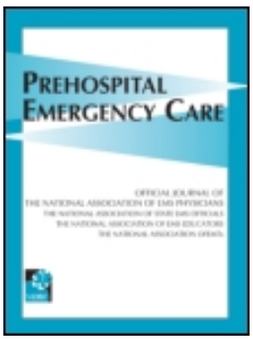

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Epidemiology of Emergency Medical Service Responses to Older People Who Have Fallen: A Prospective Cohort Study

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Abstract

Objectives. To describe the characteristics of older people who fall and call an emergency ambulance, and the operational and clinical impact of the ambulance responses they receive. **Methods.** A prospective cohort study of people aged ≥65 who had fallen and called for an ambulance was conducted between October 1, 2010 and June 30, 2011. Fall-related data were collected using a project-specific data collection tool. These data were then linked to routinely collected ambulance service clinical records and dispatch data, providing a sequential description of fall-related cases from time of ambulance dispatch through to the end of the prehospital episode of care. **Results.** There were 1,610 cases eligible for analysis. The median response time was 15 minutes (IQR 10–24) and "long-lies" (>60 minutes on the ground) occurred in 13% of cases. Patients were predominantly female (61%) and community dwelling (82%). Forty-four percent had never previously called an ambulance for a fall, whereas 248 (15%) had called within the past month. The most common patient-reported reasons for falling were loss of balance (30%) and "simple trips" (25%). New injury and/or pain was documented for 1,172 (73%) of patients, and 656 (41%) presented with "abnormal" physiology; only 238 (15%) presented with no new injury/pain and normal physiology. The nontransport rate was 28%. **Conclusion**. In this population, ambulance services appear to provide timely responses to older people who have fallen, and "long-lies" are relatively uncommon. More than one-quarter of patients were not transported to an emergency department, and repeat use of ambulance resources appears to be common. Opportunities exist to explore alternate pathways and models of care that maximize outcomes for nontransport patients as well as improving operational efficiency of the ambulance service.
Key words: ambulance; emergencies; aged; accidental falls; emergency medical services

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Introduction

Falls experienced by the elderly are among the most common events to which emergency medical services are dispatched, comprising between 5 and 10% of annual emergency workload.[1,2] Faced with an increasingly aging population, falls experienced by the elderly are likely to consume an increasing proportion of ambulance resources over the coming decade.[3]

This population of patients presents substantial operational and clinical challenges for ambulance services. While the traditional function of ambulance paramedics has been to transport patients to an emergency department (ED) for medical assessment, there is no clear evidence that doing so improves health outcomes or reduces risk of further falls for older people who have fallen.[4–6] On the other hand, older fallers not transported to an ED appear to be a vulnerable population at risk of future falls, suboptimal health outcomes, and ambulance reattendance.[7–9] Consequently, there is a real need to develop clinical strategies and innovative models of care aimed at optimizing the prehospital management of older fallers by paramedics. However, the current evidence to inform such development is lacking in proportion to the level of demand and complexity associated with these incidents, partially due to the inability of routinely collected ambulance data to capture detailed fall-specific information.[10]

With this context in mind, the aim of this prospective descriptive study was to describe 1) the characteristics of older people who fall and call an ambulance, and 2) the characteristics of the falls and the ambulance response they receive.

METHODS

Study Design

This study was a prospective, observational cohort study in which fall-specific information collected using a tailored data-collection tool was combined with ambulance clinical records (ACR) and computer-aided dispatch (CAD) data.

Study Setting

The study was conducted in New South Wales (NSW), Australia. The Ambulance Service of New South Wales (ASNSW) is a statewide government ambulance service that responds to approximately 1,120,000 incidents annually, of which 825,280 are emergency cases.[11] The ambulance service provides coverage across a geographic area of approximately 802,000 km^2 encompassing both metropolitan and rural/remote regions, and has a frontline clinical workforce of almost 3,000 operational paramedics. The paramedic workforce consists of four clinical levels: paramedic trainee (PT) (first year of training), paramedic intern (PI) (second/third year of training), qualified paramedics (QP) (completed 3 years of core training to advanced life support level), and paramedic specialist (specialist training as an intensive care paramedic (ICP) or extended care paramedic (ECP)). Paramedics operate under a protocol-based system with a high level of autonomy and with little on-scene medical consultation. Paramedic management of cases involving falls experienced by older people is guided by a "falls in the elderly" protocol (Supplement 1, available online), which provides a decision-assistance algorithm that supports paramedics in deciding how best to manage an older faller. Paramedics can recommend nontransport where strictly defined criteria are met following detailed history taking and patient assessment, although any patient requesting transport following discussion must be transported to an ED.

Dispatch of ambulance resources is managed by a computer-aided dispatch (CAD) system, in which incoming calls are categorised and prioritized using the Medical Priority Dispatch System (MPDS) and ProQA software (version 11.3) (Priority Dispatch, Salt Lake City, Utah, USA). Incidents are allocated a response priority of 1–9, with priority 1 and 2 calls constituting "emergency" responses. Priority 1 cases involve urgent, "lights and sirens" responses, while priority 2 cases receive nonurgent responses within locally defined time frames.

Study Population

The study population comprised people aged 65 years and older who received an emergency response and were confirmed to have fallen by paramedics at the scene. A *fall* was defined as "an event which results in a person coming to rest inadvertently on the ground, floor or lower level with or without loss of consciousness and other than as a consequence of sudden onset of paralysis, epileptic seizure or overwhelming external force."[12] An *emergency ambulance response* was defined as any response initiated through the emergency call system that was allocated a response priority of 1 (urgent) or 2 (nonurgent). Incidents allocated a response priority of 3–9 (cases that do not originate via the emergency call system including routine transports, operational standbys, medical appointments, and interhospital transfers) were excluded.

Data Sources

A fall-specific data collection tool was designed prior to the commencement of the study by an advisory group consisting of experts in the field of falls and balance, geriatrics, and prehospital care, using a consensus approach. This was necessary due to the fact that the routinely completed ambulance clinical record does not systematically capture fall-specific data at a detailed level. The paper-based form collected fall-specific information across 24 variables of interest detailing patient demographics, including co-morbidity and medication history, environment, previous falls and ambulance usage, fall circumstances, paramedic-diagnosed injury, and prehospital outcomes. In order to ensure its suitability for use in the field, the tool was piloted for one month prior to the commencement of data collection, with results assessed by the research team, and modifications made where required to promote consistency among data collectors. Data from this tool were merged with routinely collected clinical and dispatch information from the PCR and CAD databases.

Data Collection

Data were collected between October 1, 2010 and June 30, 2011. As participation in research is noncompulsory in the Ambulance Service of NSW, a statewide network of paramedics was established to collect data. An expression of interest was released to all paramedics in ASNSW during the 3 months preceding the data collection phase inviting them to participate in the study. By the commencement of the data collection period, 384 paramedics had agreed to participate, representing 13% of frontline operational paramedics. Paramedics received education with regard to the broad objectives and rationale of the study, but the specific research

questions upon which analyses would be based were withheld so as to reduce the potential of paramedics changing their clinical practice during the study period. Education was also provided detailing how to use the tool and the data collection requirements, including definitions of variables to increase consistency in completion.

Identification of eligible patients was determined by paramedics on scene, not during the dispatch process. After arriving on scene and determining the patient met the eligibility criteria, paramedics provided the standard level of acute care according to normal clinical practice and then obtained the additional information required for the purposes of the study. The completed fall-specific data form was then sent to the research team where it was scanned and entered into an electronic database using automated data entry software (Cardiff Teleform, Vista, CA).

Data Analysis

The fall-specific data were deterministically matched to the routinely collected clinical record and dispatch data using a unique clinical record number. Analysis was undertaken using SAS 9.2 (SAS Institute, Cary, NC, USA). Descriptive statistics were generated, using mean and standard deviation (SD) and median with interquartile range (IQR) for normal and non-normally distributed data, respectively. Differences in normally distributed independent continuous variables were assessed using Student's *t*-tests, and in non-normally distributed independent continuous variables using the Wilcoxon rank sum tests. Differences in proportions for dichotomous nominal variables were analyzed using chi-squared (χ^2) statistics. For independent ordinal group variables such as age group, the Mantel-Haenszel test for trend was used to compare more than two independent proportions. Differences for all analyses were considered statistically significant at $p < 0.05$. To enable categorical analyses of continuous variables, time of day was categorized into day (0700–1859) and night (1900–0659); response priority into urgent and nonurgent; and age into 3 groups (65–74; 75–84; 85+). Physiological status, based on vital signs, was categorized using established physiological parameters within this health system,[13] creating "normal" and "abnormal" categories Table 1). Time spent on the floor ("long-lies") was estimated by the patient or a witness if present.

Ethical Approval and Consent

A waiver of consent was granted by the Human Research Ethics Committee (HREC). Ethical approval was granted by the Sydney South West Area Health Service HREC (Protocol No. X10-0152 & HREC/10/RPAH/282).

TABLE 1. Criteria for classification of physiological status ("normal" versus "abnormal")[a]

Vital sign	Normal	Abnormal
Heart rate (beats/min)	>50 and <120	≤50 or ≥120
Respiratory rate (breaths/min)	>10 and <25	≤10 or ≥25
Systolic blood pressure (mmHg)	≥100 and <180	<100 or ≥180
SpO_2 (%)	>95	≤95
Level of consciousness (AVPU)	Alert	Not alert

[a]To be classified as "normal" physiology, all 5 vital signs must be within the specified normal parameters.
A, alert; V, responds to verbal stimuli; P, responds to painful stimuli only; U, unconscious; SpO_2, peripheral oxygen saturation.

Results

Over the 9 months of data collection, fall-specific forms for 1,720 cases were submitted. After exclusions, the final sample comprised 1,610 cases (Figure 1).

Operational Response Information

Operational characteristics of ambulance responses are detailed in Table 2. Metropolitan cases accounted for 60% of all responses. The dispatch software correctly categorized actual falls to the problem category of "falls" in 72% of cases, followed by "other" (9%) and "person on ground" (7%). Just over half of responses were prioritized as urgent. The distribution across time of day showed a peak for responses to falls midmorning between 0900 and 1000, and a low between 0100 and 0300 hours. There were no notable differences in volume of calls across the working week; cases peaked on Saturdays and were least common on Sundays. The overall nontransport rate was 28%, though there was evidence that nontransport rates differed according to operational characteristics (Table 1). The proportion of nontransports decreased as patient age group increased (trend $p = 0.01$). For those aged 65–74 years, the nontransport rate was 32%, decreasing to 30% then 24% for the 75–84 and ≥ 85 year age groups, respectively. Responses to community dwellings resulted in a higher proportion of nontransports compared to residential aged care facilities (RACF) (30 vs. 16%; $p < 0.0001$).

Patient Information

The demographic characteristics of the population are described in Table 3. The mean age was 83(8) with patients predominantly female (61%) and community dwelling (82%). Slightly more than half reported having fallen in the past year and there was a significant association between increased age and having suffered a fall in this time ($p = 0.002$). Forty-four percent (712) of fallers reported having never previously called an ambulance for a fall, while 248 (15%) had called an

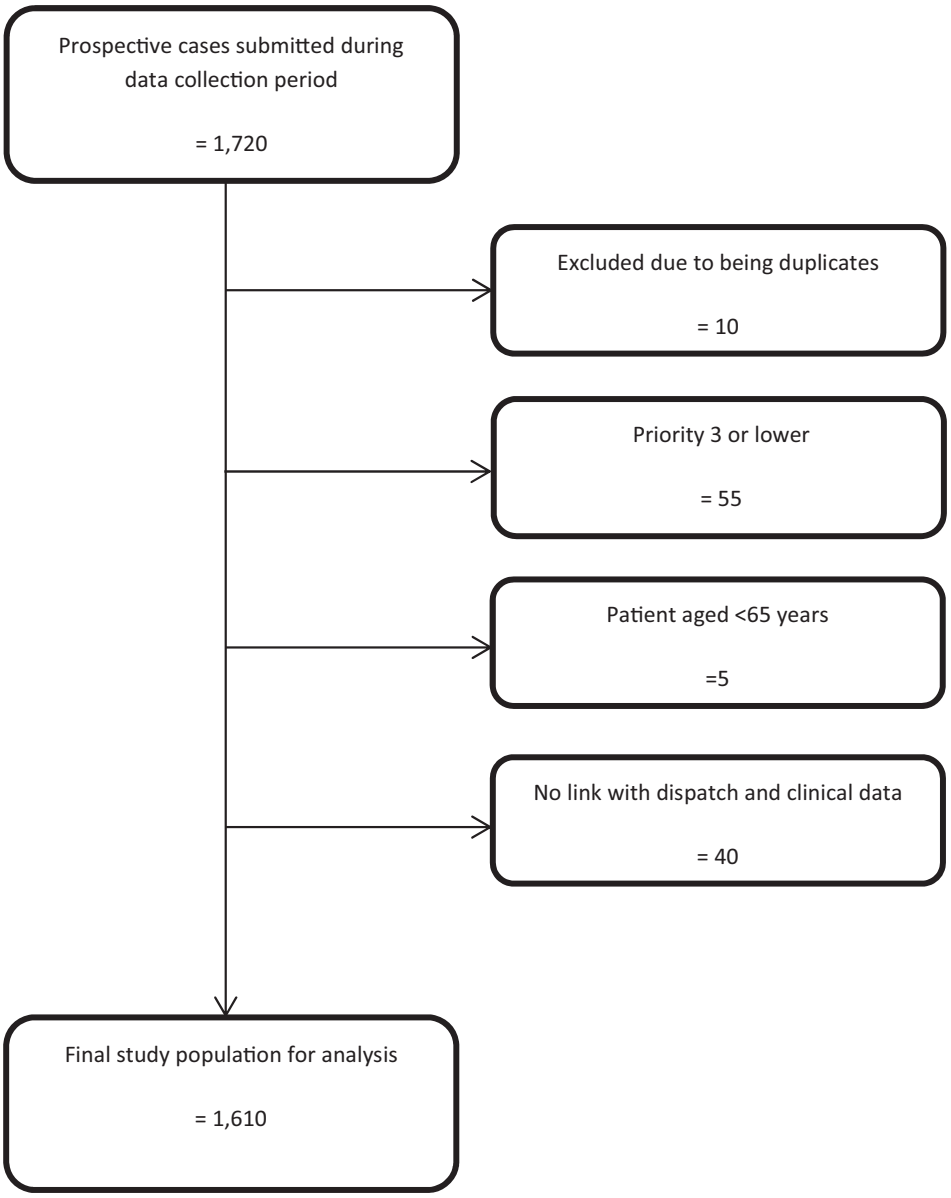

FIGURE 1. Derivation of study population.

ambulance for a fall within the past month. Anticoagulant medication was being taken by 527 (33%) of subjects, while 352 (22%) reported having a personal alarm.

Fall Information

Characteristics of the falls are described in Table 4. Two-thirds (1,018) occurred within a community dwelling setting, most commonly within the bedroom (23%) and living/dining room (20%). Eighty percent of falls (1,274/1,610) were from a standing height, followed by falls from bed and on stairs (each 7%). The patient was still on the floor when the ambulance arrived in 53% (849) of cases, and 13% experienced a "long-lie" (i.e., spending greater than 60 minutes on the ground or floor) The most common patient-reported reason for falling was "loss of balance" (30%), followed by a "trip" (25%); reasons for falling were significantly different across age groups ($p < 0.0001$) (Table 3). In particular, trips decreased and loss of balance increased as age group increased.

Injury Information

The physical presentation of patients is detailed in Table 5. Almost three-quarters of patients sustained a new injury or reported new pain, and 588 (41%) presented with abnormal physiology. Only 238 patients (15%) presented with no injury and normal physiology.

TABLE 2. Operational response characteristics of ambulance attendances to older people who have fallen

Operational variable	Value
Response time in minutes, median (IQR)	
All cases	15.0 (10.4–23.7)
Urgent (priority 1)	12.9 (9.3–17.3)
Nonurgent (priority 2)	19.7 (12.8–32.3)
Response priority, *n* (%)	
Urgent	860 (54)
Nonurgent	627 (39)
(missing)	*123 (8)*
Case cycle time[a] in minutes, median (IQR)	
All cases ($n = 1{,}610$)	79 (58–107)
Transported ($n = 1{,}127$)	90.2 (69.5–115.0)
Nontransported ($n = 430$)	53.5 (41.0–71.5)
Transport outcome, *n* (%) not transported to ED	
All cases ($n = 1{,}557$)	430 (28)
Time of day	
Dayshift (0700–1859)	308 (26)[b]
Nightshift (1900–0659)	122 (32)
(missing)	*0 (0)*
Time of week	
Weekday	327 (29)
Weekend	103 (25)
(missing)	*0 (0)*
Response priority	
Urgent (priority 1)	169 (20)[b]
Nonurgent (priority 2)	250 (40)
(missing)	*11 (15)*
Location of fall	
Community dwelling	325 (33)[b]
Street/footpath	34 (25)
Public area/club	42 (16)
RACF	42 (16)
(missing)	*9 (15)*

[a]Case cycle time = interval from time emergency call is booked through to time when the allocated resource is available to respond to a new incident.
[b]Statistically significant differences at $p < 0.05$.
RACF, residential aged care facility; IQR, interquartile range; ED, emergency department.

The most common anatomical location of injury was the head or face, accounting for 38% of injurious falls. Compared to women, males experienced more neck injuries (5 vs. 2%; $p < 0.05$) and arm/hand injuries (40 vs. 30%; $p < 0.05$). Hip injuries were suspected in 18% of injurious falls, with women experiencing significantly more hip injuries than men (20 vs. 16%; $p < 0.05$). The most common type of injury was a suspected fracture, present in 29% of falls in which an injury was reported.

Discussion

This study is the first to prospectively describe emergency responses to older people who have fallen from an operational, clinical, and patient perspective and provides information spanning the time from the initial ambulance dispatch to the end of the ambulance component of care. The operational findings reported in this study provide a detailed insight into the responsiveness of a large ambulance service to emergencies involving older people who have fallen. The service appears to provide timely responses that prevent long-lies despite 53% of the patients still being on the ground at the time of ambulance arrival, a proportion notably higher than the 8% reported in a retrospective Australian study.[14] The median response time of 15 minutes may have contributed to the majority of fallers avoiding long-lies and the associated deleterious effects, such as dehydration, pneumonia, pressure sores, and hypothermia.[15] Minimizing long-lies is an important component of prehospital care provision, as they represent potentially avoidable morbidity and mortality; spending greater than 60 minutes on the ground has been strongly associated with greater post-fall restriction in activities of daily living and increased mortality. Wild et al. found that 55% of older fallers who spent more than 60 minutes on the floor, regardless of whether or not they were injured, died within the following 6 months.[16]

A pattern of repeat ambulance attendance was identified within this cohort. Previous ambulance attendance following a fall was reported by 56% of patients overall, and in 61% of the patients aged 85 years or more. For all ages, 16% of these ambulance attendances were within the preceding 4 weeks. These findings are consistent with previous studies from the United Kingdom, the United States, and Australia.[7,8,17,18] While much of the focus on re-attendance has been on those fallers who were not transported and who have been shown to be at risk of further falls and poor health outcomes,[7–9] our study cohort included people who were transported to an ED. This group has also been shown to be at increased risk of future falls, and despite evidence to support intervention, many still do not receive guideline recommended care and may be discharged from an ED with a greater risk of subsequent falls.[5,19] Emerging research indicates that alternative models of care based around referral to community-based fall prevention initiatives capable of providing rapid assessment in the home can dramatically improve outcomes for nontransported older fallers.[20,21] How such programs perform when integrated into standard practice using existing health service infrastructure is unclear, though, and the willingness of paramedics to engage in referral of older fallers to such a program has recently been questioned.[22] Nonetheless, this type of highly responsive fall prevention initiative represents a supportive pathway for fallers refusing to travel to an ED as well as a non-ED alternative for those patients to whom nontransport is recommended following paramedic assessment.

Injurious falls were common, with 73% resulting in a new injury or acute pain; this figure is notably higher than the 54% previously reported in a retrospective study within the same ambulance service.[2] This difference may reflect the limitations of using retrospective routinely collected ambulance data for clinical

TABLE 3. Demographic characteristics of patients who fell and received an emergency ambulance response (overall and by transport outcome)

Patient demographic characteristics	All patients ($n = 1,610$)	Transported ($n = 1,127$)	Nontransported ($n = 430$)
Age, mean (SD)	83 (8)	83 (8)	81 (8)[a]
Age group, *n* (%)			
65–74 years	241 (15)	163 (68)	78 (32)[a]
75–84 years	556 (35)	389 (70)	167 (30)
≥85 years	677 (42)	514 (76)	163 (24)
(missing)	*136 (9)*	*61 (74)*	*22 (26)*
Sex, *n* (%)			
Female	975 (61)	719 (74)	256 (26)
Male	571 (36)	401 (70)	170 (30)
(missing)	*64 (4)*	*7 (64)*	*4 (26)*
Non-English-speaking background, *n* (%)			
Yes	185 (12)	141 (79)	38 (21)[a]
No	1,283 (80)	876 (71)	362 (29)
(missing)	*142 (9)*	*110 (79)*	*30 (21)*
Residential status, *n* (%)			
Community dwelling	1,325 (82)	898 (70)	385 (30)[a]
Residential aged care	266 (17)	214 (84)	42 (16)
(missing)	*19 (1)*	*15 (83)*	*3 (17)*
Ambulatory status, *n* (%)			
No walking aids	586 (36)	452 (80)	114 (20)[a]
Walking stick	328 (20)	225 (71)	92 (29)
Walking frame	546 (34)	345 (66)	182 (35)
Wheelchair	4 (<1)	3 (75)	1 (25)
Crutches	37 (2)	16 (46)	19 (54)
(*missing)*	*109 (7)*	*86 (80)*	*22 (20)*
Prescription medications, *n* (%)			
0–3 medications	444 (28)	306 (71)	124 (29)
4–7 medications	646 (40)	451 (73)	168 (27)
≥8 medications	350 (22)	245 (72)	97 (28)
(missing)	*170 (11)*	*125 (75)*	*41 (25)*
Anticoagulant medication, *n* (%)			
Yes	527 (33)	369 (72)	141 (28)
No	951 (59)	659 (72)	257 (28)
(missing)	*132 (8)*	*99 (76)*	*32 (24)*
Personal alarm system, *n* (%)			
Present	352 (22)	195 (58)	143 (42)[a]
Absent	1,191 (74)	878 (76)	274 (24)
(missing)	*67 (4)*	*54 (81)*	*13 (19)*
Falls in past 12 months, *n* (%)			
Yes	807 (50)	539 (70)	238 (30)[a]
No	673 (42)	489 (75)	161 (25)
(missing)	*130 (8)*	*99 (76)*	*31 (24)*
No. falls for those who fell in past 12 months, median (IQR)	2 (1–4)	2 (1–4)	3 (1–4)
Most recent emergency calls for falls, *n* (%)			
Never called for falls	712 (44)	526 (77)	160 (23)†
<7 days	75 (5)	52 (71)	21 (29)
1–2 weeks	87 (5)	55 (65)	30 (35)
3–4 weeks	86 (5)	41 (50)	41 (50)
>5 weeks	505 (31)	345 (71)	141 (29)
(missing)	*145 (9)*	*108 (75)*	*37 (26)*

[a]Statistically significant differences at $p < 0.05$.
SD, standard deviation; IQR, interquartile range.

information purposes. The injury types and anatomical locations reported in this study are broadly consistent with the existing literature.[23–25] The majority of patients presented with normal physiology, but only a small proportion (15%) presented with no new injury/pain and normal physiology. Most people (80%) with no new injury and normal physiology were not transported to an ED. These patients may be viewed as potentially suitable and safe for nontransport to an ED and referral to community fall prevention agencies.

This cohort produced an overall nontransport rate of 28%, which is consistent with the 26% previously reported in this ambulance service using retrospective data and within the range of 10–40% reported in the international literature.[2,8,26–29] There was substantial heterogeneity in transport disposition, with nontransport more likely at night, when the fall was in a public place, and when the faller was a community dwelling person. Falls in residents of RACFs resulted in the lowest nontransport rate, with almost 4 in every 5

TABLE 4. Characteristics of falls receiving an emergency ambulance response (by age group and sex)

Fall characteristic	All patients ($n = 1,610$)	Age groups			Sex	
		65–74 ($n = 241$)	75–84 ($n = 556$)	≥85 ($n = 677$)	Male ($n = 571$)	Female ($n = 975$)
Time spent on ground/floor in minutes, *n* (%)						
<5	400 (25)	79 (33)	138 (25)	149 (22)[a]	150 (26)	233 (24)
5–15	398 (25)	61 (25)	132 (24)	169 (25)	147 (26)	234 (24)
16–30	311 (19)	37 (15)	108 (19)	140 (20)	105 (18)	192 (20)
31–60	231 (14)	37 (15)	85 (15)	89 (13)	77 (14)	146 (15)
>60	202 (13)	17 (7)	69 (12)	101 (15)	61 (11)	135 (14)
(missing)	*68 (4)*	*10 (4)*	*24 (4)*	*29 (4)*	*31 (5)*	*35 (4)*
On ground at time of ambulance arrival, *n* (%)						
Yes	849 (53)	115 (48)	304 (55)	353 (52)	294 (52)	520 (53)
No	708 (44)	118 (49)	231 (42)	303 (45)	258 (45)	423 (43)
(missing)	*53 (3)*	*8 (3)*	*21 (4)*	*21 (3)*	*19 (3)*	*32 (3)*
Place of fall, *n* (%)						
Community dwelling	1,018 (66)	152 (63)	378 (68)	411 (61)	374 (66)	608 (62)[a]
Public area	122 (8)	30 (12)	42 (8)	36 (5)	50 (9)	67 (7)
Footpath/street	141 (9)	32 (13)	50 (9)	40 (6)	50 (9)	84 (9)
RACF	266 (17)	17 (7)	63 (11)	167 (25)	71 (12)	181 (19)
(missing)	*63 (4)*	*10 (14)*	*23 (4)*	*23 (4)*	*26 (5)*	*35 (4)*
Fall from, *n* (%)						
Same level/standing	1274 (80)	196 (81)	431 (78)	544 (80)[a]	436 (76)	790 (81)
Stairs/steps	105 (7)	19 (8)	45 (8)	30 (5)	38 (7)	62 (6)
Ladder	6 (<1)	2 (1)	4 (1)	0 (0)	5 (1)	1 (<1)
Bed	106 (7)	7 (3)	26 (5)	63 (10)	42 (7)	60 (6)
Chair	68 (4)	6 (3)	33 (6)	24 (4)	24 (4)	40 (4)
Other	16 (1)	3 (1)	5 (1)	4 (1)	10 (2)	4 (<1)
(missing)	*35 (2)*	*8 (3)*	*12 (2)*	*12 (2)*	*16 (3)*	*18 (2)*
Location in residence, *n* (%)						
Bedroom	369 (23)	34 (14)	107 (19)	199 (29)	126 (22)	230 (24)
Bathroom/toilet	178 (11)	17 (7)	69 (12)	81 (12)	54 (102)	120 (12)
Kitchen	154 (10)	21 (93)	56 (10)	64 (10)	54 (10)	93 (10)
Laundry	11 (1)	2 (1)	6 (1)	3 (1)	7 (1)	4 (<1)
Garden/yard	196 (12)	38 (16)	68 (12)	70 (10)	83 (15)	100 (10)
Living/dining room	323 (20)	54 (22)	111 (20)	136 (20)	111 (19)	201 (21)
Not applicable	379 (24)	75 (31)	139 (25)	124 (18)	136 (24)	227 (23)
Apparent reason for falling, *n* (%)						
Slip	161 (10)	35 (15)	55 (10)	48 (7)[a]	56 (10)	97 (10)
Trip	405 (25)	72 (30)	148 (27)	155 (23)	130 (23)	256 (27)
Dizziness	102 (6)	13 (5)	39 (7)	42 (6)	39 (7)	57 (6)
Loss of balance	476 (30)	58 (24)	160 (29)	225 (33)	169 (30)	291 (30)
Fall from bed	81 (5)	6 (3)	21 (4)	47 (7)	30 (5)	48 (5)
No recollection	136 (9)	9 (4)	46 (8)	72 (11)	39 (7)	92 (9)
Other	249 (16)	48 (20)	87 (16)	88 (13)	*108 (19)*	*134 (14)*

[a] Row percentages statistically significant difference at $p \leq 0.05$.
RACF, residential aged care facility.

fallers being transported. This is likely to reflect the medico-legal aspects of care in relation to falls in this environment as well as the fact that these people represent the frailest end of our older population and in whom significant injury is not always easy to identify. Further exploration of responses to older fallers in RACFs is recommended as this population could benefit from reducing unnecessary transports to an ED.[30]

In summary, traditional prehospital care models may not be well equipped to provide optimal care to older people following a fall. In the face of an aging population and growing demand,[31] ambulance services are encouraged to explore alternative models of prehospital care that may improve service delivery to older people who have fallen. Alternative paramedic models such as Extended Care Paramedics or Emergency Care Practitioners, currently operating in Australasia and the United Kingdom, respectively, appear to offer improved safety and outcomes for older fallers and are worthy of further investigation.[12,27–29,32,33] Evidence-based referral pathways for nontransported fallers should continue to be tested and, where effective, translation from research to practice advocated.

Development of clinical strategy or alternative, innovative models of care requires a clear and detailed understanding of the scope and nature of a clinical issue and the population impacted by it. Equally important, a clear understanding of existing service delivery is critical for identifying strengths and weaknesses in current clinical practice. This study provides such information, providing a solid epidemiological foundation that will be useful for informing development,

TABLE 5. Characteristics of injury and presenting physiology according to age group and sex

Injury and physiological characteristics	All patients ($n = 1,610$)	Age groups			Sex	
		65–74 years ($n = 241$)	75–84 years ($n = 556$)	≥85 years ($n = 677$)	Male ($n = 571$)	Female ($n = 975$)
Change in usual function post-fall, *n* (%)						
Yes	708 (44)	112 (47)	257 (46)	298 (44)	285 (50)	417 (43)
No	667 (41)	92 (38)	196 (35)	271 (40)	188 (33)	397 (41)
(missing)	*235 (15)*	*37 (15)*	*103 (19)*	*108 (16)*	*98 (17)*	161(17)
Presenting physiological status, *n* (%)						
Normal	840 (52)	127 (53)	299 (54)	361 (53)	317 (56)	521 (53)
Abnormal	656 (41)	97 (40)	214 (39)	277 (41)	221 (39)	381 (39)
(missing)	*114 (7)*	*17 (7)*	*43 (8)*	*39 (6)*	*33 (6)*	*73 (8)*
Injury/pain and normal physiology, *n* (%)						
No injury and normal physiology	238 (15)	32 (13)	95 (17)	93 (14	104 (18)	134 (14)
Injury & abnormal physiology	1,337 (83)	208 (86)	455 (82)	568 (84)	458 (80)	826 (85)
(missing)	*35 (2)*	*1 (<1)*	6(1)	*16 (2)*	*9 (2)*	*15 (2)*
New injury/pain sustained, *n* (%)						
Yes	1,172 (73)	182 (76)	384 (69)	509 (75)†	399 (70)	722 (74)
No	392 (24)	56 (23)	156 (28)	144 (21)	156 (27)	224 (23)
(missing)	*46 (3)*	*3 (1)*	*16 (3)*	*24 (4)*	*16 (3)*	*29 (3)*
Location of injury, *n* (%) patients with a new injury/pain for each age and sex group[a]						
Head/face	441 (38)	78 (43)	158 (41)	205 (40)	155 (39)	276 (38)
Neck	35 (3)	6 (3)	11 (3)	18 (4)	18 (5)	26 (2)[b]
Back	130 (11)	17 (9)	41 (11)	72 (14)	20 (5)	36 (5)
Chest	55 (5)	6 (3)	20 (5)	29 (7)	40 (10)	89 (12)
Pelvis	54 (5)	7 (4)	18 (5)	29 (6)	15 (4)	42 (6)
Arm/hand	372 (32)	55 (30)	134 (35)	183 (36)	159 (40)	219 (30)[b]
Hip	206 (18)	29 (16)	70 (18)	107 (21)	62 (16)	146 (20)[b]
Leg/foot	306 (26)	56 (31)	109 (28)	141 (28)	104 (26)	204 (28)
Type of injury, *n* (%) of patients with a new injury for each age and sex group[a]						
Bruise	292 (25)	40 (22)	109 (28)	143 (28)	87 (22)	203 (28)[b]
Skin tear/flap	256 (22)	28 (15)	80 (21)	148 (29)†	124 (31)	127 (18)[b]
Suspected fracture	340 (29)	61 (34)	123 (32)	156 (31)	91 (23)	251 (35)[b]
Abrasion	218 (19)	36 (20)	96 (25)	86 (17)	102 (26)	114 (16)[b]
Laceration	243 (21)	44 (24)	81 (21)	118 (23)	97 (24)	142 (20)
Pain only	290 (25)	49 (27)	100 (26)	141 (28)	88 (22)	210 (29)[b]

[a] Totals do not add to 100% as some patients had multiple injuries.
[b] Row percentages statistically significant difference at $p \leq 0.05$.

and subsequent evaluation, of contemporary clinical and operational policies designed to optimize EMS management of older people who have fallen.

LIMITATIONS

There are several limitations to this study. First, the nonconsecutive nature of the prospect cohort study from which this study population was extracted could introduce a risk of selection bias, which may affect the generalizability of the results. However, we believe that paramedics were just as likely to enroll a patient as they were not to enroll a patient, rather than being selective as to whom they chose. A consecutive patient enrollment was not feasible due to the statewide system in which the study was conducted, and the reliance on paramedics to volunteer to participate in the research. Based on earlier research, we estimate the size of the sample described in this study to represent approximately 5% of potentially eligible cases to which paramedics would have been dispatched during the 9-month data collection period. However, the demographics of the population in this study are similar to those reported in a previous population-based study in the same service,[2] suggesting that this group of patients may be broadly representative of the actual population from which they were drawn.

It is possible that awareness of the study could have impacted on paramedic behavior and clinical practice (Hawthorne effect), with evidence that this has been seen previously in the prehospital context.[34] Again, a comparison of the important variable of transport outcome in this study to that found in an earlier population-based retrospective study in the same service revealed a similar result, suggesting minimal impact on paramedic behavior arising from the observational study design.[2]

Missing data were evident in some fields despite a response to each field being mandatory, a common limitation associated with using a paper-based data collection tool. Similarly, missing data were evident in the routinely collected ambulance records, a

finding common in ambulance clinical records. Where present, missing data have been transparently reported and taken into account in the calculation of proportions.

The study consists predominantly of cases from metropolitan and large regional areas of NSW and the results may therefore be less applicable to smaller regional and remote areas. This metropolitan bias was unintentional and reflects the lower number of falls occurring in regional areas compared to metropolitan centers and also greater participation by metropolitan-based paramedics.

Finally, these data do not represent all months of the year, as we were constrained to a 9-month data collection period for funding and logistical reasons. It is possible that falls that occurred during late winter or early spring may differ in characteristics from those collected for this study, but again, based on previous research, it is unlikely that inclusion of such cases would have substantially altered the characteristics of the study population.[2]

Conclusion

In this large metropolitan ambulance service, "long-lies" are relatively uncommon for older people who have fallen. More than one-quarter of patients were not transported to an ED, and repeat use of ambulance resources appears to be common. Opportunities exist to explore alternate pathways and models of care that maximize outcomes for nontransport patients as well as improve operational efficiency of the ambulance service.

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SUPPLEMENTARY MATERIAL AVAILABLE ONLINE

Supplement 1: Falls in the Elderly

Supplemental material can be viewed and dowloaded at http://informahealthcare.com/pec.