



RWD23

- Overall survival (OS) is the gold-standard endpoint in observational studies utilizing real-world data (RWD), and requires mortality information with high accuracy and completeness.
- There are four sources of mortality data that are publicly available for commercial purposes.
  - The limited access master death file (LAMDF) from the social security administration (SSA).

# Background

- 2) Digital obituary and burials records (Obituary)
- Structured and data from unstructured documents in Electronic 3) medical record data (EMR)
- Open or closed administrative claims (Claims) 4)
- Assessment of a composite indicator requires a gold standard, and the most widely used is the National Death Index (NDI). However, NDI is not available for commercial use and may only be used for epidemiological or medical studies that do not provide direct commercial benefit.
- Other EHR-focused RWD providers have evaluated their composite death indicators against NDI (citation), but those measures did not incorporate all four sources of publicly available death information.<sup>2,3,4</sup>
- ConcertAl has constructed an All-Source Composite Mortality Endpoint (ASCME) that includes all commercially available sources of mortality information. The current study evaluates the completeness and accuracy of ASCME against the NDI database.

Methods
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Data Source

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- ConcertAl Patient360<sup>TM</sup> real-world care product suite
  - Comprehensive real-world oncology database of de-identified, humancurated records from > 225,000 patients with confirmed cancer diagnosis.
  - Contains structured and manually abstracted clinical data from academic and community sources, with daily mortality updates from all four sources.

# Table 1. Completeness of Mortality Information, by Mortality Data Source.

Commercially Available							
Mortality Sources	Total Patients	Sensitivity	Specificity	PPV	NPV		
EMR (structured and curated data)	32358	75.5 (74.8, 76.1)	98.2 (98.0 <i>,</i> 98.4)	97.3 (97.0 <i>,</i> 97.6)	82.7 (82.2, 83.2)		
EMR + SSA + Obituary	32358	89.8 (89.3, 90.2)	96.8 (96.5 <i>,</i> 97.1)	95.9 (95.6 <i>,</i> 96.2)	91.9 (91.5, 92.2)		
<b>ASCME</b> : EMR+ SSA + Obituary + Claims	32358	95.0 (94.6 <i>,</i> 95.3)	96.5 (96.2 <i>,</i> 96.7)	95.8 (95.4 <i>,</i> 96.1)	95.8 (95.5, 96.1)		

Results

- National Death Index (NDI) Database
  - The most comprehensive single database of death certificates in the U.S.A.
  - Is supported through fees from approved research use of the database.
    - Safeguards prevent the misuse of the data and prohibit commercial use of NDI data.
  - NDI releases a finalized annual file of US deaths 12 to 15 months after the end of the most recent included year.

### Patients

- Patient eligibility required the following.
- $\circ$  Included in one of ConcertAl's Patient360<sup>TM</sup> products: bladder, breast, gastroesophageal, hepatocellular carcinoma, melanoma, non-small cell lung cancer (NSCLC), pancreatic, prostate, renal cell carcinoma, and small cell lung cancer (SCLC).
- Prevalent in one of the products on or after 1/1/2014; histological confirmation of cancer through human review; known year of initial diagnosis; and initial diagnoses on or before 12/31/2021, to allow for minimum 12 months of follow up at the data end (12/31/2022), to align with the 2022 finalized NDI data file available in March 2024.

### Procedure

- Sample size determination
- Estimated for early and late disease in each cancer type separately, assuming sensitivity based on existing literature, and empirical death prevalence for each group.

## Table 2. Completeness and Accuracy of ConcertAI's ASCME Mortality Indicator, by Patient Characteristics.

	Group	Total Patients	Percent Deceased*	Sensitivity	Specificity	PPV	NPV	+/- 5 Days Concordance
	All Patients	32358	43.1	95.0 (94.6 <i>,</i> 95.3)	96.5 (96.2, 96.7)	95.8 (95.4, 96.1)	95.8 (95.5, 96.1)	97.9 (97.6,98.1)
	Academic	2946	48.6	95.2 (94.1 <i>,</i> 96.3)	97.0 (96.0, 97.8)	97.1 (96.1, 97.9)	95.1 (93.8, 96.1)	97.3 (96.4,98.1)
	Community	29412	42.5	95.0 (94.6 <i>,</i> 95.3)	96.4 (96.1, 96.7)	95.6 (95.2 <i>,</i> 95.9)	95.9 (95.6, 96.2)	97.9 (97.7,98.2)
Age	<=65	15987	33.2	94.5 (93.9 <i>,</i> 95.1)	97.6 (97.3, 97.9)	95.5 (94.9 <i>,</i> 96.1)	97.0 (96.7, 97.3)	97.2 (96.7,97.6)
	>65	16371	52.8	95.3 (94.8 <i>,</i> 95.7)	94.9 (94.4, 95.4)	95.9 (95.5 <i>,</i> 96.3)	94.1 (93.6, 94.7)	98.3 (98.0,98.6)
Race	Black or African American	2341	50.1	94.0 (92.6 <i>,</i> 95.3)	95.4 (94.0, 96.6)	95.9 (94.7, 97.0)	93.3 (91.6, 94.7)	96.8 (95.7,97.7)
	White	27332	42.5	95.5 (95.1 <i>,</i> 95.8)	96.8 (96.5, 97.0)	96.0 (95.6, 96.3)	96.4 (96.0, 96.6)	98.0 (97.7,98.2)
	Other	2685	43.6	91.6 (89.9 <i>,</i> 93.0)	94.0 (92.6, 95.2)	93.5 (92.0, 94.8)	92.3 (90.8, 93.6)	97.8 (96.8,98.5)
Census Region	Midwest	7902	46.1	96.7 (96.1, 97.2)	94.9 (94.2, 95.5)	94.5 (93.8, 95.2)	96.9 (96.3, 97.4)	98.4 (97.9,98.7)
	Northeast	7242	38.2	96.2 (95.4 <i>,</i> 96.8)	97.8 (97.3, 98.2)	96.6 (95.9 <i>,</i> 97.3)	97.5 (96.9, 97.9)	97.5 (96.8,98.0)
	South	12475	43.3	94.7 (94.1 <i>,</i> 95.3)	96.6 (96.1, 97.0)	95.9 (95.3 <i>,</i> 96.4)	95.6 (95.1, 96.1)	97.8 (97.3,98.1)
	West	3926	43.1	90.1 (88.6 <i>,</i> 91.5)	96.9 (96.1, 97.6)	95.9 (94.8 <i>,</i> 96.8)	92.5 (91.3, 93.5)	97.8 (96.9,98.4)
	Not Reported	813	48.6	95.3 (93.3 <i>,</i> 96.8)	93.3 (88.8, 96.4)	97.8 (96.3, 98.8)	86.2 (80.8, 90.6)	98.1 (96.6,98.9)

\*Percent of patients with a date of death in ConcertAl Patient360<sup>TM</sup> products and confirmed deceased in NDI.

100%

75%

50%

25%

Probability

Survival

#### Table 3. Completeness and Accuracy of ConcertAl's ASCME Mortality Indicator, by Tumor.

	Total	Percent					+/- 5 Days
Tumor Type	Patients	Deceased*	Sensitivity	Specificity	PPV	NPV	Concordance
Bladder	2138	61.5	94.6 (93.3 <i>,</i> 95.7)	92.9 (90.8 <i>,</i> 94.7)	96.3 (95.2 <i>,</i> 97.3)	89.8 (87.4 <i>,</i> 91.9)	98.2 (97.3,98.8)
Breast	9377	18.4	93.4 (92.1, 94.5)	98.4 (98.0 <i>,</i> 98.6)	93.3 (92.1, 94.4)	98.4 (98.1 <i>,</i> 98.6)	97.4 (96.6,98.1)
Gastroesophageal	2944	58.9	95.3 (94.2, 96.2)	94.2 (92.6, 95.5)	96.4 (95.4, 97.2)	92.4 (90.8 <i>,</i> 93.9)	97.6 (96.8,98.3)
Hepatocellular Carcinoma	1045	72.2	94.0 (92.2, 95.6)	87.9 (83.1 <i>,</i> 91.8)	96.3 (94.7, 97.5)	81.5 (76.2 <i>,</i> 86.0)	98.0 (96.7,98.8)
Melanoma	5588	27.4	95.8 (94.6 <i>,</i> 96.7)	98.0 (97.5 <i>,</i> 98.4)	95.0 (93.8 <i>,</i> 96.0)	98.3 (97.8 <i>,</i> 98.7)	97.7 (96.8,98.4)
NSCLC	5062	50.0	94.5 (93.6, 95.4)	95.3 (94.4, 96.1)	95.8 (94.9 <i>,</i> 96.5)	93.9 (92.9 <i>,</i> 94.8)	97.7 (97.0,98.2)
Pancreatic	2489	70.3	95.3 (94.3 <i>,</i> 96.3)	89.3 (86.7 <i>,</i> 91.6)	96.2 (95.2 <i>,</i> 97.0)	87.0 (84.2 <i>,</i> 89.5)	98.2 (97.4,98.7)
Prostate	857	76.1	97.8 (96.3, 98.7)	92.6 (87.8 <i>,</i> 95.9)	97.9 (96.5 <i>,</i> 98.8)	92.1 (87.2 <i>,</i> 95.5)	97.5 (96.1,98.5)
Renal Cell Carcinoma	1486	60.4	96.4 (94.9, 97.5)	93.3 (90.9 <i>,</i> 95.3)	96.0 (94.6, 97.2)	93.8 (91.5 <i>,</i> 95.7)	98.2 (97.1,98.9)
SCLC	1372	77.6	95.1 (93.7, 96.3)	84.3 (79.2 <i>,</i> 88.6)	96.5 (95.2 <i>,</i> 97.5)	79.2 (73.9 <i>,</i> 84.0)	98.5 (97.6,99.1)

- Samples for each cancer type exceeded this threshold where possible, to account for potential attrition in sample matching with NDI data.
- Sample Size: **N** = **34,029** aggregated across random samples of studyeligible patients from each Patient360<sup>TM</sup> tumor-specific product.
- NDI patient matching
  - Based on NDI's established and calibrated two-step method.<sup>1</sup>
    - ✓ 1) Generate all possible matches between study patients and NDI database with match of one or more of seven personal identifiers: social security number (SSN), first and last names, middle initial, and elements of date of birth.
    - $\checkmark$  2) Determine the single best record match based on the sum of weights assigned to the agreement on the core match elements, plus additional PII (e.g., state of residence and race).
  - $\circ$  Patients retained were those with class 1 match, or class 2 4 match with weighted scores exceeding the NDI cutoff for true match.

## **Study Measures**

- Evaluated completeness of data capture and accuracy of recorded dates of death.
- Completeness: sensitivity, specificity, positive predictive value (PPV), and negative predictive value (NPV).
- Accuracy: 5, 7, and 15-day concordance between ASCME and NDI date of death.

## Statistical Analysis

ConcertAl

- Study measures were evaluated descriptively overall, by cancer type, and by mortality data source.

\*Percent of patients with a date of death in ConcertAI Patient360<sup>TM</sup> tumor-specific products and confirmed deceased in NDI. Note: The pattern of specificity and NPV across tumors with higher vs. lower mortality suggests the possibility of an anomaly related to the sensitivity of the NDI gold standard.

## Figure 1. Overall Survival, by Mortality Data Source, for Early and Metastatic NSCLC.



Kaplan-Meier survival analysis assessed stage-specific cancer subgroups (e.g., early vs. late disease) to evaluate the contribution of mortality sources to measurement of overall survival.

- There is a 1.9 month difference in median survival with ASCME vs NDI as compared to a 1-year difference in median survival with a composite endpoint not including claims vs NDI in early NSCLC. Median survival in early NSCLC of 6.9 years with ASCME is comparable to median OS of 6.4 years estimated in SEER-Medicare on a similar population<sup>5</sup>.
- There is a 7 to 8 day difference in median survival with ASCME vs NDI as compared to a 27 days difference in median survival with a composite endpoint not including claims vs NDI in metastatic NSCLC.

# Conclusions

- ConcertAl's All-Source Composite Mortality Endpoint (ASCME) is a more complete commercially available mortality measure than any composite mortality endpoint reported in existing published work (Table 1).<sup>2,3,4</sup>
- **ASCME** has 95.0% sensitivity and 96.5% specificity when compared to NDI in ConcertAI Patient360<sup>TM</sup> products (Table 1).
- The 5-day date of death concordance between **ASCME** and NDI is 97.9% across all patient subgroups and tumor types, which exceeds the 15-day concordance in other published comparisons (Tables 2 and 3).<sup>3</sup>
- **ASCME's** inclusion of claims produces an overall increase of 5.2% in mortality capture in the ConcertAI Patient360<sup>™</sup> products, and an increase of 5.8% compared with the published report of a widely used alternative source of EHRfocused RWD (Tables 2 and 3).<sup>3</sup>
- The 5.2% increase in mortality capture has a meaningful effect on overall survival in both EHR-focused RWD early and metastatic disease (Figure 1). Inclusion of all commercially available sources of mortality will enhance the comparability of death information in EHR-focused RWD and prospectively collected clinical data.

# References

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