Risk Stratification in Evidence-Based Medicine

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Medical University of South Carolina
Risk Stratification in primary care

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What risks are we concerned about?

• Death
• Clinical progression/deterioration
• Disease and morbidity
• Functional impairment
• Acute care utilization and cost
  – Condition-related
  – Access at high-cost point
  – End of life care
Growth in Total Health Expenditure Per Capita, U.S. and Selected Countries, 1970-2008


Note: Other Personal Health Care includes, for example, dental and other professional health services, durable medical equipment, etc. Other Health Spending includes, for example, administration and net cost of private health insurance, public health activity, research, and structures and equipment, etc.

What data can we use to predict acute care risk?

Factors
- Age
- Gender
- Behavioral risk factors
- Behavioral health conditions
- Chronic medical conditions*
- Prognosis
- Medications*
- Laboratory/Studies
- Social factors
- Prior history of utilization*

Data sources
- Self-report
- Claims
- EMR
Mutability and time horizon for risk???

- Age
- Gender
- Behavioral risk factors - long
- Conditions/Disease(s) control +/- short
- Behavioral health - long
- Medications +/- short
- Laboratory/studies
- Social factors +/- short
- History of utilization - short
## UIM Patient Demographic

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<tr>
<th>Demographics (n=9,933 patients)</th>
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<td>Age, y (mean ± SD)</td>
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<td>Married, No. (%)</td>
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Frequency of Comorbidities of UIM Patients
UIM: Overall MUSC ED, Hospital, rehospitalization over three years

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<th>Total # in 3+ years</th>
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Concentration of Health Care Spending in the U.S. Population, 2009

Note: Dollar amounts in parentheses are the annual expenses per person in each percentile. Population is the civilian noninstitutionalized population, including those without any health care spending. Health care spending is total payments from all sources (including direct payments from individuals and families, private insurance, Medicare, Medicaid, and miscellaneous other sources) to hospitals, physicians, other providers (including dental care), and pharmacies; health insurance premiums are not included.

Population Risk Stratification
Risk Stratification

Cluster A

Cluster B

Cluster C

Cluster D

Cluster E
12 cluster model: Multiple chronic conditions

<table>
<thead>
<tr>
<th>Cluster Name</th>
<th>N</th>
<th>% High Risk Pts. In Cluster</th>
<th>OBE</th>
<th>HU</th>
<th>HYP</th>
<th>DEP</th>
<th>HYPO</th>
<th>DU</th>
<th>FED</th>
<th>ST</th>
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○ = prevalence of 50-75%

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● = prevalence of 25-50%

● = prevalence of 50-75%

● = prevalence of 75-100%
12 Clusters: Other risk factors

• Largest number of patients was in the multiple chronic condition cluster (1512)
• Largest proportion of high-utilization patients was in the renal disease cluster (68%) RR = 5.47
• Visit adherence
  – < 80% adherence dramatically increases ED and hospitalization risk RR= 1.33
• Social determinants
  – Zip codes with >25% of residents below poverty level RR = 1.25
• Dx: Sickle cell disease: 1% of population, 12% of utilization

Note: Percentages include health insurance premiums.

Risk Prediction Models to Predict Emergency Hospital Admission in Community-dwelling Adults

A Systematic Review

Emma Wallace, MB, BAO, Bch,* Ellen Stuart, MB, BAO, Bch,* Niall Vaughan†
Kathleen Bennett, PhD;‡ Tom Fahey, MD,* and Susan M. Smith, MD*

Background: Risk prediction models have been developed to identify those at increased risk for emergency admissions, which could facilitate targeted interventions in primary care to prevent these events.

Objective: Systematic review of validated risk prediction models for predicting emergency hospital admissions in community-dwelling adults.

Methods: A systematic literature review and narrative analysis was conducted. Inclusion criteria were as follows; Population: community-dwelling adults (aged 18 years and above); Risk: risk prediction models, not contingent on an index hospital admission, with a derivation and ≥1 validation cohort; Primary outcome: emergency hospital admission (defined as unplanned overnight stay in hospital); Study design: retrospective or prospective cohort studies.

Results: Of 18,983 records reviewed, 27 unique risk prediction models met the inclusion criteria. Eleven were developed in the United States, 11 in the United Kingdom, 3 in Italy, 1 in Spain, and 1 in Canada. Nine models were derived using self-report data, and the remainder (n=18) used routine administrative or clinical record data. Total study sample sizes ranged from 96 to 4.7 million participants. Predictor variables most frequently included in models were: (1) named medical diagnoses (n=23); (2) age (n=23); (3) prior emergency admission (n=22); and (4) sex (n=18). Eleven models included nonmedical factors, such as functional status and social supports. Regarding predictive accuracy, models developed using administrative or clinical record data tended to perform better than those developed using self-report data (c statistics 0.63–0.83 vs. 0.61–0.74, respectively). Six models reported c statistics of ≥0.8, indicating good performance. All 6 included variables for prior health care utilization, multimorbidity or polypharmacy, and named medical diagnoses or prescribed medications. Three predicted admissions regarded as being ambulatory care sensitive.

Conclusions: This study suggests that risk models developed using administrative or clinical record data tend to perform better. In applying a risk prediction model to a new population, careful consideration needs to be given to the purpose of its use and local factors.

Key Words: risk prediction model, emergency hospital admission, community-dwelling adults

(Med Care 2014;52: 751–765)

In the United States, rehospitalizations alone are estimated to cost $12 billion each year.¹ Emergency or unplanned admissions account for approximately 35% of all hospitalizations in the United Kingdom (UK) costing an average of £11 billion annually.² As a result of this escalating expenditure, reducing emergency admissions is a priority for health care policy-makers.³ For patients, unplanned hospi-
18 models presented $c$ statistics for the outcome of admission (0.61 to 0.83)

Wallace Med Care 2014

• 6 models reported $c$ statistics of $>0.8$
  – all included prior health care utilization variables
  – Multi-morbidity or polypharmacy measures
  – medical diagnoses or specific prescribed medications

• 3/6 models utilized emergency admissions for ACS conditions as a primary outcome measure.

• 7 additional risk prediction models reported $c$ statistics of 0.7 - 0.8 (acceptable model performance)
18 models presented $c$ statistics for the outcome of admission (0.61 to 0.83)

Wallace Med Care 2014

- Only 5 of the 18 models developed using administrative or clinical record data were derived specifically for use in older people.
- The remainder were developed for use in general populations aged over 18 years.
- 9 models used self-report data primarily
- 8 were designed for use in older people.
- Models developed primarily using administrative or clinical record data performed better ($c$ statistic 0.68 - 0.83) than those developed using self-report data ($c$ statistic 0.61 - 0.74)
How do we use risk data?

- High risk panel managers
- Patient and caregiver engagement
- Proactive care management (e.g. medication adherence)
- Outreach
- Care coordination
- End of life planning
Acute Care Utilization by Dementia Caregivers Within Urban Primary Care Practices

Cathy C. Schubert, MD³, Malaz Boustani, MD, MPH¹,²,³, Christopher M. Callahan, MD¹,²,³, Anthony J. Perkins, MS¹,², Siu Hui, PhD¹,²,³, and Hugh C. Hendrie, MB, ChB¹,²,⁴

¹Indiana University Center for Aging Research, Indianapolis, IN, USA; ²Regenstrief Institute, Inc., Indianapolis, IN, USA; ³Department of Medicine, Indiana University School of Medicine, Indianapolis, IN, USA; ⁴Department of Psychiatry, Indiana University School of Medicine, Indianapolis, IN, USA.

BACKGROUND: Caring for an individual with Alzheimer's dementia (AD) is stressful, and studies show that this stress has an impact on both the physical and mental health of the caregiver. However, many questions remain about the characteristics of AD patients and their caregivers that contribute to this stress and how it impacts caregivers' use of healthcare resources.

OBJECTIVE: To study the impact of stress on the physical and mental health of the caregiver.

DESIGN: Patients underwent extensive testing to allow description of their degree of cognitive impairment, behavioral and psychological symptoms, medical comorbidities, and functional abilities. Caregivers were assessed for depressive symptoms and also for emergency department (ED) use and hospitalizations in the previous six months. Multivariate logistic regression was used to evaluate impact of patients' dementia symptoms on caregivers' acute care utilization.

PARTICIPANTS: One hundred and fifty-three AD patients and their caregivers attending two large, urban, university-affiliated primary care practices were

KEY WORDS: health care utilization; ED visit; hospitalization; dementia; caregiver.

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INTRODUCTION

Approximately four million older adults in the United States have Alzheimer's dementia (AD), and three million of them are living in the community.¹ Family and friends are currently providing 75% of the daily care needs of these patients, with the remaining 25% being provided by purchased home care services.² Thus, dementing illnesses are complex in that they impact not only the health and function of the patient but also that of the caregiving family member or friend. With the aging of the population, the number of cases of AD is anticipated to increase to 18.5 million by 2050.³ If a similar proportion of AD patients remains in the community as now, the burden of caregiving on the family and friends by 2050 will increase exponentially.
Dementia patients: caregiver risk

• 24% of the caregivers (n=155) had at least one ED visit or hospitalization in the six months
• Adjusting for caregiver age, gender, and education, acute care utilization was associated with caregiver
  – depression by PHQ-9 (OR 1.09, 95% CI 1.00–1.18)
  – Behavioral and psychological symptoms by the NPI (OR 1.04, 95% CI 1.01–1.08)
• Patients’ functional status (OR 1.05, 95% CI 1.01–1.09).
Conclusions

• No “perfect” model
• More data, more accuracy
  – Electronic
  – Clinical
  – Questionnaire
• We think the following are critical for us
  – Social determinants
  – Visit adherence
  – Behavioral health conditions
• Populations differ; so does risk
Questions?

