Predicting Out-of-Hospital Death Using Insurance Claims Data

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Abstract 1865

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BACKGROUND

- Insurance claims data provide a rich resource for pharmacoepidemiology research.
- Without linkage to death certificate data, most insurance claims data only contain deaths that occur in hospital.
- Out-of-hospital deaths likely result in disenrollment; however, most disenrollment simply reflects a change in insurance provider.
- In the United States, an estimated 64% of deaths in those aged under 65 years, and 66% in those 65 years or older, occur out of hospital.

OBJECTIVES

To create a claims-based algorithm to distinguish between disenrollment due to out-of-hospital death and other types of disenrollment.

METHODS

Data Source:

- 1% random sample IBM Watson Health MarketScan Commercial Claims and Encounters and Medicare Supplemental Databases, 2006-2011

Out-of-Hospital Death:

- Gold standard: Social security administration (SSA) death files
- Defined as death date within 30 days of insurance disenrollment

Statistical Analyses:

- Logistic regression to estimate adjusted odds ratios (aOR) and 95% confidence intervals (CI) for predictors of out-of-hospital death.
- Commercial Claims and Encounters (CCAE) and Medicare Supplemental (MDCR) populations were analyzed separately

Baseline Predictors of Death:

- **Initial model** included 169 predictors including demographics, medications, healthcare utilization, frailty indicators, comorbid conditions, and preventative care
  - Events measured in 0-30, 31-90, 91-182, and 183-365 days prior to disenrollment
- **Final parsimonious model** included 38 predictors
  - Healthcare utilization and flu shot measured in 0-90, and 91-365 days prior to disenrollment
  - All other events measured in 0-365 days prior to disenrollment

STUDY POPULATION

- ≥ 365 days of continuous enrollment prior to disenrollment
- Last instance of disenrollment between 2006 - 2011

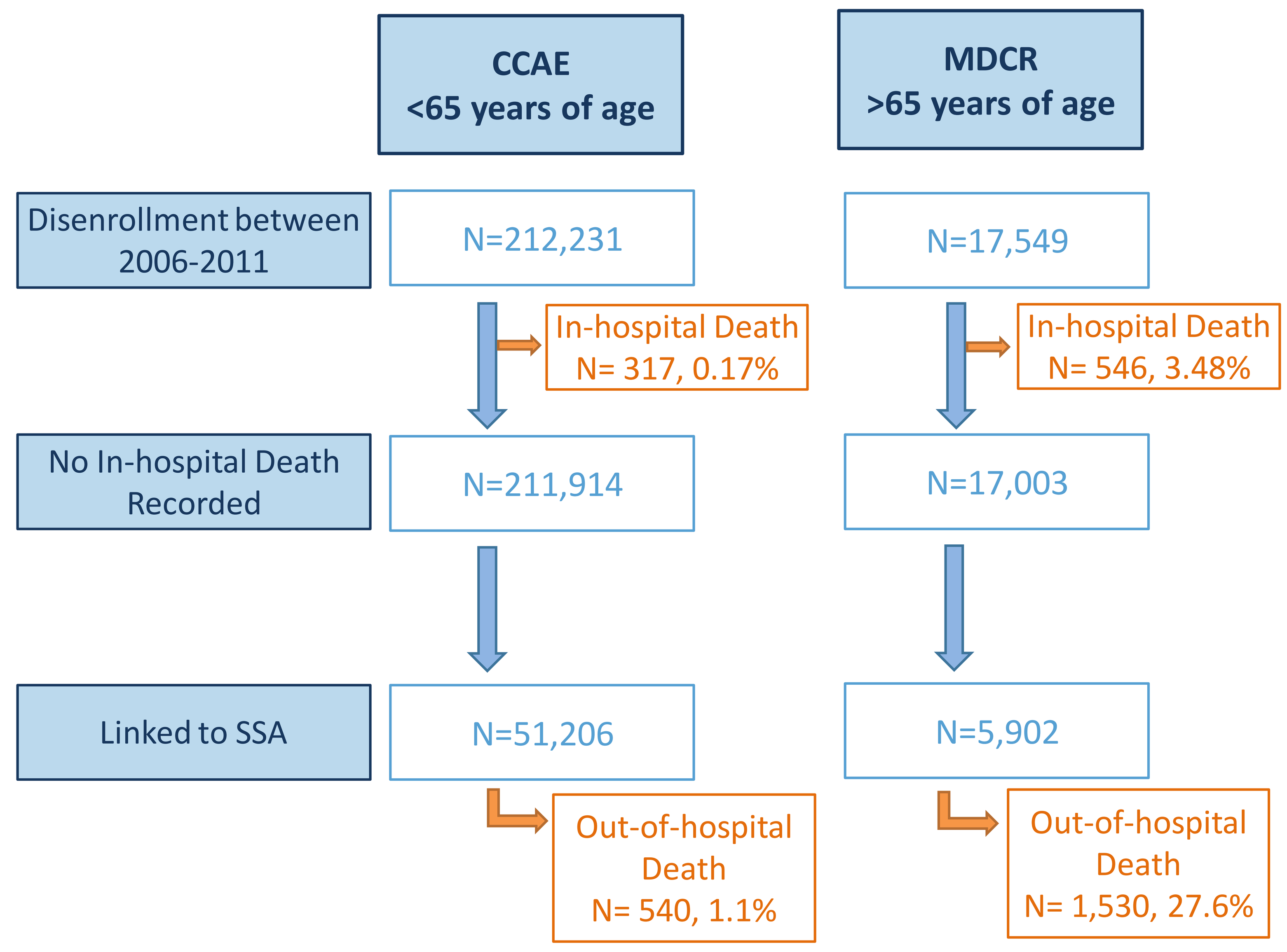

Figure 1. Flow chart describing cohort of disenrolled patients in the analysis.

CONCLUSIONS

- Death is a critical outcome for many research questions and a competing risk for all others.
- The rate of unobservable out-of-hospital death is 6.7 times that of observable in-hospital death in the CCAE population, and 7.9 times in the MDCR population.
- Our preliminary models predicted out-of-hospital death with high specificity, with c-statistics of 0.94 and 0.91 in the CCAE and MDCR populations, respectively.
- These algorithms allow researchers to choose cutoffs of predicted probability to balance sensitivity and specificity, enabling quantitative bias analyses in claims-based pharmacoepidemiology studies.

RESULTS

Commercial Claims and Encounters (< 65 years of age) : N=51,206

Selected Predictors	Mean %	OR (95% CI)
Age - 5 years	41.4	1.47 (1.45-1.48)
Male	53.4%	1.63 (1.27-2.10)
December 31 Disenrollment	36.4%	0.17 (0.12-0.24)
Hip Fracture	0.1%	0.42 (0.10-1.84)
Cancer Screening	19.4%	0.56 (0.38-0.81)
Mammogram	11.8%	0.56 (0.38-0.81)
Weakness	0.6%	0.62 (0.37-1.03)
Flu Shot (91-365 days prior)	10.2%	0.73 (0.53-1.01)
Chronic Liver Disease	1.3%	1.36 (0.88-2.11)
Heart Failure	1.4%	1.43 (0.97-2.10)
COPD	6.2%	1.54 (1.14-2.08)
Alcohol Abuse	0.7%	1.82 (0.85-3.89)
Pneumonia	0.4%	1.97 (1.10-3.53)
Ambulatory Life Support	2.8%	1.98 (1.44-2.73)
Home Oxygen	0.5%	2.00 (1.25-3.21)
Dementia	0.6%	2.25 (1.34-3.81)
Inpatient Hospitalization	7.2%	2.41 (1.77-3.28)
Home Hosptial Bed	0.1%	2.66 (1.31-5.43)
Acute Kidney Injury	0.5%	3.27 (2.16-4.94)
Cancer	4.7%	4.20 (3.27-5.39)
Emergency Room (0-90 days prior)	5.8%	5.40 (4.18-6.98)
Hospice Care (0-90 days prior)	0.3%	17.5 (10.0-30.6)

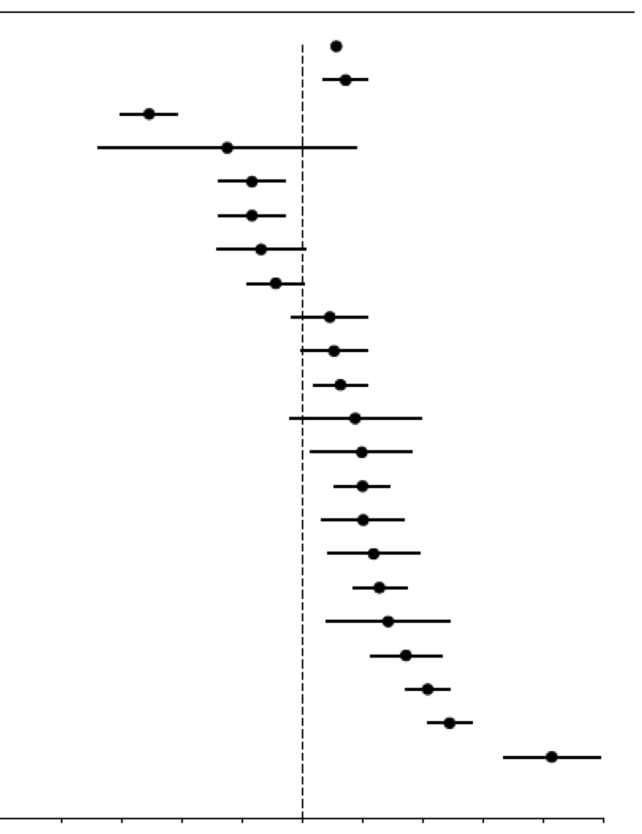

Figure 2. Odds Ratios for age, gender, and 20 strongest predictors of out-of-hospital death among the CCAE population.

Predicted Probability	Percent of Disenrolled Patients	PPV	Sensitivity	Specificity
0.012	10%	0.087	0.824	0.907
0.022	5%	0.160	0.759	0.958
0.074	2%	0.350	0.663	0.987
0.193	1%	0.551	0.522	0.995
C-statistic:	0.939			

Table 1. Algorithm performance using various cut points of predictive probability of out-of-hospital death among the CCAE population.

Medicare Supplemental (≥ 65 years of age) : N=5,902

Selected Predictors	Mean %	OR (95% CI)
Age - 5 years	79.7	1.29 (1.27-1.30)
Male	57.9%	1.31 (1.11-1.56)
December 31 Disenrollment	54.3%	0.06 (0.05-0.07)
Mammogram	11.4%	0.61 (0.38-0.99)
Anxiety	3.2%	0.72 (0.46-1.15)
Hypertension	51.1%	0.73 (0.61-0.86)
Flu Shot (0-90 days prior)	6.3%	0.76 (0.48-1.22)
Emergency Room (91-365 days prior)	0.7%	1.23 (0.55-2.74)
Acute Kidney Injury	8.8%	1.26 (0.96-1.64)
Heart Failure	23.1%	1.26 (1.02-1.56)
Ambulatory Life Support	28.2%	1.28 (1.03-1.59)
Drug Dependence	1.3%	1.28 (0.37-4.43)
COPD	21.1%	1.31 (1.07-1.61)
Dementia	16.3%	1.39 (1.13-1.71)
Depressoin	6.0%	1.41 (1.03-1.93)
Substance Abuse	1.1%	1.44 (0.33-6.38)
Inpatient Hospitalization	36.2%	1.67 (1.33-2.10)
Cancer	28.8%	1.73 (1.45-2.06)
Alcohol	0.6%	1.76 (0.64-4.86)
Home Hospital Bed	3.1%	1.84 (1.25-2.70)
Chronic Liver Disease	3.3%	1.85 (1.23-2.78)
Emergency Room (0-90 days prior)	25.0%	3.17 (2.60-3.86)

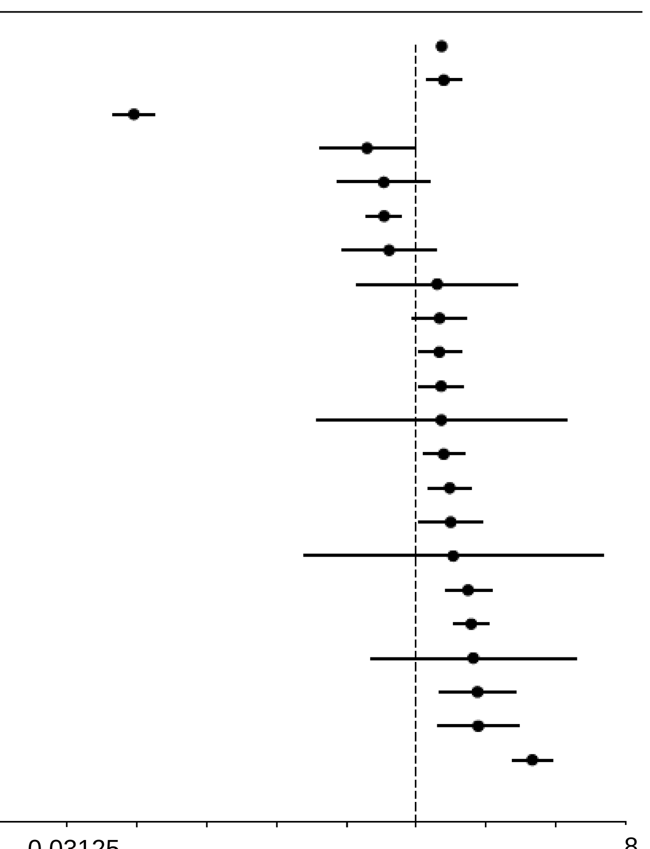

Figure 3. Odds Ratios for age, gender, and 20 strongest predictors of out-of-hospital death among the MDCR population.

Predicted Probability	Percent of Disenrolled Patients	PPV	Sensitivity	Specificity
0.806	10%	0.812	0.294	0.974
0.869	5%	0.817	0.148	0.987
0.907	2%	0.856	0.062	0.996
0.923	1%	0.864	0.031	0.998
C-statistic:	0.912			

Table 2. Algorithm performance using various cut points of predictive probability of out-of-hospital death among the MDCR population.

DISCLOSURES

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