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**Abstract**

# Healthcare Cost Analysis of Older Patients Using a Personal Emergency Response Service Uncovers Costs Savings Opportunity

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**Abstract**

**Background:** In the US healthcare system, half of overall Medicare and Medicaid Services reimbursement goes towards caring for the top 5% most expensive patients. However, little is known about how these patients' costs change annually prior to them reaching the top 5%. To address these gaps and investigate potential cost savings opportunities, we analyzed patient flow and associated healthcare cost trends over the period 2011-2015.

**Objective:** To evaluate longitudinal trends in healthcare cost of older patients using Personal Emergency Response Service (PERS).

**Methods:** This is a retrospective, longitudinal, multicenter study to evaluate healthcare cost of 2,643 older patients over the period 2011-2015. All patients had at least one inpatient and/or outpatient encounter, and at least one episode of home health care during the study period. In addition, all patients used PERS at home anytime during the study period. The study population was segmented by their annual healthcare expenditures into Top (5%), Middle (6-50%) and Bottom (51-100%) segments. Cost acuity pyramids were built based on these segments for each fiscal year. The longitudinal healthcare expenditure trends of the complete study population, as well as each segment, were assessed by linear regression models. Patient flows throughout the segments of the cost acuity pyramids from year to year were modeled by Markov chains. The associated costs flows were quantified over a 2-year period.

**Results:** Total healthcare cost of the study population nearly doubled from \$17.7M in 2011 to \$33.0M in 2015. This increasing trend was statistically significant ( $P=0.003$ ) with an expected yearly cost increase of \$3.6M. This growth was driven by a significantly higher cost increase in the Middle segment (\$2.3M;  $P=0.002$ ). The expected yearly costs increase of the Top and Bottom segments was \$1.2M ( $P=0.008$ ) and \$0.1M ( $P=0.003$ ) respectively, and both were statistically significant. The patients and cost flow analyses showed that 18% of patients moved up the cost acuity pyramid yearly, and their cost increased by 672% in contrast to 22% of patients who moved down with a cost decrease by 86%. The remaining 60% of patients stayed in the same segment from year to year, but their cost increased by 18%.

**Conclusions:** While many healthcare organizations target costly intensive interventions for their most expensive patients, this analysis unveiled a potential cost savings opportunity by managing the patients in the lower cost segments that are at risk of moving up the cost acuity pyramid. To achieve this, data analytics that integrate longitudinal data from the EHR and home monitoring devices may help healthcare organizations to optimize resources by enabling clinicians to proactively manage patients in their home or community environments, beyond institutional settings and 30-60 day telehealth services.

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**KEYWORDS**

Healthcare cost analysis; Cost acuity pyramid segmentation; Personal Emergency Response Service (PERS)

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**Multimedia Appendix 1**

Full poster.

[\[PDF File \(Adobe PDF File\), 584KB-Multimedia Appendix 1\]](#)

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