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White Paper

Reasons patients are using Personal Emergency Response Services... **and it's not just falls**

White Paper by Partners Connected Health and Philips Lifeline

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Executive summary

Individuals in the United States are living longer than ever before: a person aged 65 years can expect to live another 19.3 years on average.[1] As we age, the risk of developing chronic conditions increases. Therefore, aging care should include carefully managing multiple chronic conditions in order for seniors to remain independent.

A Personal Emergency Response Service (PERS) enables older adults to get the help they need in an emergency situation, such as a sudden worsening of a chronic condition, or a fall or other injury.[2] Often, a PERS service is used to signal for help to prevent further injury due to lying on the floor for an extended time after experiencing a fall.[3] While fall management is an important aspect of PERS, other acute emergency situations may also occur (e.g., worsening chronic conditions). Therefore, we hypothesize that PERS can benefit those with chronic diseases in addition to serving as a fall notification service.

This retrospective analysis of medical records and PERS utilization data of older PERS users found that 80% of them enrolled in the service shortly after a physician, emergency department or hospital visit. In 35% of users, an emergency hospital stay preceded PERS enrollment. Chronic conditions were the principal reason for more than 50% of those visits, while fractures accounted for only 12%. While on the service, PERS users requested 380 ambulance transports per 1,000 users annually. In nearly half of these transports, the primary reason was classified as a "physical or psychological symptom," and in fewer than a quarter a fall or fracture was recorded.

The principal diagnoses for unplanned hospital admissions after the transports included chronic conditions (congestive heart failure [CHF] and chronic obstructive pulmonary disease [COPD]), as well as infectious diseases (urinary tract infection, pneumonia and septicemia).

This analysis showed that PERS is broadly used to signal for help in situations that are often related to underlying chronic conditions. While PERS are traditionally associated with services for seniors signaling for help in case of a fall, this study indicates that patients with chronic conditions often may benefit from PERS.

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Introduction

Rise in chronic conditions

People can expect to live longer than ever before. It is estimated that the number of Americans aged 65 and older is projected to more than double from 46 million today to over 98 million by 2060, and the 65-and-older age group's share of the total population will rise to nearly 24% from 15%.[4] Older people are disproportionally affected by chronic diseases such as diabetes, hypertension, arthritis and heart diseases. In fact, about 70% of individuals aged 65 years and above have two or more chronic conditions, and this increases to more than 80% of older people aged 85 and above.[5] Several chronic conditions, including hypertension, arthritis, heart disease, dementia, stroke, incontinence and Parkinson's disease are associated with increased fall incidence.[6] Furthermore, the prevalence of falling increases with the number of co-morbid chronic diseases.[7] A study from Philips Lifeline, *Chronic conditions and the high risk of falling,* has indicated that falls by older people with chronic diseases more often lead to ambulance transport to the hospital than is the case for individuals without such conditions.[8] Other studies have demonstrated a link between chronic diseases and higher overall rates of emergency department (ED) visits as well.[9]

In fact, about 70% of individuals aged 65 years and older have two or more chronic conditions, and this increases to more than 80% of elderly aged 85 and older.

In an analysis of ED visits in 2009 in the US, there were nearly 20 million visits in persons aged 65 years and over, which translates to more than 500 ED visits per 1,000 persons per year.[10] This risk of ED visits increases with age: in the population aged 85 years and over, the visit rate was well over 800 per 1,000 persons per year.[10] While falls and injuries are the cause of emergency room visits in nearly 30% of cases,[10] other common symptoms reported by older patients in the ER are chest pain and shortness of breath—both potential indicators of heart disease.[11] Other common causes of ED visits for older patients—besides heart attacks and falls—include strokes, chronic obstructive pulmonary disease, pneumonia, abdominal pain, urinary tract infections (UTIs) and adverse drug reactions.[12–14]

Medical conditions such as asthma, UTIs and complications of diabetes are considered ambulatory care sensitive conditions (ACSCs). Primary or preventive healthcare can reduce the need for visits and inpatient hospitalization related to ACSCs. The rate of potentially preventable ED visits for ACSCs not resulting in hospital admission increased from 2008 – 2012 nearly 1.5 times more than the overall rate of treat-and-release visits.[15] It has been suggested that availability and appropriate use of community-based primary care could avoid ED visits for ACSCs.[16]

Emergency room visits are not only discomforting for an individual and their families, but are also costly. In 2009, the total cost of ED visits for persons aged 65 – 90 was $15 billion, averaging $1,306 per visit.[17] However, it does not stop there. With increasing age, the chances that an ED visit will also result in subsequent hospital admission also increases, resulting in additional healthcare costs. For example, in 2006, the average length of stay was 5.6 days with a cost of nearly $12,000 for injurious falls in seniors.[18] In 2010, the aggregate cost for all hospital stays among those 65+ was over $150 billion.[19]

Uses of Personal Emergency Response Services

PERS, also called medical alert services, can provide older adults with quick access to a response center to request the help they need. Such situations may include falls and broken bones in addition to physical and psychological symptoms, such as trouble breathing and pain in the chest or elsewhere. Patients use their device by pressing a button, usually worn as a pendant or wrist strap. This transmits a signal to a response center representative, who contacts the help requested by the patient. Some PERS devices also contain sensors for detection of falls, such that if one is detected and the user is unable to press their help button, a call for help is automatically signaled. Previous studies have provided evidence that PERS reduce hospital utilization, costs, and mortality.[20, 21]

PERS are often regarded as a service that helps older people get access to help after falls, which are prevalent in this age group. According to the 2002 Medicare Current Beneficiary Survey, an estimated 22% of Medicare beneficiaries 65 years and over fell in the previous year.[22] Furthermore, the rate of falls increases with age. A prospective study in a community population 70 years and older found that fall rate increases from nearly 50 per 100 aged 70 – 74 to more than 150 per 100 individuals aged 90 years and older.[23] Falls among older patients, however, can often be linked to a person's physical condition or the presence of chronic diseases.[7]

Furthermore, many chronic conditions can cause other acute symptoms that may potentially lead to the need for emergency response in which older patients would benefit from PERS:

- Heart disease can cause dizziness, balance problems and muscle fatigue, and is commonly associated with respiratory problems.[24]
- Strokes often result in muscle weakness, paralysis and/or sensory imbalances on one side of the body, which can limit the ability of an individual to move about safely.[25]
- Anemia, a condition in which there are not enough healthy red blood cells to oxygenate the body adequately, may make a person feel weak and dizzy, and can cause shortness of breath and chest pain.[26]
- COPD exacerbations causes shortness of breath, even when performing light activity.[27]
- Atrial fibrillation causes palpitations, which are sensations of a racing, uncomfortable, irregular heartbeat or a flip-flopping in the chest. It may also cause muscle weakness and fatigue, thereby increasing the risk of stroke, heart failure and other heart-related complications.[28]
- Cancer and its treatment can cause complications such as pain, fatigue and difficulty breathing. Cancer involving the brain can also cause stroke-like symptoms.[29]

When acute symptoms such as palpitations, respiratory problems and falls arise, PERS users may press their button and signal the response center to deploy a responder or emergency medical services. But users may also seek contact for less urgent issues, such as the need for a responder to aid with activities of daily living (e.g., toileting, bathing), refilling medications, or calling a nurse or doctor. In essence, the response center works as a single point of contact to support patients with chronic diseases.

Hypothesis and aims

Based on the literature cited previously, we hypothesized that patients may use PERS not only as an alert system for falls, but also as a complement to their chronic disease management programs. Therefore, we conducted a retrospective data analysis to investigate the following: 1) the medical reasons for enrolling in a PERS, and 2) the principal diagnoses in post-emergency situations requiring ambulance transport of PERS users.

Study design and methods

Study subjects

The study was approved by the Partners Human Research Committee, the Institutional Review Board for **Partners HealthCare hospitals**. Patients included in this study were residents of the Greater Boston area who received care at Partners HealthCare at Home (PHH), a homecare management service that offers general care as well as specialized services to help patients manage chronic conditions. PHH serves all patients within the Partners HealthCare System (PHS), comprising a network of seven major hospitals, two large academic centers and several community health centers. In addition to in-person home visits, PHH uses a variety of technological innovations to monitor patients remotely and deliver high-quality clinical care, as well as to monitor patients' use of a PERS system such as Philips Lifeline.

PERS data include demographics, patients' living situations, caregiver networks, self-reported medical conditions and information gleaned during the interactions of patients with Philips Lifeline call center associates.

Data sources

The primary sources for this study included electronic medical record repositories of hospitals within the PHS network and the Philips Lifeline data repository. Medical record data include demographics, hospital utilization and medication information. PERS data include demographics, patients' living situations, caregiver networks, self-reported medical conditions and information gleaned during the interactions of patients with Philips Lifeline call center associates. Longitudinal clinical data from the electronic health record (EHR) of 1,156 individuals enrolled in the PHH program and subscribed to Philips Lifeline for any duration between October 1, 2011 and October 1, 2014 were combined with retrospective medical alert pattern data from the Philips Lifeline service. EHR data were extracted for the period October 1, 2010 to October 1, 2015, such that there was at least one year of hospital utilization data before and after PERS enrollment. All data were de-identified prior to analysis.

Analysis

The combined data were aligned on the PERS enrollment date to enable analysis of healthcare utilization before and after enrollment. Incidents requiring hospital transport were filtered based on PERS case outcome, and situations were grouped according to: a) falls and fractures, b) physical and psychological symptoms (breathing problems, chest and other pain, dizziness, fatigue etc.), and c) other situations. PERS and EHR data were compared to filter out emergency hospital admissions for which ambulance transport occurred up to five days beforehand. The primary diagnoses for these admissions were determined by grouping the ICD-9 codes according to AHRQ's Clinical Classification Software.[30] Analyses were performed using the statistical software R[31] and Microsoft Excel.

Results

Patient characteristics

Demographics and other characteristics of the 1,156 patients are listed in Table 1. Philips Lifeline users were, on average, nearly 80 years old at service enrollment, and the majority (76%) were female. Furthermore, about one-third were married or partnered, while another third were widowed. A total of 90% of patients reported one or more medical conditions at service enrollment, while nearly 30% reported five or more conditions. Chronic conditions such as COPD, diabetes and heart failure are among the ten most common self-reported medical conditions.

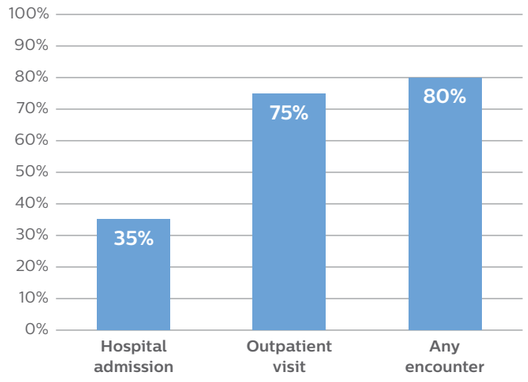
Table 1: Patient characteristics

Number of patients	1,156
Age	78 ± 11 yrs.
Gender	76% Female
Marital status	28% Married/partnered 32% Widow 19% Single 13% Divorced/separated 9% Unknown
Self-reported medical conditions	90% One or more 72% Two or more 58% Three or more 44% Four or more 29% Five or more
Ten most common self-reported medical conditions	41% History of falls 36% Walking aid 31% High blood pressure 17% Arthritis 17% Diabetes 15% Balance problems 10% Atrial fibrillation 9% COPD 8% Depression 7% Heart failure

Healthcare encounters

The majority of PERS enrollments were preceded by a healthcare encounter. In a period of four months preceding PERS enrollment, 404 patients (35%) had one or more hospital admissions and 867 (75%) had one or more outpatient encounters. In total, 920 patients (80%) had one or more inpatient or outpatient encounters in the four months prior to enrollment (Figure 1).

Figure 1: Percentage of patients having healthcare encounter within four months prior to PERS enrollment

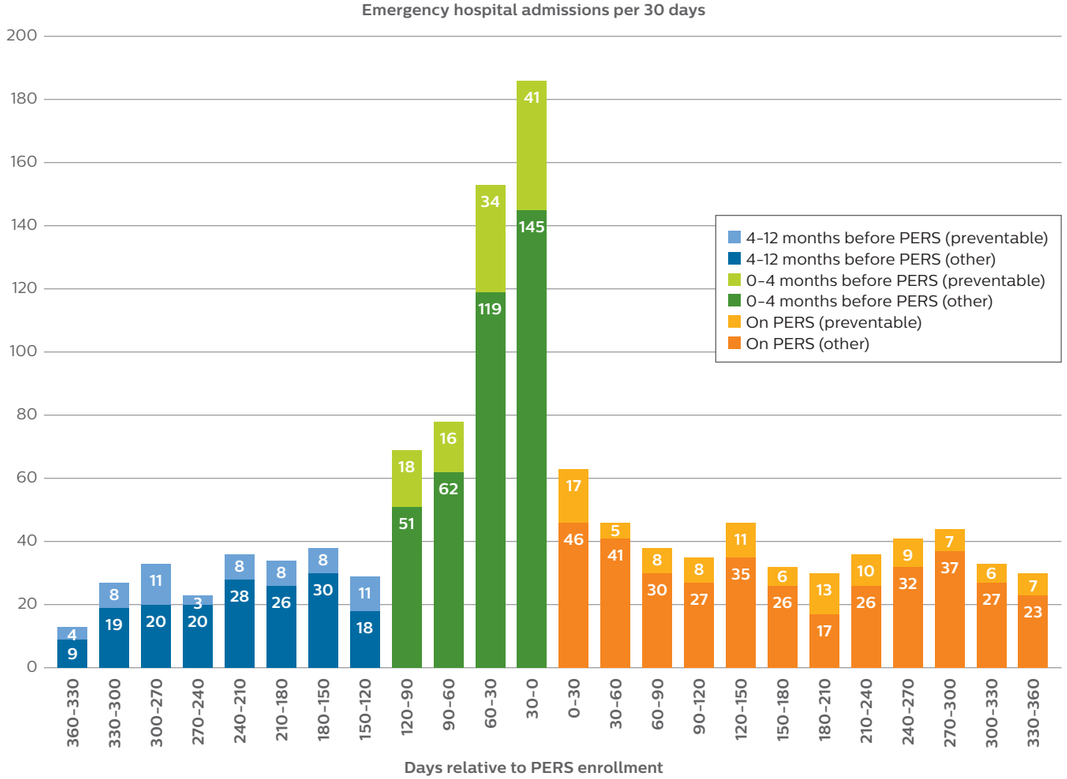


Chronic conditions such as COPD, diabetes and heart failure are among the ten most common self-reported medical conditions.

Four times higher rate of unplanned hospital admissions prior to PERS enrollment

A plot of the number of emergency admissions per 30 days, relative to the PERS enrollment date, revealed a significant increase of 4.2 times in admissions in the four months prior, compared to emergency admissions during the preceding months (Figure 2). This suggests that emergency admissions may trigger enrollment in PERS. The rate of emergency hospital admissions decreased after enrollment, which may be attributable to both the effect of PERS on reducing hospital admissions[20] or to "regression toward the mean"—the statistical phenomenon that if a variable (i.e., the rate of emergency admissions) is extreme on its first measurement, it will tend to be closer to the average on its second measurement. Figure 2 also details potentially preventable admissions, i.e., hospitalizations that could have been avoided because the condition either could have been prevented, or treated outside of an inpatient hospital setting. These admissions were identified using ICD-9 diagnosis code groups provided by the Centers for Medicare & Medicaid Services (CMS).[32] Overall, 23% of emergency hospital admissions were classified as potentially preventable.

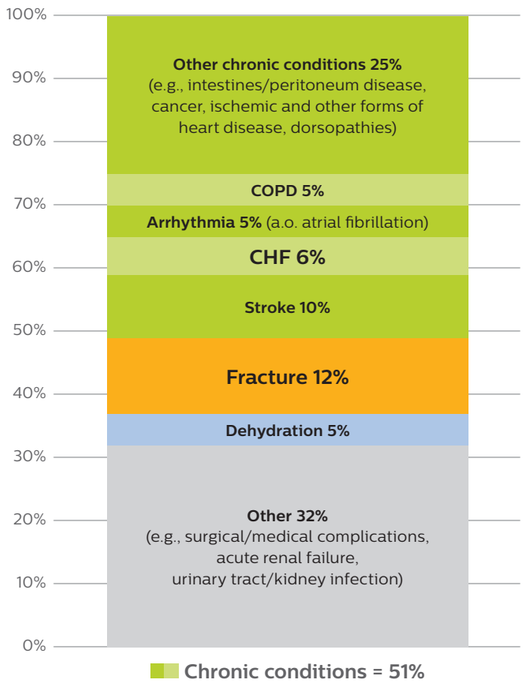
Figure 2: Emergency hospital admissions before and after PERS enrollment
(potentially preventable and other)



Chronic conditions comprise more than half of admissions prior to PERS enrollment

An evaluation of the primary reasons for emergency hospital admissions in the four months before PERS enrollment revealed that 51% of them were due to chronic conditions such as COPD, anemia, stroke, and CHF, while fractures and dehydration accounted for only 12% and 5%, respectively.

Figure 3: Principal diagnostic categories for emergency hospital admissions in the four months before PERS enrollment



Top five reasons for emergency admissions after a hospital transport

While on the service, PERS users requested 380 ambulance transports per 1,000 users annually. Emergency transport to the hospital was requested for a total of 2,474 incidents. Personal agents at the Philips Lifeline response center documented the details of all incidents. Circumstances of the incidents resulting in hospital transport were categorized and are listed in Table 2. Physical and psychological symptoms—the largest category—included respiratory problems, chest and other pain, illness and dizziness. It should be noted that the "Other" category includes incidents described in free-text case notes. Such notes were reviewed for words related to falls, as well as physical and psychological symptoms, and then assigned to their respective categories.

Table 2: Circumstances for incidents requiring emergency hospital transport

Circumstance	Number of incidents	Percent of incidents
All transports	**2,474**	**100**
Physical and psychological symptoms	1,144	46
Falls and fractures	568	23
Other (e.g., incidents described in free-text case notes)	762	31

For a total of 505 emergency hospital admissions to PHS, Philips Lifeline PERS was used to request ambulance transport within five days of the admission. This five-day window was allowed to account for the possible imperfect alignment of PERS and EHR data. The five most common conditions were compared with those from the general US population (Table 3, next page).

Table 3: Five most common principal conditions for hospital admission after ED visit for US population[1] and PERS patients. Disease classification according to AHRQ's Clinical Classifications Software.

US population 65 – 84 years[33]		US population 85+ years[33]		PERS population 78±11 years in this study	
Condition	**%**	**Condition**	**%**	**Condition**	**%**
Septicemia	6.1	Congestive heart failure	7.8	Urinary tract infection	6.3
Congestive heart failure	5.5	Septicemia	6.8	Congestive heart failure	6.1
Pneumonia	5.1	Pneumonia	6.1	Pneumonia	5.9
Chronic obstructive pulmonary disease	4.8	Urinary tract infection	5.1	Septicemia	5.7
Cardiac dysrhythmias	4.3	Hip fracture	4.3	Chronic obstructive pulmonary disease	4.8

Conclusion

Acute symptoms such as breathing problems, dizziness and chest pain often manifest as a result of worsening, underlying chronic conditions. Analysis of combined medical record and PERS data indicates that chronic conditions are a major reason for seniors to enroll in a PERS. During PERS use, almost 50% of all hospital transport requests are attributed to physical and psychological conditions, and 23% to falls and fractures.

PERS benefits patients with chronic conditions

While PERS programs are traditionally described as fall management services for seniors, our analysis indicates that they are also used for many acute symptoms often related to underlying chronic conditions. Thus, PERS may support patients with chronic diseases, in addition to serving as an alert service for falls. Early referrals of patients having chronic conditions and those at risk for falls could potentially enable timely care and interventions, thereby reducing costly admissions while simultaneously improving clinical outcomes and the well-being of patients and their families. A further recommendation is to use population health management strategies—such as monitoring the risk of patients needing ambulance transport in any upcoming period[34]—that enable the delivery of timely, seamless care and interventions to help reduce avoidable emergency admissions.

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