been suggested as one option.[14] However, the presence of numerous potentially confounding variables, the influence of chance and the low underlying rate make mortality variations a poor indicator of sub-standard GP care.[14] An assessment of community-based adverse events may be a useful alternative.

Only a handful of studies have attempted to examine the quality of primary care and remarkably few have assessed the quality of care in a representative sample of the population.[25] Although medical record review is considered the benchmark for estimating the extent of medical injuries in hospitals [6, 9, 29] no direct counterpart to the Harvard Medical Practice Study has been undertaken in primary care. Primary care practitioners have potentially more opportunity for error as they provide medical services to considerably more patients than their hospital colleagues and respond to a wider range of patients and problems with more variable degrees of complexity and severity.[22] To date, few studies have even attempted to characterise the frequency and types of adverse events associated with primary care. Apart from some isolated examples that have examined complaints [24], malpractice claims[18] or monitored prescriptions[27] most of these studies have used self-reported ‘critical incidents’, and have included events that led to either actual or potential harm.[5, 11, 13, 23] Limitations include an inability to

reliably estimate the prevalence of events in the community, a reliance on the willingness and accuracy of reporting by practitioners, and a focus on minor errors and incidents that often did not result in serious clinical sequelae.[4] By contrast, an examination of the medical records identified as a result of a structured sample of medical admissions could avoid these deficiencies, provide a unique insight into the occurrence of severe AEs, and represent an important example of the use of an information system for collecting data about the quality of care outside hospitals.

Methods

The New Zealand Quality of Healthcare Study (NZQHS) used an internationally-recognised methodology [6, 29] to systematically sample public hospital admissions and examine for the presence of an AE using medical records. NZQHS included AEs that originated either in or outside hospital.

Details of the stratified cluster sampling of admissions to the 13 New Zealand public hospitals during 1998 and the two-step retrospective assessments used to analyse the representative 6,579 records have previously been published [9] and closely resemble those used in American and Australian [6, 29] studies.

Sampling strategy

Medical records were drawn from a representative sample of 13 public hospitals selected from amongst 20 institutions with 100 or more beds. Sampling followed stratification by

hospital type (based on service facilities provided) and geographical area across New Zealand. The survey population was defined as all patient admissions for calendar year 1998 (excluding day, psychiatric, and rehabilitation-only cases). The sampling frame for each hospital was a list of all eligible admissions in that hospital. The New Zealand Health Information Service (NZHIS) selected a systematic list sample of 575 admissions from each of these hospitals for the year 1998, with cases ordered by admission date, and provided related administrative, sociodemographic and clinical data. The medical record associated with each sampled admission was analysed for the occurrence of an AE. To be included in the study an AE must have been associated with the sampled admission.

Record review

The core data collection procedure was a two-stage retrospective review of a representative sample of medical records from each selected hospital, using instruments closely modeled on those in the American [6] and Australian [29] studies.

The first stage was the screen undertaken by specifically trained registered nurses. The purpose of this stage was to ascertain if the hospitalisation in question - the sampled admission - met any of 18 screening criteria selected as potentially indicative of an AE. The second stage undertaken by specifically trained and very experienced physicians used an instrument relying on structured implicit review, that is, the guided exercise of professional judgement. The objective was to determine whether the sampled admission

was associated with an AE and, if so, to characterise it according to key clinical criteria [9].

Definition of variables

An AE could have occurred in a public hospital or community settings. The full medical record associated with each sampled admission was analysed for the occurrence of an AE.

An AE was operationally defined as an unintended injury, resulting in temporary or permanent disability, and caused by health care management rather than the underlying disease process.

Disability was categorised as: temporary, lasting up to a year, or permanent impairment of function, or death. Attributable bed days refer to those extra days associated with an AE that were spent in the study hospital during one or more admissions.

A high level of preventability of an AE was assessed as an error in health care management which was more likely than not due to failure to follow accepted practice at an individual or system level.

System was defined in two different contexts according to the study protocol. Firstly, an AE could be classified into ‘clinical areas’ including whether it was a result of ‘system

error' due to issues such as defective or absent equipment, inadequate communication, poor staff training/supervision/provision, delay in the provision of services, or the absence or failure to implement a protocol/plan. Secondly, in relation to areas where effort could be directed to prevent AE recurrence, 'system areas' encompassed policies/protocols/procedures, access to/transfer of information, communication, organisation management/culture, and record keeping.

NZDep96 quintiles [8] were derived from patient domicile codes as a measure of residential area deprivation.

Principal diagnosis or reason for admission was classified according to 25 Major Diagnostic Categories (MDCs) derived from Australian Diagnostic Related Group classification version 3.1 (AN-DRG 3.1) [3].

Information about the admissions that were determined by trained medical officers to be related to AEs that occurred outside of the hospital setting were analysed and compared to events attributed to in-hospital care.

Results

Overall some 2.6% (95% CI: 2.0-3.1%) of admissions were associated with a community-based AE (Table 1) and community-based events accounted for nearly 20% (15.9-23.2%) of all AEs in the study. AEs originating in the community were

significantly more likely than inpatient events to be highly preventable (45% compared to 34%) and were associated with a slightly higher rate of death or permanent disability (16.8% versus 14.4%). The number of mean attributable bed days was slightly higher for community based events compared to those events that occurred at hospitals (9.8 versus 8.9).

TABLE ONE ABOUT HERE

Most adverse events occurring outside hospital were associated with patients who were elderly, female, European and in a lower socio-economic group (Table 2). Patients in the community who sustained an adverse event were statistically significantly more likely than inpatients to be elderly.

TABLE TWO ABOUT HERE

Community-based AEs usually occurred in a doctor's office (32%), the patient's home (27%), or a rest home (19%)(Table 2).

TABLE THREE ABOUT HERE

Systems issues and drug related events were the most common areas related to community-based AEs. Approximately one third of all community-based AEs were attributed to either systems or drug related problems. By contrast, inpatient AEs were

significantly more frequently associated with operations and less often related to falls (Table 4). Systems issues were also important at hospitals.

TABLE FOUR ABOUT HERE

AEs regardless of location were most frequently related to the musculoskeletal system however community-based AEs were especially frequently associated with that body system (22.7% versus 15.8%). AEs associated with the circulatory system were common at both locations whereas obstetric, digestive system and perinatal AEs were more often associated with hospital events.

TABLE FIVE ABOUT HERE

System issues were identified as the most important factor at preventing both community-based and inpatient AEs. Improved education, consultation with peers, and to a lesser extent, resources were also key factors.

TABLE SIX ABOUT HERE

Discussion

The epidemiology, risks and outcomes of errors and adverse events related to primary care are very poorly understood.[1] Patient volumes and the complexity of primary care make investigations of patient safety vitally important.[1] The NZ Quality of Health Care Study provides a unique opportunity to assess the prevalence of serious adverse events in

primary care and the community. Some 2.6% of all hospitalisations at New Zealand hospitals, or approximately 13,000 admissions each year, may be related to community-based adverse events. This finding is broadly in keeping with other research that has attempted to estimate the proportion of admissions related to adverse drug events or reactions (ADEs or ADRs). Although adverse drug events are only a sub-group of all AEs they are the most common type of community-based AE. Estimates of the proportion of admissions related to ADE/ADRs vary between 2.5-6.9%[10, 16, 20, 26] but they have often been based on a wider definition of an event, smaller sample sizes and a less rigorous selection process. In addition, the NZ Quality study specifically identified AEs that were serious enough to warrant hospital admission and with the exception of fatal events occurring in the community have likely included a more severe spectrum of AEs.

Underlying the public health importance of community-based AEs, it has been estimated that hospital costs for each AE amounts to approximately (NZ 2001) $10,264 [7] and therefore the economic burden associated with community-based AEs accounts for about 6% of the total expenditure on public hospitals in New Zealand. The only previously published estimate of the proportion of national expenditure related to AEs was provided by Detournay et al., 2000 who calculated that the average cost for hospitalisation due to an ADR was FF16,515 (1996 values) and estimated that ADRs were responsible for FF2.2 billion annually and nearly 2% of the total budget for all French hospitals in 1996. These estimates can only be regarded as broad approximations as neither included detailed ‘micro’ or bottom-up costings and both omitted a number of costs not borne by

the hospital including indirect costs and those costs that were not part of the primary hospital admission.

The New Zealand study has highlighted a number of important differences between inpatient and community-based adverse events. AEs originating outside of hospitals likely have different origins to inpatient events. Community-based events were more likely to be highly preventable than in-hospital events, there was a higher proportion of medication-related problems and a greater impact upon the elderly. Prescribing is one of the most potent interventions GPs exercise and the potential for drug interactions and adverse reactions is well recognised, especially among the elderly in the community who may be subject to instances of polypharmacy. Prescribing problems in general practice are relatively common and potentially serious - approximately 9% of hospital admission may be related to problems associated with prescribing [19]. Particular safety concerns have been highlighted with certain medications including lithium, warfarin, non-steroidal anti-inflammatory drugs, corticosteroids and anti-depressants [19].

The discrepancies between inpatient and community-based adverse events have been disclosed using a well validated taxonomy that was designed for use in hospitals.[6] The differences highlight the likelihood that medical error and adverse events have varying characteristics in each setting and they underpin the need for a robust classification system to be developed in primary care.[11] Future work should also consider the perspectives of patients rather than just health professionals in the identification and classification of errors or adverse events.[15] The scope of harm experienced by patients

is likely to be much broader than the need for hospital admission and may extend into areas of psychological injury associated with impaired access to care or communication problems with health practitioners.[15]

Generalising the number of adverse events in the community to the estimated 15.6 million general practice consultations in New Zealand during 1998 [2] suggests that approximately 1/100,000 consultations may be associated with a serious AE. This result is consistent with a previous estimate (3.8/100,000) of primary care-related harm.[13] By contrast a review of the frequency of errors in general practice suggests that they are significantly more frequent and may occur between five and 80 times per 100,000 consultations.[23, 24] The finding that errors are more common than adverse events is fully consistent with the 'iceberg' model of error in complex systems where human errors occur relatively frequently but most do not lead to adverse patient outcomes[21].

The relatively uncommon nature of community-based serious adverse events suggests that they may be too infrequent to be used as an indicator of the quality of primary care. In order to reliably discriminate a 50% difference between locations with 80% power over 1770 admissions would need to be audited in each region. Instead more useful information could be gained by comparing rates of community-based adverse events related to high risk groups, such as the elderly. If the baseline rate of community-based adverse events in people over 65 years was 10% then only 435 admissions would need to be evaluated at each location in order to have 80% probability of detecting a 50% reduction in the events. Some experience has already been obtained with auditing the

impact of adverse drug events on admission rates.[19] The risk of an adverse drug event is increased with age and a number of common medications (such as NSAIDs and anticoagulants) have been highlighted.[19] The frequency of community-based adverse events related to various medications amongst the elderly may be a useful and reliable indicator of the quality of primary care in a region.

The New Zealand Quality of Health care study provides a unique example of an evaluation of the quality of care in a representative sample of the population in which possible reasons for substandard care were identified and the characteristics of patients most at risk of sub-standard care have been identified. Evaluations of the quality of primary care should focus on representative, randomly selected samples of records drawn from the entire population rather than potentially biased samples drawn from self selected groups or practices.[28] Record review complements other approaches to identifying medical harm in the community especially incident monitoring methods.[5] Ultimately the provision of a database to log medical harm such as that set up in the aviation industry over a decade ago may be the most effective method to recognise and study patient harm.[1] Such a database should include and analyse information from self-reported incidents, data from secondary sources and litigation claims or complaints.[12] The system could also undertake the next steps of providing feedback to practices and assessing the impact of interventions instigated to improve patient safety.[12]

Authorship

The authors participated in all stages of the preparation of this report. Dr Hider is the guarantor for the paper.

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Contribution

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Table 1: Comparison of outside versus inside hospital adverse events (AEs).

	AEs that occurred outside hospital % or mean (95% confidence interval)*	**AEs that occurred inside hospital** % or mean (95% confidence interval)
AE distribution	167/850 19.6% (15.9-23.2) †	683/850 80.4% (76.8-84.1) †
Proportion of all sampled admissions that were related to an AE	167/6579 2.6% (2.0-3.1) †	683/6579 10.6% (8.4-12.8) †
AEs that were highly preventable	45.5% (238/683) (41.1-49.9) †	34.2% (77/167) (30.9-37.5) †
Mean attributable bed days	9.8 (7.3-12.3)	8.9 (7.5-10.4)
AEs that were associated with death or permanent disability	16.8% (10.5-23.1)	14.4% (11.2-17.6)

* Percentages, means and 95% confidence intervals have been appropriately adjusted to account for sample design.

† Significant difference between outside and inside hospital AEs.

Table 2: Description of patients sustaining a community-based or inpatient AE

	Outside hospital (n=167)	**Inside hospital (n=683)**
	% of AEs (95% confidence interval)*	% of AEs (95% confidence interval)
Age group		
0-14 (n=102)	8.3 % (1.3-15.2)	13.0 % (8.6-17.4)
15-64 (n=402)	35.4 (27.7-43.2) †	50.6 (47.0-54.2) †
65+ (n=346)	56.3 (47.3-65.2) †	36.4 (29.8-43.0) †
Gender		
Male (n=380)	46.2 (38.6-53.7)	43.8 (39.4-48.1)
Female (n=470)	53.8 (46.3-61.4)	56.2 (51.9-60.6)
Ethnic group		
European (n=626)	79.3 (68.8-89.7)	71.6 (62.5-80.6)
Other (n=224)	20.7 (10.3-31.2)	28.4 (19.4-37.5)
Area deprivation score (NZDep96 quintiles)		
1 + 2 (most affluent) (n=224)	30.3 (16.4-44.2)	25.8 (19.5-32.1)
3 (n=185)	19.7 (13.6-25.8)	22.7 (16.5-28.8)
4 + 5 (most deprived) (n=434)	50.0 (35.5-64.5)	51.5 (40.8-62.2)

* Percentages and 95% confidence intervals have been appropriately adjusted to account for sample design.

† Significant difference between outside and inside hospital AEs.

Table 3: Site of occurrence of community based adverse events

Site	Proportion of Aes (n=167)
Doctor's office	32.3%
Patient's home	26.9%
Rest home	19.2%
Private hospital	10.2%
Ambulatory care unit	6.6%
Other	4.8%
All AEs	100%

Table 4: Comparison of clinical areas and location of AE occurrance

	Location of AE occurrence	
	Outside hospital (n=167)	**Inside hospital** (n=683)
	% of AEs (95% confidence interval)*	% of AEs (95% confidence interval)
Clinical area		
System (n=254)	29.5 (24.7-34.2)	29.6 (23.6-35.6)
Operative (n=258)	10.3 (5.7-14.9) †	35.0 (29.6-40.4) †
Drug (n=131)	36.3 (28.9-43.8) †	10.1 (7.3-12.8) †
Therapy (n=89)	13.2 (5.7-20.7)	10.3 (6.-14.5)
Diagnosis (n=85)	10.0 (5.2-14.7)	9.6 (7.6-11.6)
Procedure (n=83)	7.3 (1.5-13.1)	10.4 (7.8-13.0)
Falls (n=36)	14.4 (6.4-22.4) †	1.7 (0.6-2.7) †
Obstetric (n=52)	0.6 (0-2.1)	7.8 (2.0-13.5)
Neonatal (n=27)	0.8 (0-2.3)	4.0 (1.7-6.2)
Fractures (n=35)	2.6 (0-6.0)	4.3 (2.2-6.5)
Anaesthesia (n=15)	0.4 (0-1.5)	2.2 (1.3-3.0)

* Percentages and 95% confidence intervals have been appropriately adjusted to account for sample design.

† Significant difference between outside and inside hospital AEs.

Table 5: Comparison of location of occurrence of AE with diagnostic categories

	Outside hospital (n=167) % (95% confidence interval)*	**Inside hospital** (n=683) % (95% confidence interval)
Major Diagnostic Category (MDC)		
Circulatory system (n=115)	15.3 % (8.1-22.6)	13.1 % (10.7-15.6)
Musculoskeletal system (n=150)	22.7 (13.3-32.1)	15.8 (11.3-20.2)
Obstetric (n=56)	1.8 (0-4.0)	8.3 (2.0-14.7)
Digestive system (n=99)	6.6 (1.5-11.7)	12.4 (9.2-15.7)
Respiratory system (n=51)	5.3 (2.6-8.0)	6.1 (3.9-8.3)
Perinatal (n=34)	0.6 (0-2.1) †	5.0 (2.5-7.4) †
Nervous system (n=42)	5.5 (2.9-8.1)	4.8 (2.9-6.7)
Skin (n=33)	5.8 (2.0-9.7)	3.5 (1.8-5.3)
Kidney and urinary tract (n=42)	6.9 (2.4-11.4)	4.5 (2.2-6.7)
Injuries, poisonings, drugs (n=55)	7.5 (3.6-11.4)	6.3 (3.7-8.8)
Other (remaining 15 MDCs) (n=173)	21.9 (13.8-30.0)	20.2 (16.7-23.7)

* Percentages and 95% confidence intervals have been appropriately adjusted to account for sample design.

† Significant difference between outside and inside hospital AEs.

Table 6: Comparison of areas of effort to prevent recurrence and location of AE occurrence

	Location of AE occurrence			
	Outside hospital (n=167)		**Inside hospital** (n=683)	
Area of effort to prevent AE recurrence	% of AEs	% Permanent disability/death	% of AEs	% Permanent disability/death
System	35.3	22.0	29.7	13.8
Consultation	21.0	14.3	21.5	21.8
Education	24.6	12.2	16.4	13.4
Resources	12.6	14.3	9.2	15.9
Quality assurance	4.8	0	7.5	13.7
Other	9.0	26.7	13.8	13.8
All AEs		17.4 %		13.9 %