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Feature Article

# Identifying distinct risk profiles to predict adverse events among community-dwelling older adults

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ABSTRACT

Preventing adverse events among chronically ill older adults living in the community is a national health priority. The purpose of this study was to generate distinct risk profiles and compare these profiles in time to: hospitalization, emergency department (ED) visit or death in 371 community-dwelling older adults enrolled in a Medicare demonstration project. Guided by the Behavioral Model of Health Service Use, a secondary analysis was conducted using Latent Class Analysis to generate the risk profiles with Kaplan Meier methodology and log rank statistics to compare risk profiles. The Vuong-Lo-Mendell-Rubin Likelihood Ratio Test demonstrated optimal fit for three risk profiles (*High*, *Medium*, and *Low Risk*). The *High Risk* profile had significantly shorter time to hospitalization, ED visit, and death ($p < 0.001$ for each). These findings provide a road map for generating risk profiles that could enable more effective targeting of interventions and be instrumental in reducing health care costs for subgroups of chronically ill community-dwelling older adults.



## Introduction

Almost half of the current adult United States (US) population lives with at least one chronic illness, many of whom suffer from multiple chronic conditions (MCC).[1] The US Census Bureau estimates the population aged 65 or older will increase from 13% in 2010 to 20% in 2030.[2] Currently, two-thirds of all Medicare beneficiaries suffer from two or more chronic conditions with 37% suffering from five or more.[3] Furthermore, as our population ages, it is expected that older adults living with MCCs will dramatically increase as the incidence of MCCs increases with age.[3] In 2010, 63% of older adults aged 65 to 74 suffered from MCCs. Among older adults 85 or older, 83% suffered from MCCs.[3]

Prior research indicates that older adults with MCCs frequently have complex care needs and often experience transitions in care, which are frequently managed poorly[4] making them vulnerable for poor outcomes[5] including hospitalization, emergency department

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(ED) use, increased physician visits,[2] shorter time to death,[6] medication errors,[7,8] reduced quality of life[9] and decline in functional status.[10] Moreover, MCCs are contributing to this population's higher rates of hospitalization and ED visits.[2] Medicare beneficiaries with four or more chronic conditions have higher overall Medicare spending compared to those with three or less.[3] In addition to increasing unnecessary costs for payers and leaving older adults at risk for poor outcomes, avoidable hospitalizations also accelerate cognitive decline,[11] delirium,[12] and increase risk for medical errors[13,14] and death.[3,15]

Medicare beneficiaries with six or more chronic conditions have a 30-day all-cause hospital readmission rate of 25% compared to 19% for all fee-for-service Medicare beneficiaries.[3] Hospitalization costs incurred by Medicare recipients exceeded $120 billion in 2012, an increase of $10 billion from 2006.[16] It is well established that Medicare expenditures for unplanned and potentially preventable hospitalizations and ED visits contribute substantially to increases in costs. In 2011, 28% of all Medicare fee-for-service hospital admissions were potentially avoidable and 55% of all treat-and-release ED visits were considered preventable among this same population.[17]

To date, the majority of attention has been placed on individual risk factors associated with hospitalization among community-dwelling older adults.[18–20] There has been little emphasis and evidence of how health system and individual clinical factors can be clustered into distinct risk profiles predicting the likelihood each risk profile has of experiencing adverse events such as hospitalization, ED visits, and death. Several studies have examined demographic factors associated with risk for hospital readmission such as lack of physician follow-up,[19] living alone, having four or more diagnoses, taking five or more medications[20] or having functional impairment.[21] Other studies have developed prediction models for hospital readmission but none have performed well enough for widespread use.[22]

Berkowitz and Anderson[23] found men to be 20% more likely to be readmitted than women and that Blacks and dual eligible Medicare/Medicaid beneficiaries have slightly increased risk. Patients with end-stage renal disease,[23] heart failure[19] and multiple chronic conditions[3] also have a higher risk for admission. Other important drivers for hospital admission include poor social support and poverty[24]; as both have been found to negatively impact health care adherence.[25] Patients living in high-poverty neighborhoods are 24% more likely to be hospitalized[26] and married patients have significantly less risk of hospital admission, suggesting the importance of social support. While several approaches have been utilized to measure likelihood of risk for poor outcomes, predictive model development is lacking and strategies for risk-reduction of avoidable and costly healthcare utilization outcomes have not been tested.

These findings suggest that opportunities exist to improve primary care outpatient and community services to prevent and reduce hospital admissions and ED visits.[17] While much emphasis has been placed on readmission risk, the literature remains scant on identifying groups of co-occurring risk factors (risk profiles) associated with potentially avoidable hospitalizations, ED visits or death. This knowledge could enable more effective targeting of resource intense interventions and be instrumental in reducing health care costs while enhancing quality of life for high-need, high-cost subgroups of chronically ill community-dwelling older adults.[27] Seeking new models of care are essential to reduce Medicare spending, manage risk for adverse events and to meet the needs of the growing population of chronically ill older adults living in the community.

Existing literature has utilized administrative data to retrospectively examine hospital admission risk within the context of specific diagnosis types. This information is potentially useful on its own, but it is likely more valuable to examine common patterns of clinical risk factors associated with risk for any hospitalization, ED visit or death among older adults with multiple co-morbid conditions. Stratifying older adults is critical for aligning risk of adverse patient events to enable timely preventive interventions to diminish such risk. To address these gaps in knowledge, an exploratory, hypothesis generating analysis was conducted using extant data from a Medicare demonstration project. The goal of developing risk profiles is to manage rather than avoid risk, allowing providers to link identified needs with targeted interventions provided before an adverse event or further decline occurs. We employed a unique analytical technique, Latent Class Analysis (LCA), to identify how various health system, clinical and sociodemographic risk factors co-occur among older adults living at home (referred to as risk profiles). Once these clusters were identified, we examined the differences in three adverse events (time to hospitalization, ED visits and death) among these distinct risk profiles.

## Conceptual framework

The Behavioral Model of Health Service Use proposed by Andersen[28] and refined by Andersen and Newman[29] served as the conceptual basis of this study. The model suggests individual and health system factors impact health care utilization (Fig. 1).[29] A multidisciplinary team of clinical scholars[30–32] first determined the existence of individual and health system risk factors predisposing older adults to health care utilization, specifically hospitalization, ED visits and death identified from the literature. We then determined latent classes comprised of the individual risk factors (referred to as risk profiles) associated with these adverse events using Latent Class Analysis. A Latent Class Analysis is a way to classify cases in a manner that has not been previously established. We hoped to be able to identify classes where certain risk factors co-occurred to get a better understanding of risk profile groups. Finally, the team explored the relationships between the distinct risk profiles and time to first hospitalization, time to first ED visit (health care utilization variables) or death, 3 months through 5 years following admission to a community-based care coordination program. This approach allowed the team to employ a unique analytical lens to identify how various clinical risk factors co-occur among older adults living at home, to distinguish distinct risk

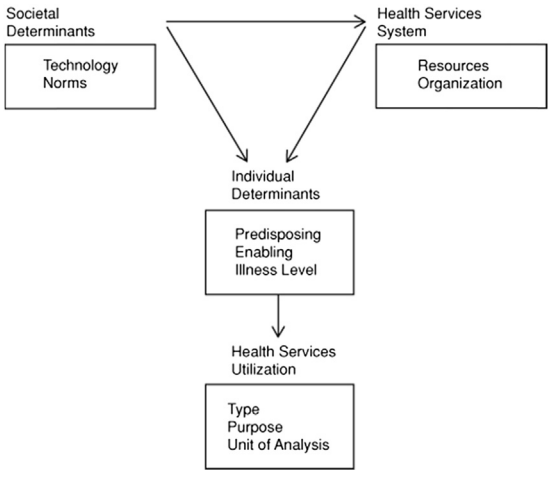


**Fig. 1.** Behavioral model of health service use.[29]