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## ORIGINAL RESEARCH

### Personal alarm use to call the ambulance after a fall in older people: characteristics of clients and falls

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#### Abstract

##### Objectives

To examine differences in fall characteristics and emergency service response to older fallers ( $\geq 65$  years of age), considering their use, or not, of a personal alarm.

##### Methods

A retrospective one month audit of South Australian Ambulance Service records was conducted. Characteristics of ambulance call-outs for falls or alarm activations were described (Sample 1). Alarm-activated services for older fallers were matched (by day and type of service) with fallers who did not use a personal alarm (Sample 2).

##### Results

In Sample 1, 379 of 1700 callers used a personal alarm to call the ambulance, although 58% these alarm-activated calls were false alarms (neither lift nor hospital transport service provided). From Sample 2, most alarm calls were made by females (72%) alone at the time of fall (78%). Ambulance response time did not differ between alarm (median=11 mins) and non-alarm users (median=14 minutes,  $p=0.56$ ). The difference reflects a clinically non-critical difference in non-life threatening cases. 82% of alarm users and 75% of non-alarm users were on the ground when the ambulance arrived. Of non-alarm users, 11 were self-reported 'long lies' (>one hour) before the ambulance was called, and there were 13 other cases with unknown time on the floor. This compared with 11 self-reported long lies in alarm users.

##### Conclusion

Older women living alone were the major users of personal alarms for assistance after falling. If activated quickly, alarms enabled most fallers to gain ambulance attention within 15 minutes. However, personal alarm use was also associated with a high incidence of false alarms.

**Keywords:** ambulance service, falls; older people; personal alarm

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## **Background**

Falls are frequent in older people, and costly to individuals, health care systems and human services.<sup>1-4</sup> For older people living alone at home, the fear of falling and subsequent inability to gain help may be associated with activity restriction and functional decline.<sup>5</sup> Lying on the floor after a fall for an extended period of time has been associated with serious injury, hospital admission, and change of living arrangements into long term care in a prospective cohort study of people over the age of 90 years.<sup>6</sup> In the same cohort, a 'long lie' after a fall (i.e. more than a hour) was reported in 30% of fallers.

Personal alarm devices have been reported as a reliable way of assisting older people to obtain help in a timely manner after a fall.<sup>7,8</sup> Alarms are usually worn as a pendant or bracelet, and work reliably in the range of the home telephone, in the house and garden. Alarms generally operate in two ways; when activated they place a direct call to ambulance services, or they place a call to a prioritised list of nominated intermediaries (alarm provider, family members) who then may attend the older person themselves or alert ambulance services if required.

Ambulance services are integral to the safety and independence of many older people who are living independently in the community. After being alerted to a fall, ambulance services provide different levels of assistance to older people, such as a lift to upright position, attention to minor injuries and advice about seeking medical assistance, or in the event of severe injury, injury stabilisation followed by transport to hospital. Awareness of the role of ambulance services in identification of people at risk of further falls is also developing.<sup>9</sup>

However, there is little data on the interactions between personal alarm device use and ambulance services in the attendance of people who require emergency assistance after a fall. Therefore, the aim of this study was to investigate alarm use and ambulance service provision to people who called the ambulance after a fall, either with or without the use of a personal alarm device. The primary question of this research was: What are the characteristics of older fallers, and fall outcomes, for those who used a personal alarm to call the ambulance, compared with those who did not? To set these findings in the broader context of ambulance service, a secondary research question was: What are the patterns of personal alarm use and ambulance service to people requiring emergency assistance after a fall?

## **Methods**

A retrospective audit of South Australian Ambulance Service (SAAS) case-cards and radio-call room records was conducted. A convenience sample period of one month (January 2009) was chosen. Two samples of interest were identified:

Sample 1: This sample was obtained from database files provided by SAAS and included all case-cards (i.e. included clients of all ages) for the period 2 -31 January 2009 that were coded as "falls" or "alarm activations" or "alert button activation error". The purpose of this sample was to determine the scope of ambulance call-outs for all falls and alarm activations during the sample month.

Sample 2: From the initial sample (all calls coded as a "fall" between 2/1/2009 and 31/1/2009), but now excluding alarm activation error, all clients  $\geq 65$  years of age who used a personal alarm to call the ambulance were identified. These cases were then matched by date

of service, ambulance action (i.e. transport to hospital or lift only) and age with clients who did not use an alarm. The purpose of this sampling was to examine groups of older fallers who were similar in all aspects, except for use of a personal alarm or not.

A purpose-built data extraction file was used to record de-identified information extracted from each falls case in Sample 2 for:

- *demographics*: age, gender
- *service details*: date, type of service, response time
- *fall details*: mechanism, location, other persons present, location of person when ambulance arrived, reported injury from fall
- *ambulance contact details*: alarm use, who called ambulance
- *fall risk factors*: medical conditions, medications, cognitive status, balance/mobility issues, continence, falls history, visual/sensory problems, environmental factors.

For Sample 1, descriptive analysis was used to report the total number and percentages of alarm activation versus non-alarm activation calls. For each category (alarm versus non-alarm activation), the percentages requiring different types of ambulance service (lift, transport to hospital, other) were reported. In Sample 2, descriptive analysis was used to report characteristics of falls and fallers, and then to compare the findings for fallers who did and did not use an alarm to call for help. The significance of between-group differences was determined by t-tests (continuous variables) or chi-squared tests (categorical variables), or non-parametric equivalents where data was not normally distributed. Significance was established at  $p < 0.05$ .

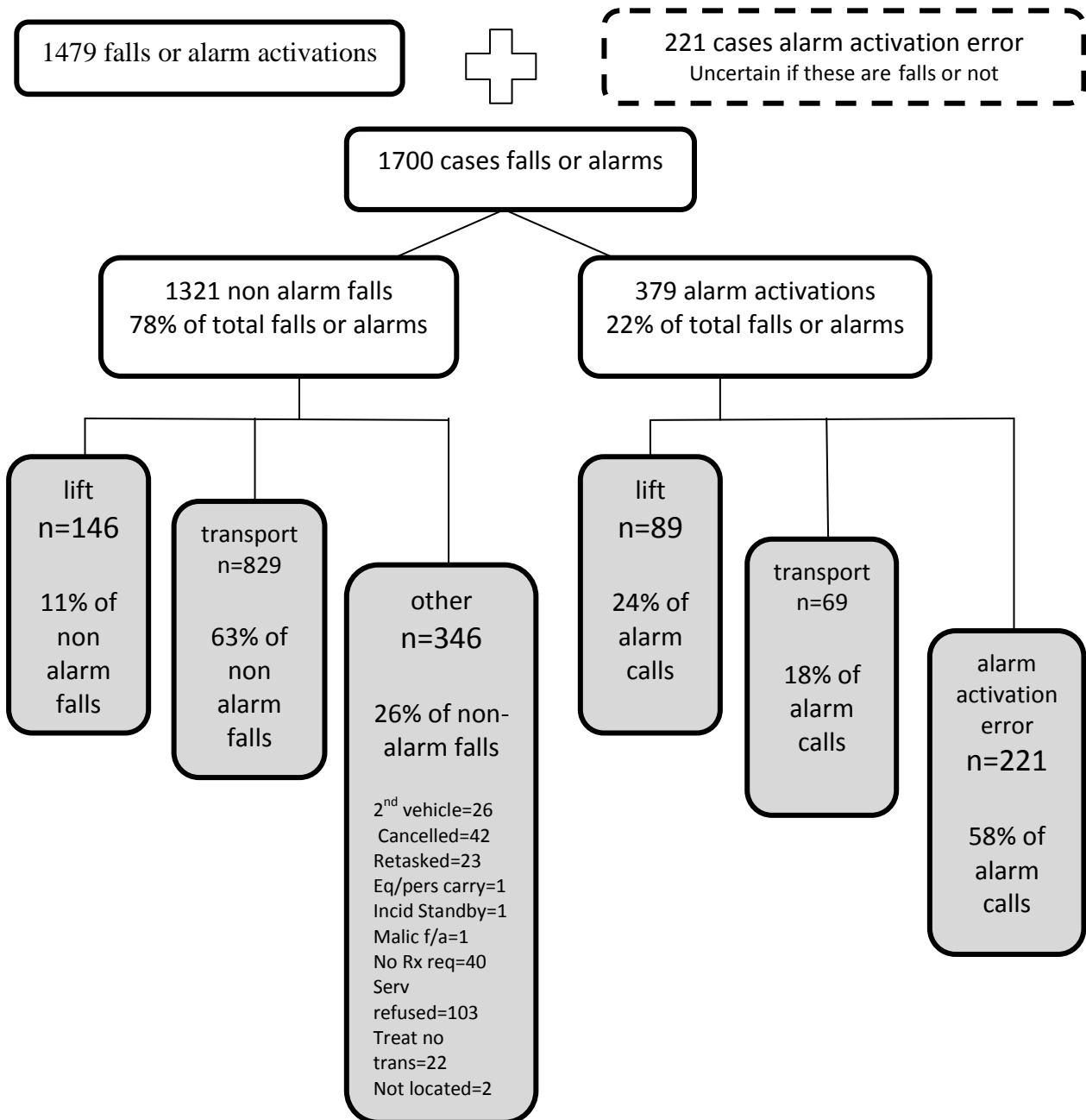
Ethics approval for the conduct of this study was provided by the Human Research and Ethics Committees of the Health Department of South Australia, and the University of South Australia.

## **Results**

### *Sample 1: Overview of falls and alarm activations*

The sample consisted of 1700 cases of which 1479 were for falls (including 124 fallers who used a personal alarm to call the ambulance), and 221 cases of 'alert button activation error' (Figure 1). Alert button activation error codes were allocated when individuals activated a personal alarm, an ambulance was dispatched, but at the time of ambulance attendance the individual did not require either a lift, or transport to hospital.

**Figure 1.** Summary of ambulance service outcomes for falls, alarm activation, or alarm activation error January 2009 (Sample 1 data)



**Figure 1 legend:** Eq/pers carry=ambulance required to carry extra equipment /personnel; incid standby = incident standby; malic f/a=malicious false alarm; no Rx required=no treatment required; serv refused=service refused; treat no trans=treatment but no transport provided; went by other=went by other means of transport to health care provider.

**Sample 2: Older fallers who did/did not use personal alarm to call the ambulance: matched sample**

The primary cases of interest were all clients  $\geq 65$  years of age who used a personal alarm to call the ambulance (n=124) and these cases were matched by date of service, ambulance action and age with clients who did not use an alarm (n=144). Older fallers who used a personal alarm to contact the ambulance and required a lift or transport made up 7% of all calls (for all falls or alarm activations) during the sample month (124/1700).

Demographics, fall location, presence of others at time of fall, and details of who called the ambulance are described for alarm users and the matched sample in Table 1. Alarm users were more likely to be female, while the non-alarm fallers had non-significant differences between males (42%) and females (58%). The most common specific locations for falls (groups combined) were inside the house (room unspecified, 74/268 = 28% of all falls), bedroom (69/268 = 26%), garden/backyard (43/268 = 16%) and bathroom/toilet (29/268 = 11%).

**Table 1.** Characteristics of fallers, falls and contact with ambulance service for personal alarm users and non-alarm users.

	alarm users n=124	matched sample of non-alarm users (by age, date and type of ambulance service) n=144
	frequency (%)	frequency(%)
females	89 (72)	84(58)*
fall location		
home	121(98)	100(70)*
residential care facility	1(1)	32(22)
public place	0	12(8)
not recorded	2(1)	0
alone at time of fall		
yes	97(78)	64(44)*
no	27(22)	79(55)
unknown	0	1(1)
ambulance called by		
self	115(93)	21(15)*
family	5(4)	66(46)
health care staff/carers	2(1.5)	41(28)
other	2(1.5)	16(11)

\*difference between alarm and non alarm users  $p < .001$

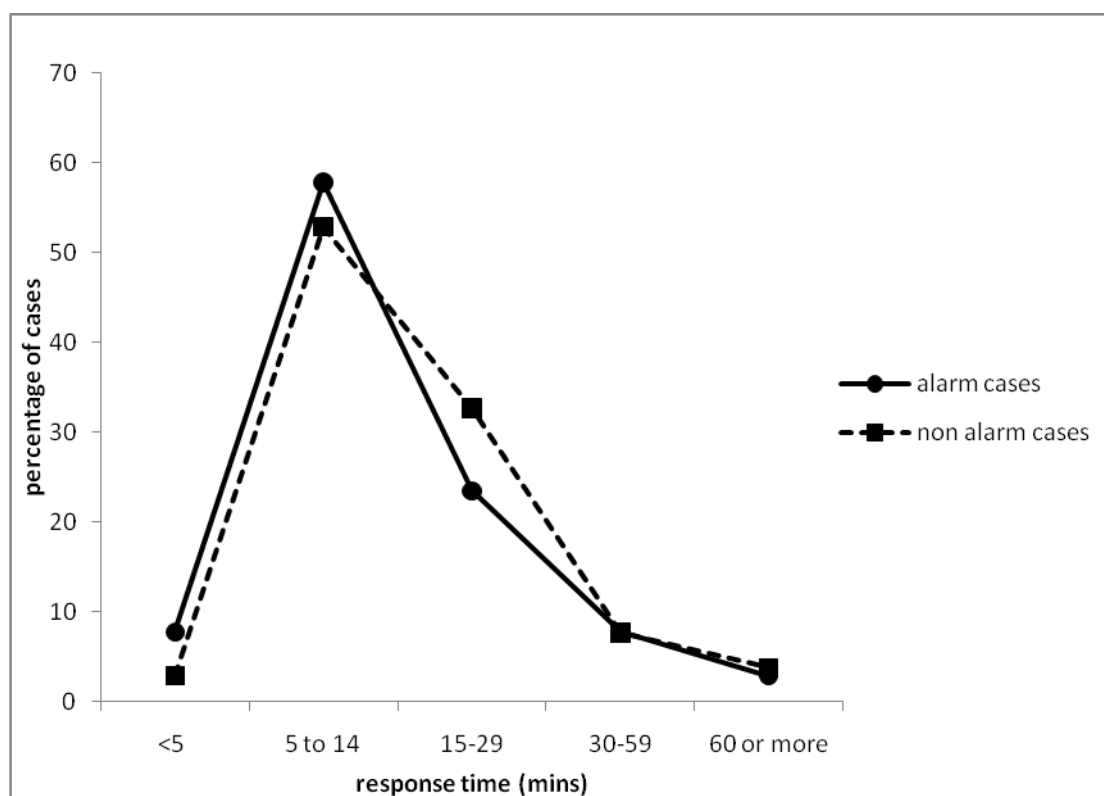
Forty-four percent (64/144) of the non-alarm users were alone at the time of the fall. Here “alone” included being found on the floor by family, carers or facility staff who were present in the same location, but not immediately “with” the person at the time of the fall. Eight percent of non-alarm client falls occurred in public places including cinemas, shopping centres and footpaths.

Twenty-two percent of falls in non-alarm clients occurred at residential care facilities. Staff initiated all ambulance calls for fallers in aged care facilities. Most of these fallers required transport to hospital (25/32 = 78%), with the remainder requiring a lift only. Co-existing mental health conditions were reported for over 60% of these fallers, including dementia/confusion in 50% (n=16), and depression or anxiety in 12.5% (n=4).

A subset of 22 clients without alarms (15% of those without alarms) called the ambulance themselves. Three other clients without alarms were alone at the time of the fall and unable to gain assistance: one was found after a long delay, one other called to neighbours and gained help that way, and one was found by a visiting family member.

In this sample 78% of clients (210/268) were still on the floor when the ambulance arrived. For most of these 210 clients (n=102 alarm users, n=108 non-alarm users), help had arrived within 15 minutes of contacting the service (66% of alarm calls, 56% of non-alarm calls) (Figure 2). Twenty-four percent of alarm calls, and 33% of non alarm calls received help between 15 and 30 minutes after their call. Very few cases waited longer than one hour (3% of alarm calls, 4% non-alarm calls). Response time was not significantly different between fallers who used a personal alarm (median=11 mins, 25<sup>th</sup> to 75<sup>th</sup> centile 7-17 mins) and fallers who did not (median=14 mins, 25<sup>th</sup> to 75<sup>th</sup> centile 9-20mins) ( $p=0.56$ ).

**Figure 2:** Response times for ambulance attendance to older fallers



However, this data provides no information about the length of time the faller waited prior to making contact with emergency services, and hence the real incidence of long lies cannot be determined from this data alone.

In 22 cases (10.5% of all fallers still on the ground when the ambulance arrived, 8.2% of entire sample) clients reported they had been on the floor for over an hour before they were able to make contact with the ambulance service. While this provides an estimate of the incidence of long lies, the accuracy of the data depends on faller recall, which may be influenced by fall severity and state of consciousness. In this matched sample the incidence

of self-reported long lies was essentially the same amongst those who did and did not have a personal alarm. Eleven clients who used an alarm to call the ambulance reported a long lie, and time on the floor was unknown in a further two cases. Similarly, 11 self-reported cases of long lies occurred amongst people who did not have an alarm, with an additional 13 cases where time on the floor prior to ambulance contact was unknown.

## **Discussion**

This research provides insight into one month's consecutive activity of a State Ambulance service, regarding the assistance provided to older people after a fall, and the use of personal alarm systems in gaining emergency help.

During the one month period, 124 older South Australians used a personal alarm to summon ambulance help in relation to a fall. Of these people, 82% were still on the floor when the ambulance arrived. Rapid ambulance response meant that most received help within 15 minutes. For these clients, the use of a personal alarm avoided a long period on the floor, and subsequent physical and psychological injury, as no-one else was at home to assist them.

However, this study also identified inefficiencies associated with personal alarm use and emergency service response, associated with the difficulty of differentiating false alarms from genuine calls. Emergency service data in this sample demonstrated a high number of occasions where the ambulance was dispatched, but neither a "lift" nor a "transport to hospital" service was subsequently required. In the overview of January 2009 data, an average of 7 dispatches per day (alarm activated) and 12 dispatches per day (non-alarm activated) came into this "false alarm" category. Strategies to address the high costs associated with false alarms may include greater use of single responder emergency vehicles, or personal response systems with greater intermediary assistance prior to ambulance call-out.

Having a personal alarm did not always protect the faller from a 'long lie'. A high incidence of self-reported 'long lies' occurred in both alarm and non-alarm users in this sample, although a greater number of cases where time on the floor was unknown occurred amongst those with no alarms. Reasons for ineffective alarm use could not be explored in this quantitative study. However, interviews with older fallers report ineffective alarm use due to the device being out of reach at the time of the fall, thinking the alarm would not work because they were outside, or not wanting to activate it for fear of perceived consequences, or being a burden to others.<sup>10</sup> This is supported by the findings of Fleming and Brayne<sup>6</sup> who found that of 141 fallers who had an alarm, were alone at the time of falling and couldn't get up, 113 of them did not activate their alarm. Of these 141 fallers, 38 had 'long lies', only one of which did not have an alarm to activate. Fleming and Brayne<sup>6, p.1</sup> discussed 'the complexity of issues around the use of call alarms, including perceptions of irrelevance, concerns about independence, and practical difficulties'.

Many older fallers with no alarm had someone else present at the time of the fall, who contacted emergency services. However, fifteen percent of non-alarm users needed to gain assistance themselves. This subgroup could possibly benefit from an alarm. Further prospective research on personal alarm use is needed to determine the characteristics of effective and ineffective alarm users. Cost-benefit analysis of personal alarms should include client and carer outcomes, health care utilisation and harm from falls.

This audit identified 32 calls in a one month period for ambulance assistance after falls in residential care facilities. The serious nature of these falls (requiring transport to hospital), and associated comorbidities (e.g. cognitive decline), are consistent with previous studies.<sup>11</sup> This incidental finding suggests that unwitnessed and other falls in residential care facilities require further exploration of both care staff prevention and management, and ambulance service response.

During the sample analysis month, 235 calls for falls or alarm activations were met with a “lift only” service. These clients represent a high risk group in whom referral to community falls prevention services may be indicated. A London-based study of older fallers found that those who had been attended by the ambulance, but not conveyed to hospital, had an increased risk of mortality or hospital admission compared with the general population, and 47% of this group made at least one further emergency call in the following two weeks.<sup>9</sup> Strategies to assist paramedics to assess and plan care for older people who have fallen are now being evaluated.<sup>12</sup> A falls prevention intervention in older fallers who had called the ambulance but not been transported to hospital, demonstrated reduced fall rate and ambulance use in the following year, compared with controls.<sup>13</sup> These studies indicate the growing evidence-base describing the roles of emergency services in the primary and secondary prevention of falls amongst older people.

### **Conclusion**

This analysis of ambulance data for one month of call-outs to older fallers highlighted that a personal alarm is not a solution to falling, nor in some instances, to ‘long lies’. Clearly personal alarms can help older fallers who live alone to gain assistance, but only when the alarms are accepted, understood, and used effectively. The benefits of personal alarm use to quality of life and harm minimisation may be substantial in older people at risk of falling who live alone. However, this audit has also highlighted the significant current cost of unnecessary ambulance call-outs in relation to alarm activation. Personal alarm use and the interaction with emergency services require further exploration as part of the continuum for preventing falls and harm from falls in older people.

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