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Brief Report

# Profile differences of purchasers, non-purchasers, and users and non-users of Personal Emergency Response Systems: Results of a prospective cohort study

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ABSTRACT

*Background:* 'Personal Emergency Response Systems' (PERS) can provide a solution for raising the alert after a fall but no criteria are available to enable us to estimate whether a population which is set to benefit from a PERS will be able to use the device.
*Objective:* To describe the profile differences of purchasers and non-purchasers of a PERS and to explore the population of users and non-users of these devices.
*Methods:* The study was part of an observational cohort survey of elderly fallers which took place in the emergency department of our University urban hospital.
*Results:* 413 patients were included. 115 of them were purchasers of a PERS, presented a lower index of independence in daily activities, greater fall history and a tendency to live alone. Only 18 purchasers used their PERS to alert and they were significantly more likely to live alone, showed a trend to be younger and less demented. This subgroup spent less time on the ground and with a lower 6-months mortality.
*Conclusions:* The subjects who had and had not purchased a PERS presented no significant differences in terms of time on the ground or consequences. However it was more relevant to focus on the users and non-users of those PERS to isolate a frailer population. Indeed the consequences of falls were more devastating in the group of purchasers who had not used their device to alert. This group may benefit the most from new generations of PERS which do not require control by the subject.


Even when uninjured, about half of the elderly subjects who suffer a fall are unable to get up without help[1] and it is well known now that lying on the floor for over an hour is strongly associated with serious injuries, hospital admission, and subsequent transfer into long term care.[2] To avoid such devastating consequences, a complete dedicated monitoring field is emerging, notably 'Personal Emergency Response Systems' (PERS) that can be used to provide an alert in the case of a fall. But these technologically refined products are not necessarily the right solution in all situations and all users. Indeed, even if many of these promising experimental devices designed to detect falls, have given the proof of their efficacy in experimental situations, reliable results with no false alarms are rarely observed when it comes to their use in real-life. It has also to be recognised that the population which is set to benefit from PERS is more often defined as 'purchasers' rather than with criteria enabling an estimation of whether or not they will be able to use the device to raise an alarm in the case of a fall. These two goals result in inconsistencies in the literature regarding the effectiveness of many PERS.[3] And ultimately, notwithstanding the steady growth of research in this field, no reliable fall detection system is currently on the market and the claimed performance of PERSs is not forthcoming.

The objectives of this study were to describe the different profiles of non-purchasers and purchasers of PERS, explore more precisely the population of users versus non-users of these devices in order to identify the frailest population and to identify the challenges and issues surrounding their safety.

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## Methods

### Study design

The study was part of an observational, prospective, single-centre, community-based cohort survey that evaluated the 6-month outcome of elderly fallers who subsequently visited the emergency department (ED) of our tertiary teaching hospital in Paris, France.[4] Here we present subgroups analysis concerning factors that characterise non-purchasers, purchasers - users or non-users of PERS.

### Recruitment

The survey, which ran from January to December, 2006 included 433 patients aged 75 years or more who fell at home, in ancillary structures (stairs, corridors, entrance halls, lifts etc.), or in nursing-homes and were subsequently referred to the ED.

### Data collection

At enrolment, oral informed consent was obtained from participants or their surrogates when applicable. A standardized interview was made by the attending physician and assistant investigators from the patient, his/her relatives, the ambulance staff and paramedics when necessary. A pre-filled questionnaire included Data collected were biographical, social and economic data, independence by the Katz Index of Independence in Activities of Daily Living[5]; interview on mental status, pre-existing medical history, circumstances and details about the fall and immediate and short-term consequences of the fall. Details about whether or not subjects had purchased a PERS and if the device had led to the discovery of the fall or not, were specifically reported.

A 6-month follow-up by phone allowed us to obtain details about the health status of the subject. The study did not interfere with the usual procedures of care delivered to the patient.

### Statistical analysis

Continuous variables were expressed as mean (SD) or median (interquartile range), and qualitative variables as percentages. Characteristics of the study population were compared using $Chi^2$ or Fisher's Exact test for qualitative variables and the Wilcoxon test for continuous variables. Significance was assumed at $p < 0.05$. The StatView software suite version 5.0.1 (SAS Inc. Cary, NC, USA) was used for analyses.

## Results

Information about whether subjects were purchasers of a PERS was missing for 18 patients of the 433 patients corresponding to the inclusion criteria. Two additional patients were lost at follow-up. Finally 413 patients were eligible for statistical analysis. The flow-chart of the population included in this subgroups analysis is presented on Fig. 1. Subjects' age ranged from 79 to 102 years (mean = 86.2 (6.2)) and 319 (77.2%) were women. Two hundred and forty eight (60%) were living alone at home and the majority had no dependency with a mean Katz index of 4.9 (1.7). Less than a quarter of the population (55 subjects) had a diagnosis of dementia and 268 (64.9%) a history of fall in the previous year. At inclusion, 35.6% of falls were intrinsic, i.e. resulting from a medical disorder. The mean time spent on the ground was 4.1 (9.7) hours, ranged from 15 min to 75 h. Immediate consequences were fractures for 160 (38.7%) patients, post fall syndrome for 6 (1.5%) patients and metabolic abnormalities for 58 (14%) patients. After their ED visit,

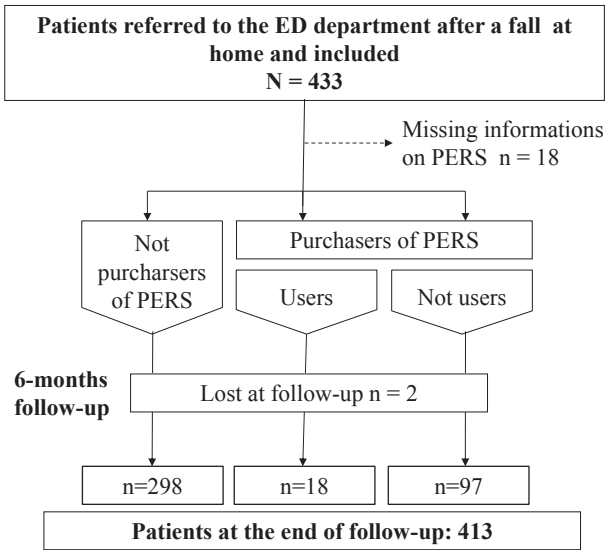


**Fig. 1.** Flowchart of the patients included in the study.

patients were admitted or discharged in a similar ratio and at 6-months, 56 were deceased (13.6%).

For the whole population, 115 (27.8%) were purchasers of a PERS and 298 (72.2%) were not.

Table 1 represents the characteristics of the population and the consequences of the fall in the two groups with or without PERS. The purchasers group were mainly females (88.7% versus 72.8%), showed a significantly lower Katz index of autonomy (4.1 (1.7) versus 5.2 (1.5); $p < 0.001$), a higher percentage of fall history (73.9% versus 61.4%; $p < 0.05$) and a greater tendency to live alone (Respectively 67% and 57%).

Only 18 purchasers (16%) used their PERS to alert. This group was significantly more likely to be living alone (88.9% versus 62.9% $p < 0.03$) and showed a trend to be younger (Respectively 86.5 (5.8) and 89.2 (5.6) years) and less demented (5.6% versus 16.5%). Their time spent on the ground was shorter (Respectively 2.2 (2.8) and 3.0 (7.6) hours) and fewer of them were deceased at 6-months (5.6% vs 15.5%). Table 2 summarises these data.

## Discussion

In our study, it appears that both subjects who had, and those that had not purchased a PERS presented many similarities: they

**Table 1**
Population characteristics and fall consequences in the purchaser and non-purchaser groups.

| | Purchaser | Non-purchaser | *p* |
|---|---|---|---|
| N (%) | 115 (27.8) | 298 (72.2) | |
| Age Mean (SD) | 87.8 (5.7) | 85.2 (6.2) | 0.3 |
| Gender (Female) n (%) | 102 (88.7) | 217 (72.8) | 0.001 |
| Katz index Mean (SD) | 4.1 (1.7) | 5.2 (1.5) | 0.001 |
| Alone at home n (%) | 77 (67) | 171 (57) | 0.09 |
| Diagnosis of dementia n (%) | 17 (14.8) | 38 (12.8) | 0.5 |
| Fall history n (%) | 85 (73.9) | 183 (61.4) | 0.05 |
| Extrinsic cause of fall n (%) | 71 (61.7) | 195 (65.4) | 0.5 |
| Hours on the ground Mean (SD) | 2.9 (6.9) | 5.2 (14.9) | 0.1 |
| Fracture n (%) | 44 (38.3) | 116 (38.9) | 0.3 |
| Metabolic consequences n (%) | 12 (10.4) | 46 (15.4) | 0.1 |
| Post-fall syndrome n (%) | 2 (1.7) | 4 (1.3) | 0.5 |
| Returned home after ED n (%) | 61 (53) | 144 (48.3) | 0.3 |
| Death at 6-months n (%) | 16 (13.9) | 41 (13.8) | 0.9 |