

Healthcare Utilization and Costs of Veterans Screened and Assessed for Traumatic Brain Injury

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VETERANS HEALTH ADMINISTRATION

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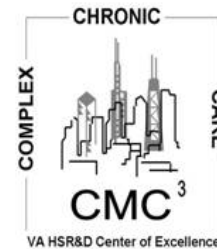
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Background: Mild Traumatic Brain Injury

- 15% to 20% of Services Members in the Afghanistan (Operation Enduring Freedom [OEF]) and Iraq (Operation Iraqi Freedom [OIF]) conflicts have had mild traumatic brain injury (TBI)
- Mild TBI can manifest as affective, somatic, and cognitive symptoms including
 - Headaches
 - Problems with sleep
 - Balance and/or Memory
 - Irritability
 - Sensitivity to light

Background: Screening of TBI

- VA implemented a national clinical reminder (CR) in 2007 to screen for TBI
- Veterans who screen positive are referred for a comprehensive TBI evaluation (CTBIE)
- TBI diagnosis is made after completion of CTBIE

Objectives

- To identify healthcare utilization and cost patterns of OEF/OIF Veterans following screening for TBI
- To determine the association of patient characteristics with healthcare utilization and costs of OEF/OIF Veterans following screening for TBI

Study Design

- We examined healthcare utilization and costs over a 12-month period following an *index date*
- *Index date*
 - For Veterans with TBI screen: Date of TBI screening
 - For Veterans without TBI screen: Date of first VA healthcare utilization after separation from the military and after April 14, 2007

Study Design (Cont.)

- All Veterans were categorized into TBI screening groups by whether they had:
 - No TBI screen
 - Negative Screen
 - Positive Screen
- Among Veterans with positive TBI screen who received the CTBIE, we categorized Veterans into CTBIE result groups:
 - Negative comprehensive TBI evaluation (CTBIE)
 - Positive comprehensive TBI evaluation (CTBIE)

Methods: Sample

- OEF/OIF Veterans were included if:
 - Member of the VA OEF/OIF roster
 - Military service separation date was after September 11, 2001 and before September 30, 2008
 - Had a VA inpatient or outpatient visit between April 14, 2007 and September 30, 2008
 - Indicated “yes” on the TBI screen that they had been deployed in Afghanistan and/or Iraq
- Final sample derived from this national population included 170,681 OEF/OIF Veterans

Methods: Data Sources

- OEF/OIF Roster
 - To identify subjects
 - Demographic data
- VA National TBI Health Factors database
 - To create the index date for each Veteran
- Comprehensive TBI Evaluation database
- VA Medical Inpatient and Outpatient Datasets
- VA Decision Support System (DSS) National Data Extracts (NDEs)
- VA Fee Basis Databases

Methods: Measures of Healthcare Utilization and Costs

- Outpatient utilization and cost categorizes included (based on clinic stop codes in DSS NDEs) :
 - Primary care
 - Rehabilitation care
 - Polytrauma care
 - Mental health care
 - Other specialty care
 - Non-VA outpatient (from Fee Basis files)
- We assessed costs on
 - Day of index visit
 - Day of comprehensive TBI evaluation (CTBIE)

Methods: Measures of Healthcare Utilization and Costs (Cont.)

- Outpatient pharmacy utilization and costs were from DSS NDEs
- Inpatient utilization and cost categories included (based on bed section):
 - Short-term medical/surgical
 - Spinal cord injury (SCI)
 - Psychiatric
 - Rehabilitation
 - Intensive Care Unit
 - Long-term care
 - Non-VA care financed by VA (from the VA Fee Basis files)

Methods: Measures of Healthcare Utilization and Costs (Cont.)

- Total costs per patient during 12 months following index date included
 - Total outpatient
 - Total outpatient pharmacy
 - Total inpatient
- All costs were adjusted to 2008 dollars using Consumer Price Index

Methods: Analyses

- We compared the 3 TBI screening groups and 2 comprehensive TBI evaluation result groups
 - Chi-Square: To compare Veteran characteristics
 - ANOVA : To compare unadjusted utilization and costs
 - Logistic regression: To compare hospitalization controlling for patient characteristics
 - Negative Binomial Models: To compare outpatient visits controlling for patient characteristics
 - Generalized linear models with gamma distribution and log link function: To compare total costs

Sample Description: By TBI Screening Groups

- 170,681 Veterans met inclusion criteria:
 - 14,266 (8%) had no TBI screen
 - 124,335 (73%) screened negative
 - 32,080 (19%) screened positive

Patient Characteristics: By TBI Screening Groups

Characteristic	No TBI Screen	Screened Negative	Screened Positive
GENDER: male	86.9%	85.9%	94.0%
AGE			
Under 25	19.4%	20.0%	25.4%
25-29	35.8%	31.3%	32.9%
30-34	13.5%	12.8%	13.2%
35+	31.3%	36.0%	28.5%
MARRIED	43.7%	46.8%	47.3%
RACE/ETHNICITY			
White	68.2%	70.5%	74.5%
Black	16.7%	17.0%	13.9%
Hispanic	12.3%	11.7%	11.8%

Patient Characteristics : By TBI Screening Groups

Characteristic	No TBI Screen	Screened Negative	Screened Positive
EDUCATION			
High School/GED or less	81.1%	78.5%	85.3%
Some College	9.8%	10.8%	8.6%
College	7.0%	8.3%	5.0%
Beyond College	2.1%	2.4%	1.2%
SERVICE CONNECTED DISABILITY	33.8%	35.5%	41.9%

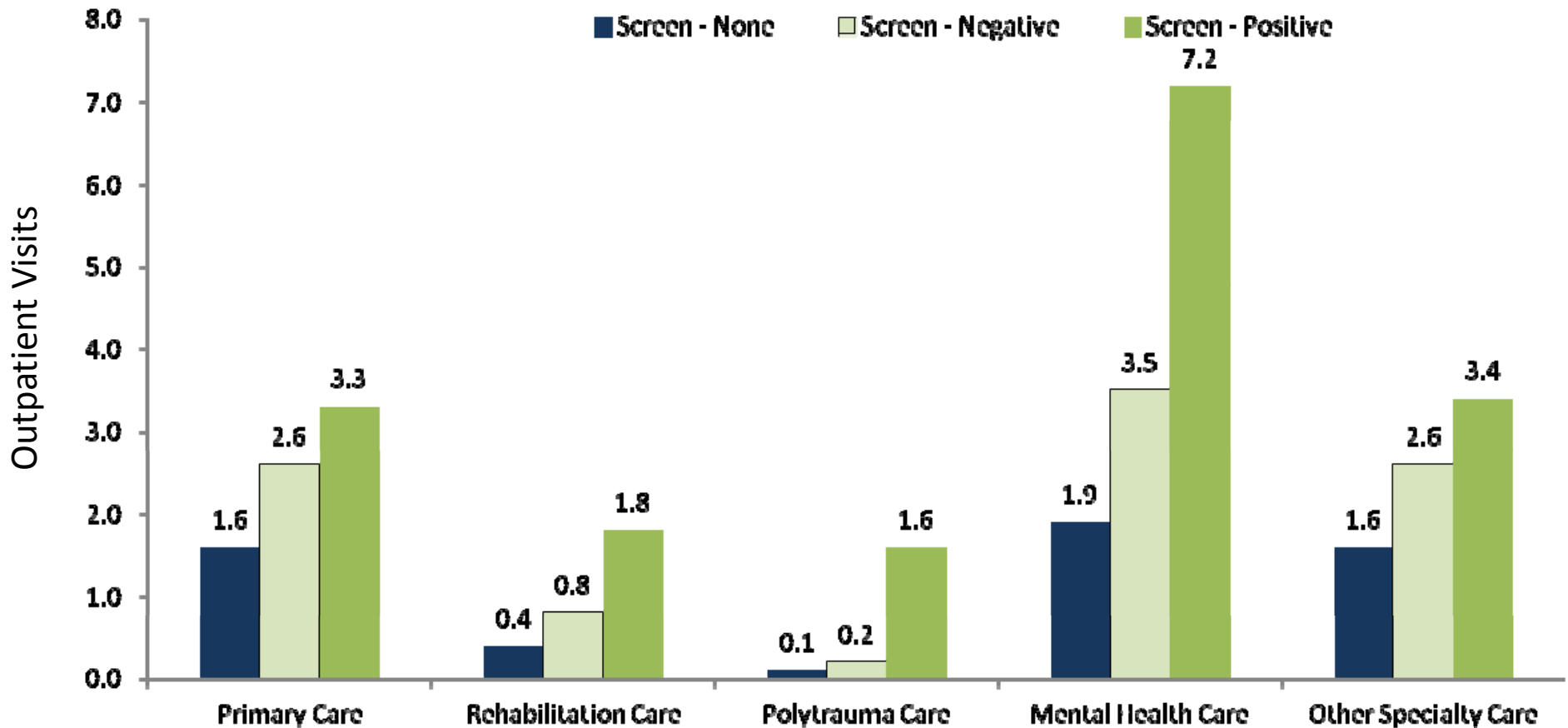
Patient Characteristics : By TBI Screening Groups

Characteristic	No TBI Screen	Screened Negative	Screened Positive
COMORBIDITIES			
Anxiety Disorder	5.8 %	5.7%	8.3%
Adjustment Disorder	5.5%	5.2%	7.2%
Substance Use Disorder	5.4%	4.6%	8.5%
Psychosexual Disorder	0.9%	0.9%	1.2%
Psychoses	0.7%	0.6%	0.7%
Post Traumatic Stress Disorder (PTSD)	15.4%	14.2%	30.7%
Depression	11.6%	11.7%	17.7%

: By TBI Screening Groups

Characteristic	No TBI Screen	Screened Negative	Screened Positive
LOST CONSCIOUSNESS			
Did Lose Consciousness	0%	1.6%	13.8%
Did Not Lose Consciousness	0%	2.3%	23.7%
Unknown	100%	96.1%	62.4%
EVACUATED FROM THEATER	0%	0.9%	6.5%
ETIOLOGY			
Bullet	0%	0.2%	2.1%
Fall	0%	1.1%	11.7%
Vehicular Accident	0%	1.1%	11.4%
Blast	0%	3.5%	34.3%

Healthcare Outpatient Utilization 12 Months Following Index Date by TBI Screening Groups (Unadjusted)

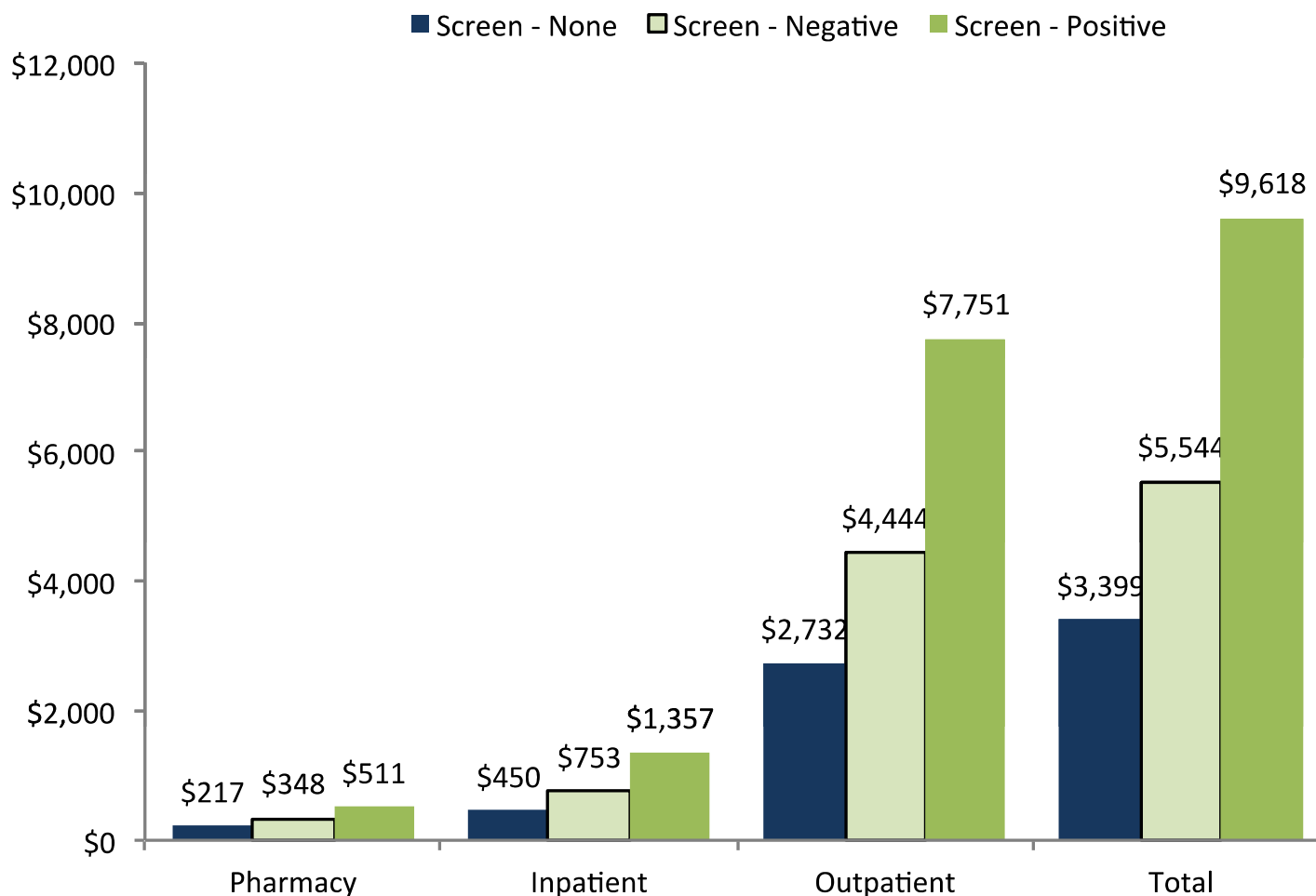


For each type of outpatient visits: P < 0.001 for comparison of screening groups

Results: Utilization By TBI Screening Groups (Unadjusted)

Healthcare Utilization	No TBI Screen	Screened Negative	Screened Positive
VA OUTPATIENT PHARMACY	7.0	14.1	20.2
INPATIENT ADMISSIONS			
Acute Care Days	0.2	0.4	0.7
Rehabilitation Days	0.02	0.01	0.01
Spinal Cord Injury (SCI) Days	0.01	0.02	<0.01
Mental Health Days	0.2	0.4	1.0
Intensive Care Unit (ICU) Days	0.01	0.01	0.01
Long-Term Care Days	0.02	0.03	0.03
Other Non-Acute Care Days	0.1	0.3	0.7
Non-VA Days	0.05	0.06	0.07

Healthcare Costs 12 Months Following Index Date by TBI Screening Groups (Unadjusted)



For each type of cost: P < 0.001 for comparison of screening groups

Results: Costs 12 Months after Index Date By TBI Screening Groups (Unadjusted)

Healthcare Cost	No TBI Screen	Screened Negative	Screened Positive
OUTPATIENT COSTS, TOTAL	\$2,732	\$4,444	\$7,751
INDEX EVALUATION	\$349	\$404	\$449
COMPREHENSIVE TBI EVALUATION	0	\$27	\$293
OTHER OUTPATIENT COSTS			
Primary Care	\$448	\$705	\$931
Rehabilitation Costs	\$71	\$144	\$353
Polytrauma Costs	\$36	\$71	\$696
Mental Health Care	\$446	\$834	\$1,806
Specialty Care	\$603	\$950	\$1,243
Other Outpatient Costs	\$616	\$1,048	\$1,638
Non-VA Outpatient Costs	\$162	\$263	\$342

Results: Costs 12 Months after Index Date By TBI Screening Groups (Unadjusted)

Healthcare Cost	No TBI Screen	Screened Negative	Screened Positive
INPATIENT COSTS, TOTAL	\$450	\$753	\$1,357
Acute Care Costs	\$174	\$297	\$506
Rehabilitation Costs	\$18	\$12	\$15
Spinal Cord Injury Costs	\$11	\$15	\$5
Mental Health Costs	\$97	\$178	\$452
Intensive Care Unit Costs	\$17	\$22	\$25
Long-Term Care Costs	\$9	\$16	\$15
Non-Acute Care Costs	\$51	\$119	\$226
Non-VA Costs	\$75	\$93	\$112
HEALTHCARE COSTS, TOTAL	\$3,399	\$5,544	\$9,618

Results: Association between TBI screening group and healthcare utilization and costs (Adjusted)

- After adjusting for patient characteristics, there continued to be associations between TBI screening group and healthcare utilization and costs during the 12 months after the index date
- For Veterans who screened positive compared to Veterans with no TBI screening, there were:
 - 1.7 times more primary care visits
 - 1.7 times more rehabilitation visits
 - 2.5 times more polytrauma visits
 - 1.5 times more mental health visits
 - 1.6 times more other specialty care outpatient visits
 - Total healthcare costs were \$4,550 higher

Results: Association of patient characteristics with healthcare utilization and costs (Adjusted)

Characteristic	Hospitalized Odds Ratio	Primary Care Visits IRR	Rehabilitation Care Visits IRR	Polytrauma Care Visits IRR	Mental Health Care IRR	Other Specialty Care Visits IRR	Total Costs
MALE	0.8	0.7	1.1	1.3	0.9	0.8	-\$905
EVACUATION FROM THEATER	1.1	1.1	1.2	1.2	1.0	1.2	\$1,222
BLAST INJURY	1.3	1.1	1.3	1.5	1.2	1.2	\$1,607
COMORBIDITIES							
Psychoses	3.2	1.2	0.9	1.0	1.8	1.0	\$4,903
Substance Use Disorder	3.1	1.0	0.9	0.9	1.3	0.9	\$2,436
Depression	1.6	1.1	1.0	1.1	1.5	1.1	\$1,609
PTSD	1.4	1.1	1.1	1.2	1.7	1.1	\$1,493

Sample Description: By CTBIE Result Groups

- Among those who screened positive and received the CTBIE:
 - 6,163 (46%) tested positive for TBI
 - 7,305 (54%) tested negative for TBI

Patient Characteristics: By CTBIE Result Groups

Characteristic	CTBIE-Negative	CTBIE-Positive
GENDER: male	94.1%	95.3%
AGE		
Under 25	23.1%	27.0%
25-29	31.4%	34.2%
30-34	13.2%	12.9%
35+	32.3%	25.9%
MARRIED	48.4%	47.5%
RACE/ETHNICITY		
White	73.3%	76.8%
Black	15.0%	11.4%
Hispanic	11.6%	11.3%

Patient Characteristics: By CTBIE Result Groups

Characteristic	CTBIE-Negative	CTBIE-Positive
EDUCATION		
High School/GED or less	83.9%	86.5%
Some College	9.6%	7.7%
College	5.2%	4.6%
Beyond College	1.3%	1.3%
SERVICE CONNECTED DISABILITY	41.3%	43.5%

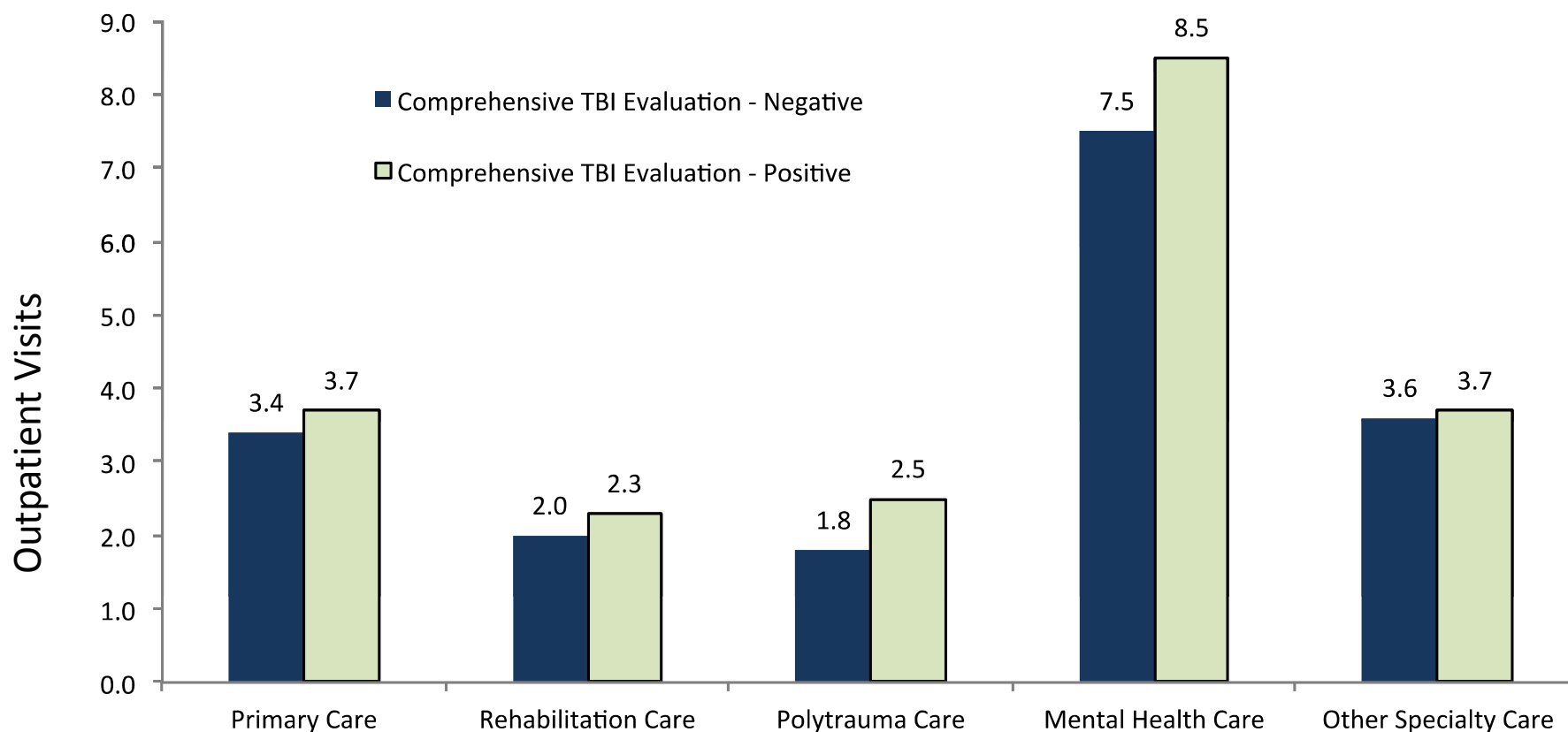
Patient Characteristics: By CTBIE Result Groups

Characteristic	CTBIE-Negative	CTBIE-Positive
COMORBIDITIES		
Anxiety Disorder	7.2%	7.6%
Adjustment Disorder	6.8%	6.5%
Substance Use Disorder	7.7%	8.5%
Psychosexual Disorder	1.1%	1.1%
Psychoses	0.6%	0.7%
PTSD	26.6%	31.4%
Depression	15.7%	16.7%

Patient Characteristics: By CTBIE Result Groups

Characteristic	CTBIE-Negative	CTBIE-Positive
LOST CONSCIOUSNESS		
Did Lose Consciousness	18.2%	48.9%
Did Not Lose Consciousness	69.8%	38.2%
Unknown	11.9%	13.0%
EVACUATED FROM THEATER	11.5%	19.2%
ETIOLOGY		
Bullet	4.3%	5.1%
Fall	25.6%	28.5%
Vehicular Accident	23.4%	29.0%
Blast	74.8%	85.3%

Healthcare Outpatient Utilization 12 Months Following Index Date by Comprehensive TBI Evaluation Result Group (Unadjusted)

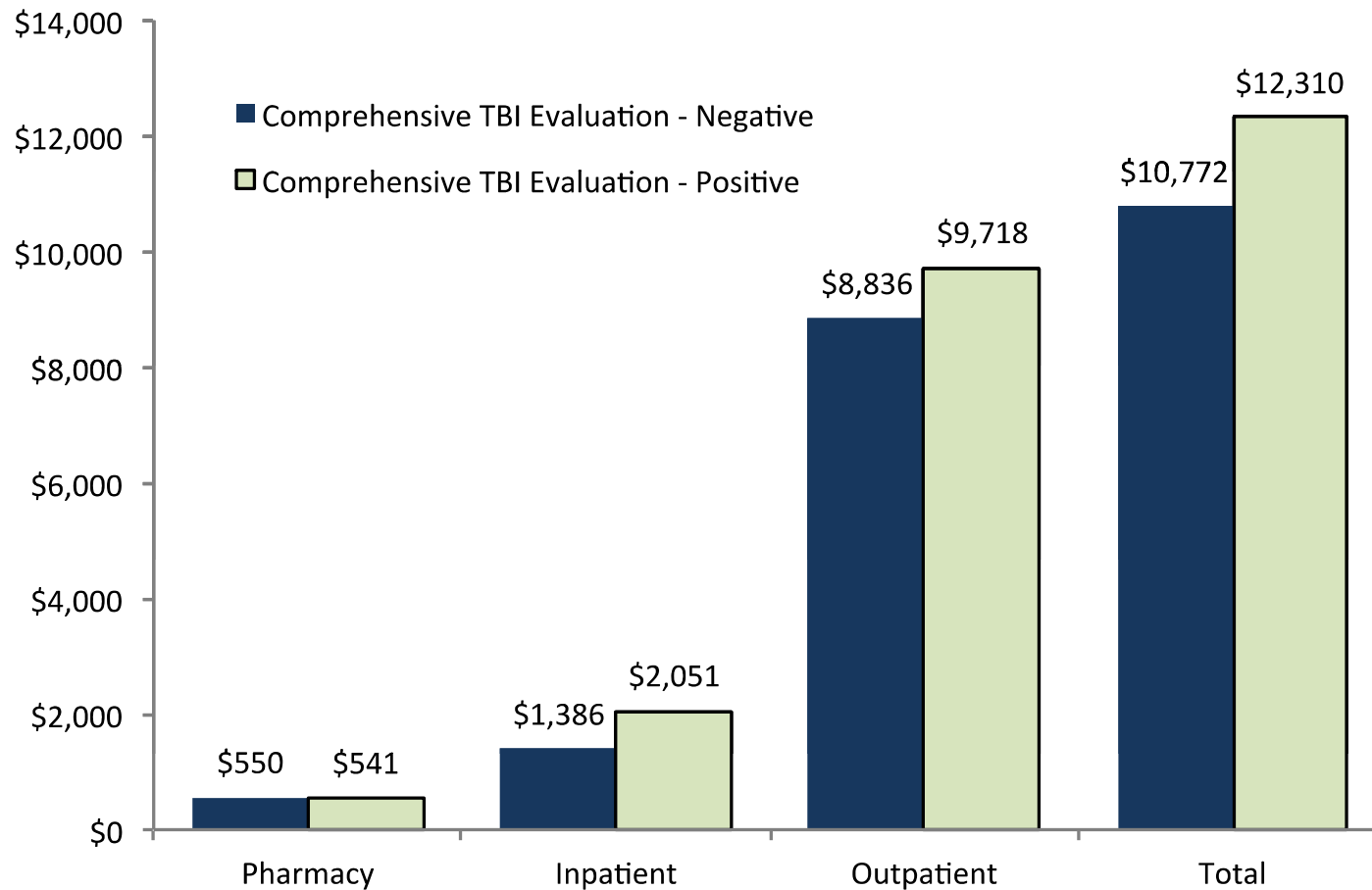


For each type of outpatient visits: $P < 0.001$ for comparison of CTBIE result groups, except for other specialty care ($p = 0.32$)

Results: Utilization By CTBIE Result Groups (Unadjusted)

Healthcare Utilization	CTBIE-Negative	CTBIE-Positive
VA OUTPATIENT PHARMACY	20.7	21.4
INPATIENT ADMISSIONS		
Acute Care Days	0.9	1.3
Rehabilitation Days	<0.01	0.01
SCI Days	0.01	<0.01
Mental Health Days	0.9	1.3
ICU Days	0.01	0.01
Long-Term Care Days	0.03	0.05
Other Non-Acute Care Days	0.7	0.7
Non-VA Days	0.04	0.11

Healthcare Costs 12 Months Following Index Date by Comprehensive TBI Evaluation Result Group (Unadjusted)



For each type of cost: $P < 0.001$ for comparison of CTBIE result groups, except for pharmacy ($P = 0.89$)

Results: Costs 12 Months after Index Date By CTBIE Result Groups (Unadjusted)

Healthcare Cost	CTBIE-Negative	CTBIE-Positive
OUTPATIENT COSTS, TOTAL	\$8,836	\$9,718
INDEX EVALUATION	\$460	\$468
COMPREHENSIVE TBI EVALUATION	\$709	\$666
OTHER OUTPATIENT COSTS		
Primary Care	\$993	\$1,111
Rehabilitation Costs	\$412	\$455
Polytrauma Costs	\$912	\$1,144
Mental Health Care	\$1,888	\$2,255
Specialty Care	\$1,314	\$1,311
Other Outpatient Costs	\$1,776	\$1,975
Non-VA Outpatient Costs	\$370	\$333

Results: Costs 12 Months after Index Date By CTBIE Result Groups (Unadjusted)

Healthcare Cost	CTBIE-Negative	CTBIE-Positive
INPATIENT COSTS, TOTAL	\$1,386	\$2,051
Acute Care Costs	\$626	\$971
Rehabilitation Costs	\$4	\$14
SCI Costs	\$4	\$0.2
Mental Health Costs	\$424	\$598
ICU Costs	\$30	\$17
Long-Term Care Costs	\$23	\$24
Non-Acute Care Costs	\$203	\$230
Non-VA Costs	\$73	\$197
HEALTHCARE COSTS, TOTAL	\$10,772	\$12,310

Results: Association between CTBIE result group and healthcare utilization and costs (Adjusted)

- There continued to be associations between CTBIE result group and healthcare utilization and costs during the 12 months after the index date, after adjusting for patient characteristics
- For Veterans with a positive comprehensive TBI evaluation:
 - 1.1 times more rehabilitation visits
 - 1.2 times more polytrauma visits
 - 1.04 times more mental health visits
 - Total healthcare costs were \$972 higher

Results: Association between other factors and healthcare utilization and costs (Adjusted)

- Other patient and facility characteristics associated with healthcare utilization and costs included
 - Male
 - 0.8 times fewer primary care visits
 - 0.8 time fewer other specialty care visits
 - Total costs were \$1,524 lower
 - Being evacuated from the theater
 - 1.1 times greater odds of hospitalization
 - 1.1 times more primary care visits
 - 1.1 times more rehabilitation visits
 - 1.2 times more other specialty care visits
 - Total costs were \$1,482 higher

Results: Association between comorbidities and healthcare utilization and costs (Adjusted)

- Psychoses
 - 2.1 times greater odds of hospitalization
 - \$6,820 higher costs than Veterans without this condition
- Substance use disorder
 - 3.0 times greater odds of hospitalization
 - \$3,930 higher costs than Veterans without this condition

Summary

- Veterans with a positive TBI screen had
 - Over 70% higher healthcare costs than Veterans who screened negative: \$9,618 (Screened Positive) vs. \$5,544 (Screened Negative)
 - Over 180% higher costs than Veterans with no TBI screening: \$9,618 (Screened Positive) vs. \$3,399 (No TBI Screening)
- Veterans who received CTBIE and had a positive diagnosis of TBI had
 - 14% higher total costs than for those without a TBI diagnosis: \$12,310 (Positive TBI diagnosis) vs. \$10,772 (Negative TBI diagnosis)

Summary

- Substantial portion of services used were for mental health care during 12 months following index date
 - Largest number of outpatient visits were to mental health clinics
 - Over 40% of inpatient days in VA facilities were for mental health care
 - Veterans with blast TBI etiologies, psychoses and substance use have significantly higher odds of hospitalization after the index date

Implications

- This study highlights the additional resources needed to provide care for Veterans with TBI relative to other Veterans
 - Over 20% of Veterans had positive TBI screen but accounted for over 30% of total cost (\$308 million) among Veterans who received the screening (\$997 million)
 - Average annual cost of Veterans with TBI confirmed through CTBIE (\$12,310) was more than twice the average cost for all VA users (\$5,765)

Implications

- Given the prevalence of TBI in OEF/OIF Veterans, evidence regarding the resources needed for Veterans screened for TBI is crucial for healthcare planning
- Substantial portion of care following the index visit was directly mental health related, particularly for patients who screened positive for TBI
- Results from TBI screening may assist in anticipating the scope and type of healthcare services needed by OEF/OIF Veterans

Limitations

- CTBIE was not universally available or fully utilized across the system
- Some Veterans may have had private insurance and received non-VA care that was not captured in the VA Fee Basis files
- The duration of repeat service use was not examined beyond 12 months

Conclusions

- Over 12 months following their initial evaluation,
 - Veterans with a positive result on the on the TBI screen had over 60% higher total costs than Veterans who screened negative and more than double total costs of Veterans with no TBI screening
- Understanding healthcare utilization and cost patterns following TBI screening is important for policymakers as they address the on-going and future healthcare needs of returning OEF/OIF Veterans

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Questions?