**Standardizing Time Toxicity Metrics for Tracheostomy Patients Across Health Systems Using OMOP-CDM**

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## Background

Tracheostomy is a procedure commonly performed in both emergent and elective settings across a wide range of patient populations, including neonates and critically ill adults.[1] While this intervention can be life-sustaining, it may also impose significant burdens on patients and families. "Time toxicity," defined as time spent receiving healthcare rather than at home, has emerged as a valuable metric for evaluating the burden of care. [2,3] It is increasingly important to include this dimension in shared decision-making, especially when the time required for treatment may outweigh its survival benefits. Despite its relevance, time toxicity has not been systematically measured in harmonized observational health data, particularly across age groups.

## Methods

We developed a custom SQL-based feature to measure time toxicity in tracheostomy patients across all age groups using data structured according to the OMOP Common Data Model. Our algorithm quantifies healthcare system contact by measuring cumulative time spent in various visit types (e.g., inpatient, outpatient, emergency department) in the year following tracheostomy. We applied this to an observational cohort of patients who underwent planned tracheostomy procedures, stratified into four age groups (infants, pediatric, young adults, and adults). In addition to time toxicity, we characterized patient demographics, comorbidities, mortality, and healthcare utilization metrics including length of stay and visit frequency. Data were sourced from the OMOP-mapped electronic health records of a large academic health system.

**Results**

Time toxicity varied significantly across age groups and visit types (Figure 1). Infants had the highest proportion of time spent in healthcare settings (49.3%), while young adults had the lowest (29.2%). Inpatient visits accounted for the majority of time toxicity across all groups. Our Table 1 summarizes population characteristics, including gender, race, mortality, healthcare utilization, and the 15 most prevalent conditions other than tracheostomy. Notably, comorbidities such as acute hypoxemic respiratory failure, hypertension, and gastroesophageal reflux disease were common in all age groups but especially prevalent in adults and infants.

**Table 1.** *Demographics, Comorbidities, and Healthcare Utilization by Age Group*

| Domain | Variable | Infants (age <1) | Pediatric (age 1-18) | Young Adults (age 18-26) | Adults (age 26+) | All stratas |
|---|---|---|---|---|---|---|
| Gender | FEMALE | 44.26% | 55.29% | 25.56% | 41.84% | 41.77% |
| | MALE | 55.74% | 44.71% | 74.44% | 58.16% | 58.23% |
| Race | American Indian or Alaska Native | 0.00% | 0.00% | 1.11% | 0.31% | 0.32% |
| | Asian | 0.00% | 2.35% | 3.33% | 2.36% | 2.33% |
| | Black or African American | 45.90% | 31.76% | 45.56% | 37.65% | 37.94% |
| | White | 40.98% | 51.76% | 36.67% | 48.52% | 48.02% |
| | Other | 13.11% | 14.12% | 13.33% | 11.17% | 11.39% |
| Visit Counts and LOS | ER Visit Count - After Index Visit | 2.90 | 1.55 | 1.14 | 0.44 | 0.57 |
| | ER Visit Count - Before Index Visit | 0.02 | 0.80 | 0.69 | 0.68 | 0.67 |
| | IP LOS - After Index Visit (max) | 19.02 | 26.55 | 25.82 | 20.84 | 21.25 |
| | IP LOS - Index Visit | 176.48 | 76.56 | 53.16 | 50.74 | 54.73 |
| | IP LOS - Prior to Index Visit (max) | 42.90 | 40.03 | 12.14 | 11.80 | 13.20 |
| | IP Visit Count - After Index Visit | 4.15 | 3.05 | 2.19 | 1.69 | 1.81 |
| | IP Visit Count - Prior to Index Visit | 0.23 | 1.81 | 0.98 | 1.06 | 1.06 |
| | OP Visit Count - After Index Visit | 131.43 | 84.07 | 51.06 | 42.29 | 46.16 |
| | OP Visit Count - Before Index Visit | 3.39 | 24.40 | 10.02 | 15.82 | 15.60 |
| | time (days) between cohort start and end | 426.97 | 305.29 | 281.34 | 201.65 | 213.41 |
| Comorbidities, Sequela | Essential hypertension | 37.70% | 45.88% | 54.44% | 59.69% | 58.50% |
| | Acute hypoxemic respiratory failure | 37.70% | 54.12% | 45.56% | 51.31% | 50.87% |
| | Sepsis | 36.07% | 32.94% | 43.33% | 50.48% | 49.29% |
| | Dysphagia | 31.15% | 37.65% | 36.67% | 48.21% | 47.03% |

| | | | | | | |
|---|---|---|---|---|---|---|
| | Acute kidney injury | 29.51% | 37.65% | 30.00% | 48.52% | 47.03% |
| | Hyperosmolality and or hypernatremia | 24.59% | 41.18% | 40.00% | 45.29% | 44.46% |
| | Hypokalemia | 42.62% | 58.82% | 48.89% | 43.50% | 44.19% |
| | Anemia | 45.90% | 40.00% | 40.00% | 43.50% | 43.31% |
| | Low blood pressure | 55.74% | 42.35% | 38.89% | 40.92% | 41.26% |
| | Complication of procedure | 47.54% | 40.00% | 43.33% | 40.92% | 41.14% |
| | Acidosis | 54.10% | 40.00% | 37.78% | 34.08% | 34.89% |
| | Gastroesophageal reflux disease without esophagitis | 73.77% | 57.65% | 27.78% | 32.90% | 34.53% |
| | Atelectasis | 62.30% | 57.65% | 37.78% | 29.10% | 31.17% |
| | Acute on chronic hypoxemic respiratory failure | 70.49% | 62.35% | 27.78% | 28.27% | 30.42% |
| | Acute tracheitis without obstruction | 85.25% | 63.53% | 16.67% | 15.05% | 18.43% |
| Mortality | 30-day Mortality | 0.00% | 0.04% | 0.12% | 4.63% | 4.79% |
| | Total Mortality | 0.67% | 0.67% | 0.32% | 21.68% | 23.34% |

**Table 2.** *Time Toxicity by Visit Type and Age Group*

| Visit Type | Infants (age <1) | Pediatric (age 1-18) | Young Adults (age 18-26) | Adults (age 26+) | All stratas |
|---|---|---|---|---|---|
| Home Visit | 0.07% | 0.08% | 0.03% | 0.07% | 0.07% |
| Telehealth Provided Other than in Patient's Home | 0.11% | 0.12% | 0.10% | 0.11% | 0.11% |
| Emergency Room Visit | 0.21% | 0.22% | 0.19% | 0.13% | 0.14% |
| Outpatient Visit | 0.46% | 0.72% | 0.74% | 0.80% | 0.78% |
| Inpatient Visit | 48.48% | 35.60% | 28.09% | 33.71% | 34.25% |
| **All Visits** | **49.34%** | **36.74%** | **29.15%** | **34.82%** | **35.35%** |

## Conclusion

Our approach enables standardized, scalable, and reproducible measurement of time toxicity using OMOP-harmonized data. By incorporating this metric into routine analytics, researchers and clinicians can better understand the real-world burden of interventions like tracheostomy. We invite the OHDSI community to adopt and refine our approach for broader use in patient-centered outcomes research and shared decision-making tools.

**References:**


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