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Analysis of Biased Language in the Medical Record Used to Describe Patients after Traumatic Brain Injury

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BACKGROUND

Biased or stigmatizing language refers to words and attitudes that convey negative impressions of patients (e.g "non-compliant," "aggressive," etc). Prior studies have identified specific words and phrases, as well as themes in negative language such as patient disapproval, that negatively influence provider attitudes towards patients and medical decision making.[1-4] Incidence of biased language use is increased in medical records of patients from historically disadvantaged groups and stigmatized diagnoses.[5,6]

Patients with **traumatic brain injury (TBI)** are a vulnerable population, often labeled as difficult due to TBI-related agitation.

Our study compares the incidence of **biased language use in medical records of patients with TBI and patients without TBI.** Our study also involves **using and comparing multiple methods of analyzing patient notes** for biased-language content.

METHODS

Population

- Adult patients admitted to a trauma center with TBI 2021-2023
- Propensity-matched cohort of patients admitted with other trauma

Study Design for Biased Language Analysis

Method #1: Biased-Word Quantification

Five words considered biased language were selected to count in patient notes: refuse, non-compliant, addict, combative, uncooperative
A custom algorithm was created to count the occurrences of each word in ~3000 patient charts.
Outcome: average number of biased words per note for the TBI group vs the non-TBI group

Method #2: Sentiment Analysis using Artificial Intelligence (AI) tools

Sentiment analysis uses **Natural Language Processing (NPL)** to identify emotional tone or sentiment in text. Note excerpts from both cohorts were scored by the "**VADER**" sentiment analysis tool.
Outcome: average VADER score for the TBI group vs the non-TBI group

Method #3: Manual Review

Two trainees will manually review a smaller sample of a few hundred notes from each cohort and score the sentiment of the notes as positive or negative.
Outcome: Reviewer sentiment scores for the TBI group vs the non-TBI group

RESULTS

Biased-Word Quantification:

Demographic Data

	TBI group (N = 2999)	Non–TBI group (N=2961)
Age at Injury		
Mean (SD)	52.6 (21.0)	52.9 (20.6)
Injury Severity Score		
Mean (SD)	10.3 (10.8)	10.4 (8.7)
Gender (male)	2134 (71%)	2124 (82%)
Race		
Asian	190 (6.3%)	184 (6.2%)
Black	209 (7.0%)	207 (7.0%)
Native Am	57 (1.9%)	45 (1.5%)
White	2311 (77%)	2307 (78%)
Pacific Islander	29 (1.0%)	28 (0.9%)
Other	70 (2.3%)	67 (2.3%)
Unknown	133 (4.4%)	123 (4.2%)
Ethnicity		
Hispanic	360 (12%)	347 (12%)
Non-hispanic	2541 (85%)	2527 (85%)
Unknown	89 (3.3%)	87 (2.9%)
Insurance		
Charity	35 (1.2%)	40 (1.4%)
Medicare/medicaid	1036 (35%)	1052 (35%)
Private	1830 (62%)	1855 (62%)
Unknown/other	57 (1.9%)	55 (1.9%)

Table 1: Demographic data for patients with TBI and matched cohort of patients without TBI

VADER sentiment analysis:

We tested the ability of VADER to rate sentiment in sample medical notes written in neutral or biased language.

Average VADER Sentiment Scores of Excerpts from Vignettes

	Sentiment score	Std Dev	P-value
Biased vignettes	0.0069 (N = 19)	0.17	0.65
Neutral Vignettes	-0.0211 (N = 20)	0.17	

Table 2: VADER sentiment scores for sample charts. VADER assigned sentiment scores to vignettes that were deliberately written in biased or neutral language and were shown in previous studies to influence provider bias.[2,3] VADER assigns a polarity score on a scale from 1 to -1, 1 being the most positive, -1 being the most negative, and 0 being neutral. Excerpts from the biased vignettes were scored, on average, slightly positive, while excerpts from the neutral vignettes were scored slightly negative.

Biased Word Occurrences in Chart per Day of Admission

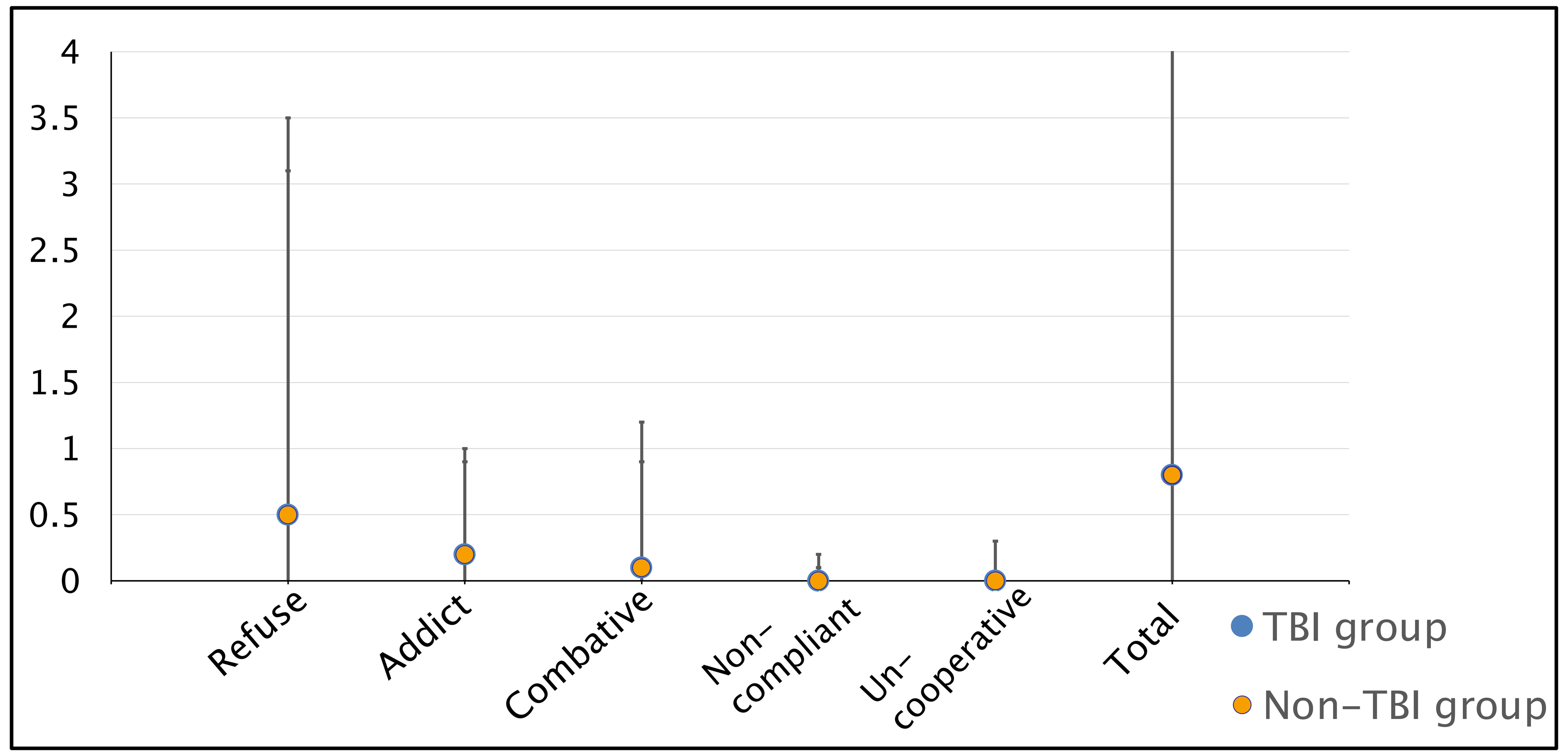

Figure 1: Average occurrences of each selected word per day of admission for patients with TBI and patients without TBI. No significant difference was found between groups.

DISCUSSION

Education and feedback for providers to write patient-centered notes that minimize transmission of bias should be informed by how biased language is used, especially for specific populations at risk, such as patients with TBI. Guidelines and tools for identifying biased language have yet to be standardized.

Biased-word quantification showed that certain words we chose to count, particularly the words "refuse" and "addict", occurred quite frequently on average in patient charts, although with high variability. The average occurrence of each word and total biased words did not differ between the group of patients with TBI and the matched cohort without TBI. Further analysis with logistic regression will examine whether TBI diagnosis is a factor in biased word occurrence when taking other demographics into account.

Preliminary testing of sentiment ratings by AI sentiment analysis tool, "VADER", aligned poorly with provider perception of sentiment. Neutral vignettes were scored as more negative, as shown in Table 2. Current AI sentiment analysis tools may not be attuned to detect language that is considered negative in medical records based on our initial testing.

NEXT STEPS

Current study:

- Perform further analysis of trends in biased word quantification based on demographics, day of admission, etc.
- Complete manual review of notes by trainees, and compare reviewer sentiment score of notes for patients with and without TBI
- Correlate reviewer sentiment score of notes with number of biased words and VADER scores

Future work:

- Identify correlations between biased language and clinical outcomes for patients with TBI

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