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## BACKGROUND

- A common threat to validity in claims-based research is the inability to distinguish deaths from disenrollment events.
- An algorithm was developed using a national administrative claims database with linked date of death to predict death within 61 days of disenrollment
- Algorithm performance in national administrative claims database:  
ROC = 0.933 in beneficiaries <65 years).

## OBJECTIVE

- To conduct an external validation of an algorithm to predict death at disenrollment in order to understand performance of the algorithm in different study populations

## METHODS

- Validation data came from a large private health insurance provider in North Carolina (NC) from 2006-2018.
- Claims were linked to death records from the NC Department of Health and Human Services using a hierarchical matching algorithm
- We identified a sub-population of beneficiaries that met the following criteria:
  - aged 18-64 years
  - with a pain diagnosis, surgery, or opioid analgesic, and
  - one year of continuous enrollment prior to disenrollment.
  - Individuals were excluded if still enrolled at the end of the study period or 64th year of age.
- We evaluated model performance using C-statistics, sensitivity, and specificity overall and in subgroups of interest (age, sex, calendar year, opioid prescriptions).

## CONCLUSIONS

- Our external validation demonstrated that the algorithm performed similarly to performance in the original dataset used for algorithm development, with high specificity and varying sensitivity.
- This work indicates that this algorithm is generalizable to other commercial claims databases and populations of interest.

## RESULTS

- We identified 1,192,813 individuals who disenrolled during the study period, of whom 14,190 (1.2%) died within 61 days of disenrollment.
- Overall model performance in the validation data was high (ROC: 0.90) and comparable to performance in the MarketScan <65 population
- At a predicted probability threshold of 80%, the algorithm classified 1.3% of disenrollments as deaths with sensitivity of 0.45 and specificity of 0.99
- Sensitivity improved at lower probability thresholds.
- In subgroup analyses, model performance was a little higher among females (sensitivity: 0.490, specificity: 0.995, ROC: 0.926) than males (sensitivity: 0.422, specificity: 0.990, ROC: 0.870) at the 80% prediction probability threshold
- Performance was highest among ages 55-64 (sensitivity: 0.591, specificity: 0.973, ROC: 0.890) and lowest among ages 18-34 (sensitivity: 0.042, specificity: 1.00, ROC: 0.815).
- Performance was comparable across calendar time.

**Table 1.** Model performance in the external NC claims cohort (1.2% death rate) vs performance in the MarketScan <65 population (1.6% death rate)

Predicted Probability Threshold	NC Claims Data Cohort						MarketScan <65 Population					
	% of disenrollments above the threshold	PPV	NPV	Sensitivity	Specificity	ROC	% of disenrollments above the threshold	PPV	NPV	Sensitivity	Specificity	ROC
0.1	23.15%	0.043	0.997	0.835	0.776		24.08%	0.063	0.998	0.900	0.771	
0.2	12.97%	0.069	0.997	0.750	0.878		9.94%	0.137	0.996	0.809	0.913	
0.3	7.82%	0.104	0.996	0.685	0.929		4.80%	0.260	0.995	0.739	0.964	
0.4	4.99%	0.150	0.995	0.631	0.957		3.09%	0.377	0.995	0.690	0.980	
0.5	3.42%	0.206	0.995	0.591	0.973	0.899	2.36%	0.464	0.994	0.650	0.987	0.933
0.6	2.49%	0.263	0.995	0.552	0.981		1.89%	0.543	0.993	0.609	0.991	
0.7	1.82%	0.331	0.994	0.508	0.988		1.53%	0.620	0.992	0.561	0.994	
0.8	1.29%	0.412	0.993	0.448	0.992		1.19%	0.703	0.991	0.498	0.996	
0.9	0.77%	0.546	0.992	0.352	0.996		0.87%	0.795	0.990	0.410	0.998	
0.95	0.45%	0.653	0.991	0.247	0.998		0.65%	0.844	0.989	0.325	0.999	

**Table 2a.** Model performance among individuals who filled an opioid prescription within 30 days of disenrollment

Predicted Probability Threshold	% of disenrollments above the threshold	PPV	NPV	Sensitivity	Specificity	ROC
0.1	43.16%	0.131	0.992	0.930	0.601	
0.2	29.37%	0.184	0.991	0.890	0.745	
0.3	21.66%	0.238	0.988	0.850	0.824	
0.4	16.76%	0.293	0.986	0.810	0.874	
0.5	13.47%	0.350	0.984	0.776	0.907	
0.6	10.90%	0.413	0.982	0.741	0.932	0.913
0.7	8.78%	0.480	0.980	0.694	0.951	
0.8	6.82%	0.557	0.976	0.626	0.968	
0.9	4.59%	0.668	0.969	0.505	0.984	
0.95	2.96%	0.740	0.960	0.361	0.992	

**Table 2b.** Model performance among individuals without an opioid prescription within 30 days of disenrollment

Predicted Probability Threshold	% of disenrollments above the threshold	PPV	NPV	Sensitivity	Specificity	ROC
0.1	21.92%	0.032	0.998	0.796	0.786	
0.2	11.96%	0.051	0.997	0.691	0.886	
0.3	6.97%	0.079	0.996	0.616	0.935	
0.4	4.27%	0.116	0.996	0.556	0.962	
0.5	2.80%	0.163	0.996	0.513	0.976	
0.6	1.98%	0.213	0.995	0.473	0.984	0.881
0.7	1.40%	0.275	0.995	0.431	0.990	
0.8	0.95%	0.349	0.994	0.374	0.994	
0.9	0.53%	0.482	0.994	0.288	0.997	
0.95	0.30%	0.600	0.993	0.200	0.999	

- Model performance was a higher among individuals who filled a prescription for opioid analgesics within 30 days of disenrollment (sensitivity: 0.626, specificity: 0.968, ROC: 0.913) than those who did not (sensitivity: 0.374, specificity: 0.994, ROC: 0.881) at the 80% prediction probability threshold

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