Characteristics of older adults hospitalised following trauma in the Midland region of New Zealand

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ABSTRACT

AIM: To describe the epidemiology of injuries sustained by older adult trauma patients admitted to hospitals in the Midland region (population 886,000) of New Zealand.

METHODS: A review of older adult (≥65 years) trauma cases from the Midland Trauma Registry for the three-year period January 2012 to December 2014 was conducted. Demographics, mechanism of injury, severity of injuries, processes of care and outcomes were analysed.

RESULTS: Older adults accounted for 14% (2,278/15,700) of all injury cases captured by the registry during the study period (average annualised incidence 585/100,000 population). The majority of injuries (90%) were minor in nature (ISS 0-12) and 65% resulted from unintentional falls. Falls was the most common mechanism in the major trauma group (38%), followed closely by road traffic crash (30%). Home was the leading place of injury (56%), followed by road/street/highway (15%). Injury rates were significantly higher among non-Māori than Māori.

CONCLUSION: These findings illustrate the growing volumes and changing epidemiology of both major and minor trauma affecting older persons hospitalised following trauma in one of the four health regions of New Zealand. There is a need to prepare for an increase in demand for trauma services to meet the needs of an ageing population in New Zealand.

New Zealand, like most developed nations is experiencing a demographic transition to an older age structure.[1] Currently, adults over 65 years old comprise around 13% of New Zealand's total population; this is predicted to increase to 17% by 2021, equating to an additional 236,500 older adults residing in New Zealand.[2] Older adults have reduced physiological and structural capacity to cope with injury, therefore relatively minor injuries may have more serious consequences than in younger patients.[3,4] This is compounded by the presence of multiple comorbidities often found within this age group.[3,5–9] It is important for those involved in the provision of clinical care and injury prevention in older persons to have a clear understanding of the patterns of injury and trends in incidence so that programmes to reduce the impact of trauma can be carefully targeted to groups at risk. The current study is the first in New Zealand to provide such detail on older persons of all injury severities admitted across one of the four health regions of New Zealand.

The incidence of trauma in this age group is increasing globally.[3–5,9] US data suggest older adult disability, and physical, sensory and cognitive limitations have declined in recent decades.[10] In addition, the activity levels in this age group appear to be increasing. A Canadian study exploring physical activity among adults over a 20-year period using national health survey data, found the prevalence of active older adults had increased from 24% in 1995 to 31% in 2000.[11] These findings may indicate a potentially more active older population

which could lead to a change in pattern of mechanism of injury in this age group.[12,13] Regardless of the mechanism of injury, an ageing population will result in an increase in the volume of trauma-related injury among older adults, placing significant pressure on scarce healthcare resources.

The Midland Trauma System (MTS) was established in 2010 to coordinate improvements in the quality of trauma care delivery within the Midland region (population 889,541) of New Zealand.[14,15] The MTS trauma registry captures data on selected trauma patients admitted to six hospitals in the region. Approximately 6,000 trauma patients are admitted to hospital in the region annually, and of these 14% are older adults. Older adult injury represents a significant health burden on patients, the community and the health system that may be amenable to evidence-based interventions.[16] The Midland region of New Zealand has a high number of people living in rural areas, high deprivation and Māori compared with New Zealand as a whole.[17,18]

The aim of this research is to describe the epidemiology of injuries, process of care and outcomes in older adult trauma patients admitted to Midland region hospitals and who are captured by the Midland Trauma Registry. This information will be used to guide trauma quality improvement and injury prevention efforts.

Methods

A retrospective review of anonymised, prospectively-collected MTS registry data for the period 1 January 2012 to 31 December 2014 was conducted. Inclusion criteria for the study were: patients aged ≥65 years admitted to a Midland base hospital as a result of, and within seven days of an injury; and resident in the Midland region. Consistent with trauma registries internationally, patients were excluded if they sustained insufficiency or periprosthetic fractures, exertional injuries, hanging/drowning/asphyxiation without evidence of external force, poisoning, ingested foreign body, injury as a direct result of pre-existing medical conditions or late effects of injury, or the injury occurred more than seven days prior to admission.[14] Event episodes were the unit of analysis. For example, in situations where a patient was transferred to other hospital/hospitals in the region for the same injury event, this was counted as a single event and the event assigned to the first MTS hospital where the patient was treated. Length of stay was inclusive of the total days admitted to all hospitals for the index event.

Variables examined included: patient demographic characteristics, injury event information, in-hospital management, type and severity of injuries, length of stay and discharge destination. The classification of the nature of injuries is consistent with the Abbreviated Injury Scale (AIS, 2005/08), a tool designed to rank injury severity.[19] The Injury Severity Score (ISS) numerically describes the overall severity of injury, and is calculated from the three most severely injured body regions as scored by the AIS.[20] Minor trauma is classified as (ISS 1-12) and major trauma as (ISS 13-75).[20]

Ethnicity information was obtained from the patients' unique national health identifier (National Health Index number [NHI]) or directly from the patients themselves. Mechanisms of injury were categorised using the International Classification of Disease (ICD-10AM 6th Edition) external cause codes.[21]

Microsoft Excel (Excel 2010) and Minitab (Minitab Inc., 2010) were used for the analyses. Descriptive statistics for continuous variables were informed by using medians and confidence intervals. The Chi^2 test was used to detect differences in proportions for non-normal distributions. P values were used to determine the result significance.

Ethical approval was not required for this study as the analyses involved the use of anonymised secondary data. The study adhered to the MTS Data Use Policy. Access to the trauma registry data was approved by the MTS Strategic Group.

Results

During the three-year study period, older adults accounted for 14% (2,278/15,700) of all traumatic injury events captured by the MTS registry and that occurred among those living in the region (Table 1).

Table 1: Characteristics of older adult (≥65 years) injured patients by Injury Severity Score (ISS), Midland region, 2012–2014 (n=2,278).[¥]

Variable	Total n (%)	Minor trauma (ISS≤12) n (%)	Major trauma (ISS>12) n (%)
Total events	2,278 (100.0%)	2,070 (90.0%)	208 (10.0%)
Age group (in years)			
65–69	636 (27.9%)	574 (27.7%)	62 (29.8%)
70–74	476 (20.9%)	431 (28.8%)	45 (30.8%)
75–79	373 (16.4%)	335 (14.8%)	38 (22.0%)
80–84	328 (14.4%)	300 (10.7%)	28 (10.3%)
85+	465 (20.4%)	430 (17.2%)	35 (14.4%)
Gender			
Female	1,275 (56.0%)	1,203 (58.1%)	72 (34.6%)
Male	1,003 (44.0%)	867 (41.9%)	136 (65.4%)
Ethnicity			
Māori	128 (5.6%)	110 (5.4%)	18 (8.7%)
Non-Māori	2,150 (94.4%)	1,960 (94.7%)	190 (91.3%)
Employment status			
Retired	1,856 (81.5%)	1,709 (95.3%)	147 (70.7%)
Employed	325 (14.3%)	277 (13.4%)	48 (23.1%)
Beneficiary	10 (0.4%)	8 (0.9%)	2 (1.0%)
Domestic	9 (0.4%)	9 (0.5%)	0 (0.0%)
Other*	78 (3.4%)	67 (3.5%)	11 (5.3%)
Domicile region			
Waikato	851 (100.0%)	775 (91.1%)	76 (8.9%)
Bay of Plenty	913 (100.0%)	836 (91.6%)	77 (8.4%)
Taranaki	246 (100.0%)	228 (92.7%)	18 (7.3%)
Lakes	155 (100.0%)	141 (91.0%)	14 (9.0%)
Midland Other[ŧ]	113 (100.0%)	90 (79.6%)	23 (20.4%)

[¥]Inclusive of Midland region residents only.
*Unemployed/not stated/student/other.
[ŧ]Tairawhiti DHB not included, full 2012–2014 dataset not available.

The majority of those presenting with major trauma were males (65.4%), in the 70 to 74 years age group (30.8%), and of non-Māori ethnicity (91.3%). The majority of patients (99%) lived in the Midland region at the time of injury. More than one-fifth (23.1%) of those who sustained major trauma were employed. For the period reviewed, there were on average two older adults admitted per day in the region for trauma-related injuries. The average annualised incidence of injury events in this age group was 585/100,000 population (95% CI 539–634/100,000) (Table 2).

Table 2: Average annualised incidence per 100,000 of trauma events in older persons in the Midland region 2012–2014*[¥] (Incidence per 100,000, 95% Confidence Intervals).

Overall	Age groups						Frequency totals
	65–69 years	70–74 years	75–79 years	80–84 years	≥85 years	All ages (≥65 years)	
	494 (452–540)	479 (438–523)	538 (494–583)	643 (595–695)	1,069 (1,007–1,135)	585 (539–634)	2,165
Gender							
Female	435 (396–478)	463 (423–507)	589 (543–639)	748 (696–804)	1,129 (1,065–1,197)	608 (562–658)	1,216
Male	557 (512–605)	499 (457–545)	481 (440–526)	509 (467–555)	949 (890–1,011)	557 (512–605)	949
Ethnicity							
Māori	462 (422–506)	418 (380–460)	475 (434–518)	474 (433–519)	635 (588–687)	460 (420–504)	124
Non-Māori	497 (455–543)	486 (445–531)	543 (499–591)	631 (584–682)	1,080 (1,018–1,146)	594 (548–644)	2041
Domicile[ŧ]							
Waikato	496 (454–542)	487 (446–532)	452 (412–296)	615 (568–666)	808 (754–866)	537 (493–584)	851
Bay of Plenty	520 (477–567)	516 (473–563)	761 (709–817)	954 (895–1,017)	1,911 (1,827–1,999)	789 (735–846)	913
Taranaki	480 (439–525)	439 (400–482)	437 (398–480)	388 (351–429)	613 (566–664)	467 (427–511)	246
Lakes	436 (397–479)	406 (368–448)	358 (323–397)	180 (156–208)	202 (176–232)	358 (323–397)	155

*Census 2013 Population, excludes Tairawhiti DHB.
[¥]Age and Ethnicity matched.
[ŧ]Patient District Health Board Domicile Census 2013 Population matched.

Incidence was significantly higher in females than males (608/100,000 cf. 557/100,000 population), and among the oldest older adults (85 years and over 1,069/100,000 population). The incidence of older adult injury admissions among females increased with age; in contrast, the rate among males had a u-shaped distribution (Table 2). Overall, non-Māori had significantly higher rates of injury than Māori (594/100,000 cf. 460/100,000 population). Geographically, overall rates were significantly higher in the Bay of Plenty region (789/100,000). The majority of older adult trauma patients were retired (81%); however, 14% were still actively engaged in employment.

The yearly volume of older adult trauma patients in this study increased significantly from 509/100,000 (n=628) in 2012 to 648/100,000 (n=800) in 2014 (p=0.014).

Blunt trauma accounted for 98% of all trauma-related admissions and almost all of the major trauma cases.

The majority of injuries were unintentional (99%) (Table 3). Overall, falls were the leading cause of injuries (65.3%), and among minor trauma admissions (67.9%). Transport-related incidents (road traffic crashes, pedestrian and pedal cycle incidents) were the second leading cause of injury overall (16.0%), but were more prominent among major trauma events (42.8%). Home was

Table 3: Injury circumstances of older adult (≥65 years) trauma patients by minor (ISS≤12) or major (≥ISS 13), Midland region, 2012–2014.

Variable	Totals	Minor trauma (ISS 0-12)	Major trauma (ISS≥13-75)
	n=2,278 n (%)	n=2,070 n (%)	n=208 n (%)
Injury intent			
Unintentional	2,254 (99.0%)	2,051 (99.2%)	203 (97.6%)
Intentional	22 (1.0%)	17 (0.8%)	5 (2.4%)
Cause of injury			
Fall	1,487 (65.3%)	1,405 (67.9%)	82 (39.4%)
Transport related*	365 (16.0%)	276 (13.3%)	89 (42.8%)
Machinery	125 (5.5%)	122 (5.9%)	3 (1.4%)
Struck	143 (6.3%)	129 (6.2%)	14 (6.7%)
Burns	19 (0.8%)	19 (0.9%)	0 (0.0%)
Other	139 (6.1%)	119 (5.7%)	20 (9.6%)
Total number of body regions injured (n=3,244)			
Head or neck	335 (10.3%)	212 (7.9%)	123 (22.0%)
Face	113 (3.5%)	76 (2.8%)	37 (6.6)
Chest	324 (10.0%)	199 (7.4%)	125 (22.4%)
Abdomen or pelvic contents	116 (3.6%)	62 (2.3%)	54 (9.7%)
Extremities or pelvic girdle	1,420 (43.8%)	1,318 (49.1%)	102 (18.2%)
External	936 (28.9%)	818 (30.5%)	118 (21.1%)
Arrival day of week			
Monday to Thursday	1,332 (58.5%)	1,215 (58.7%)	117 (56.3%)
Friday to Sunday	946 (41.5%)	855 (41.3%)	91 (43.8%)
Arrival time of day (n=2,277)**			
0600–1759	1,675 (73.6%)	1,525 (73.7%)	150 (72.1%)
1800–0559	602 (26.4%)	544 (26.3%)	58 (27.9%)
Overall length of stay (days)			
<10	1,834 (80.5%)	1,690 (81.6%)	144 (69.2%)
10–20	343 (15.1%)	299 (14.4%)	44 (21.2%)
>20	101 (4.4%)	81 (3.9%)	20 (9.6%)
Discharge destination from the last trauma care facility (n=2,277)**			
Home	1,454 (63.9%)	1,387 (67.0%)	67 (32.2%)
Rehabilitation	273 (12.0%)	222 (10.7%)	51 (24.5%)
Convalescence or acute care facility	380 (16.7%)	332 (16.0%)	48 (23.1%)
Rest home/residential	79 (3.5%)	73 (3.5%)	6 (2.9%)
Morgue	61 (2.7%)	28 (1.4%)	33 (15.9%)
Other	30 (1.3%)	28 (1.4%)	3 (1.4%)

*Motor vehicle and motorcycle crashes, pedestrian and pedal cycle incidents.
**Time of arrival was unavailable for one patient.

the most common place of injury (56.6%), followed by road/street/highway/footpath (19.8%). Among minor injury cases, home was the most common place of injury (59%), and road/street/highway/footpath (42.8%) for major injuries.

Overall, the extremities (including pelvic girdle) were the most common areas injured (43%) (Table 3). Among the major trauma group, the head/neck and chest were the most commonly injured body regions (22% each region). Overall, external injuries accounted for the second highest volume of injuries (28%) regardless of ISS, and facial injuries the least. Over one-third (37%) of patients had injuries in more than one body region. Fifty-eight percent of patients required surgery, however, overall only 2.9% required an ICU stay.

Over the three-year study period a total of 61 patients died (case fatality rate=2.7%). The population mortality rate per year was 0.016% (20/123,413).

The majority of older adult trauma admissions to Midland DHBs occurred during autumn (March/April/May). The majority of trauma events (58.5%) among older adults occurred during the weekdays (Monday to Thursday), and this pattern was similar regardless of the severity of injury (Table 3). Around three-quarters (73.5%) of those admitted to hospital arrived between the hours of 6am and 6pm, irrespective of severity.

The majority of patients (97%) did not require an ICU admission during their hospital stay (Table 3). Among the major trauma group, 3.4% of patients required an ICU stay of 10 or more days, compared to 0.1% of minor trauma patients. Just over half (57%) of patients underwent a surgical procedure (minor trauma cases 58.3 %, major trauma 54.3%). Just over 80% of patients had a total hospital stay of less than 10 days (median 5 days, IQR 2–9 days), 9.6% of major trauma patients stayed for 20 days or longer compared with only 3.9% of minor trauma cases. The majority (63%) of older adult trauma admissions were discharged home from the acute setting. However, only 32% of major trauma patients were discharged home, with this group more than twice as likely to go to a rehabilitation facility compared to those with minor injuries (24% vs 10%).

Discussion

This study explored the characteristics of older adult trauma events resulting in hospital admissions within the Midland region of New Zealand. This study has revealed the growing incidence and considerable variation in the patterns and volumes of injury across the Midland region. Higher rates of injury occurred in non-Māori, females and older adults (≥85 years). There was geographic variation in the incidence of older adult injury across the Midland region, with the Bay of Plenty region having the highest incidence of older adult trauma, and also the highest proportion of major trauma. Head/neck/thorax injuries predominated within the major trauma group. More than half (58%) of older adults admitted with injuries required a surgical procedure. Of those patients admitted, the majority (64%) were discharged home and only 12% were discharged to a rehabilitation facility. The majority of patients (81%) had a hospital stay of less than 10 days; however, 15% were in hospital for between 10 and 200 days.

The study findings have confirmed the dominant role falls play as a leading mechanism of injury among older adults.[6,7,9,22] Continued evidence-based primary prevention efforts are required to reduce falls among older adults[23,24] From a secondary prevention perspective, most hospitals have initiated fractured neck of femur (NOF) pathways. Research by Kosy et al found the introduction of a fast-track NOF pathway decreased time to theatre and length of hospital stay, improved pain management and mobility post-surgery.[25] Published injury-related literature for this age group is dominated by the epidemiology of falls and their associated contribution to morbidity and mortality.[3,6–9] Around one-third of older adults fall annually; this increases to over 50% by 80 years of age.[26] New Zealand's national injury compensation agency (the Accident Compensation Corporation [ACC]) estimates half of all claims for people aged over 65 years are as a result of falls that account for 75% of hospital admissions in this age group.[26]

Road traffic crashes were the second leading cause of major trauma among older adults in this study. This is consistent with previous published research from Sharma et al[9] The New Zealand Transport Agency

(NZTA) has a series of workshops under the 'Staying Safe' initiative that have been designed to maintain older adult driving safety.[27] The workshops provide a comprehensive guide to the older adults own safety when driving, through a series of modules designed to increase awareness of the effects of ageing and driving and self-assessment of driving skills. Programmes designed to maintain safety in older adult driving such as those provided by NZTA could be promoted.

Injuries to the chest, closely followed by head/neck regions were the most frequently injured among major trauma patients in this study, which reflected findings from other published studies.[9,24] Similar to Aitken and Burmeister et al, this study found that home was the most common discharge destination of older adults with an ISS <15.[16]

Across the three-year period, for those aged less than 65 years there were a total of 13,403 events and 43 patients died (case fatality rate 0.3%). For those aged over 64 years, the case fatality rate was 2.7%, and of those who died, 56% were aged 80+ years. The mortality rate in the present study for older adults was more than eight times the mortality rate for those aged under 65 years captured by the Midland Registry for the same the period (2.7% cf. 0.32%). A range of factors have been identified that may in part explain the higher mortality rate from trauma among older adults, including high injury severity scores, high Abbreviated Injury Scale scores, low Glasgow Coma Scale scores, comorbidities, haemodynamic compromise and diminished ability for systemic compensation.[3,6–8]

Limitations

The strengths of this study are the use of prospectively-collected data from a population-based trauma registry that records patients of all injury severities from a population that is broadly representative of the New Zealand public,[15] therefore making the findings more widely translatable. The study findings need to be considered in light of some limitations. The study is inclusive of those patient admissions included in the MTS registry and therefore may not be representative of all older adult trauma events that result in admission to hospital. The presence or absence of comorbidities, or other risk factors such as haemodynamic status or Glasgow Coma Scale, that are known to contribute to injury-related morbidity and mortality in older adults[3,6–8] were not included in these analyses. The current study did not examine the role comorbidities may play on recovery from injury. A study by Freedman et al found that early referral to an inpatient geriatrician team for complex comorbidity management within and a model of shared care with the trauma team, led to a reduction in times to surgery, shorter lengths of stay, fewer complications such as thromboembolism, delirium, cardiac and infection.[10]

Conclusion

This study has revealed the patterns of injury and the changing epidemiology of both major and minor trauma in older persons in the Midland region in New Zealand. Trauma volumes are increasing and By 2061, the numbers of people aged over 65 years residing in New Zealand is projected to increase by 25% (totalling approximately 1.5 million persons).[1] The study has also shown high rates of injury occurring in non-Māori, females and older adults (≥85 years), and revealed the considerable geographic variation in patient types and volumes between health districts; the first study of its kind to do so in New Zealand. This variation indicates that health services should remain cognisant of the variations in demographic profiles, ethnicities and behaviours that are characteristic of individual districts.

This information can be used to build better prevention, treatment and rehabilitation services as lifestyles and expectations change and the impact of this high-risk group on health services and the community in New Zealand changes and grows.

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