RACIAL/ETHNIC AND INSURANCE STATUS DISPARITIES IN POST HOSPITALIZATION CARE FOR PATIENTS WITH TRAUMATIC BRAIN INJURY

By

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CERTIFICATE OF APPROVAL

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LIST OF ABBREVIATIONS

CDC	Centers for Disease Control and Prevention
CI	Confidence Interval
GEE	Generalized Estimating Equation
HDDI	Hospital Discharge Data Index
ICD	International Classification of Diseases
IRF	Inpatient Rehabilitation Facility
ISS	Injury Severity Score
LOS	Length of Stay
NHB	Non-Hispanic Black
NHO	Non-Hispanic Other
NHW	Non-Hispanic White
OHA	Oregon Health Authority
OR	Odds Ratio
SES	Socioeconomic Status
TBI	Traumatic Brain Injury
US	United States

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ABSTRACT

BACKGROUND:

Post-hospitalization care has been shown to improve short- and long-term outcomes as well as quality of life among patients who sustain traumatic brain injury (TBI). We examined racial/ethnic and insurance disparities in post-hospitalization care among adults hospitalized for TBI in the state of Oregon.

METHODS:

We utilized data from the Oregon Hospital Discharge Data Index for the four-year period 2008-2011. Patients hospitalized for unintentional TBI were identified based on diagnosis and external cause of injury codes. Receipt of post-hospitalization care was assessed using "discharge disposition," indicating whether the patient was discharged home or to post-hospitalization care. We characterized the proportions of patients discharged to post-hospitalization care by patient characteristics. Multivariable logistic regression was used to assess the association between receiving post-hospitalization care and race/ethnicity and insurance status while controlling for potential confounders. Clustering of data by hospital was accounted for using generalized estimating equations.

RESULTS:

A total of 6,997 patients were included in analyses. Overall, 28% of patients were discharged to post-hospitalization care; this proportion was greater for Non-Hispanic Whites (32%) than Non-Hispanic Other (20%), Non-Hispanic Black (17%) and Hispanic patients (11%). Few uninsured patients were discharged to post-hospitalization care (3%). While controlling for potential confounders, Hispanics were less likely discharged to post-hospitalization care (OR 0.62; CI 0.42–0.91) than Non-Hispanic Whites. Compared to

patients with private insurance, uninsured patients were less likely discharged to post-hospitalization care (OR 0.21; CI 0.11 – 0.41) while patients with public insurance (OR 1.74; CI 1.42 – 2.14) and worker's compensation (OR 1.57; CI 1.13 – 2.18) were more likely to be discharged to post-hospitalization care.

CONCLUSIONS:

This study suggests racial/ethnic and insurance status disparities exist with regard to receiving post-acute care after hospitalization for TBI. Future research should examine factors that might contribute to and reduce these inequities in care.

BACKGROUND

Traumatic brain injury (TBI) is characterized as a sudden trauma to the head or body, caused by an outside force that may alter normal brain function[1]. According to the Centers for Disease Control and Prevention (CDC)[2], approximately 1.7 million people sustain a TBI annually in the United States. While the majority of TBIs resolve with no long-term problems, approximately 3.2 million US civilians are living with TBI-related functional limitations[3]. The direct medical costs and indirect costs such as lost productivity associated with TBI totaled an estimated $76.5 billion in the US in 2000[4,5].

The severity of a TBI may range from mild, where there is a brief change in mental status or consciousness, to severe, where there is an extended period of unconsciousness or amnesia after the injury[6]. Mild TBI accounts for approximately 75% of brain injuries[7]. While the majority of those who sustain mild TBI will have complete symptom resolution within months of their injury, approximately 15% are known to experience long-term cognitive, physical, or emotional symptoms associated with their injury[8]. The other 25% of TBIs can be classified as moderate or severe and are often associated with complex, debilitating lifelong symptoms and functional disability.

Post hospitalization care is often needed for patients with TBI, at all severity levels, to help optimize recovery outcomes and allow patients to regain as much functionality as possible. Education about TBI as well as expectation setting is part of this process. Placement in a skilled nursing facility, a rehabilitation facility or with home health services is often

desirable[9]. Receiving post-hospitalization care has been shown to improve both short and long-term outcomes as well as overall quality of life among patients with TBI[10].

There is increased recognition of the existence of health disparities in our current healthcare system[11]. Patients' race and ethnicity are often associated with differences in access to care, treatment options, and health outcomes[12]. Several trauma systems studies have shown that ethnic minority patients are less likely to be placed in some form of rehabilitation after trauma than non-Hispanic White patients[11,13], suggesting inequalities in access to post-trauma care. Similar disparities appear to exist based on patients' insurance status, with regard to admittance to the hospital and discharge to post-hospitalization care. Research suggests that uninsured patients with TBI are less likely to be admitted to a hospital regardless of the severity of injury[14]. Uninsured patients also had higher mortality rates than patients with insurance[15]. According to one study, the absence of health insurance increased trauma patients' adjusted odds of death by almost 50%[16].

No research to our knowledge has examined racial/ethnic or insurance status disparities in post-hospitalization care among patients admitted for TBI utilizing statewide hospital discharge data. The primary objective of this study was to identify potential disparities in post-hospitalization care among all patients hospitalized with TBI. We hypothesized that among patients hospitalized with TBI: (1) non-Caucasian patients would be less likely to be discharged to post-hospitalization care than Caucasian patients; and (2) uninsured patients would be less likely to be discharged to post-hospitalization care than those with some form of insurance.

METHODS

This retrospective study utilized de-identified data from the Oregon Hospital Discharge Data Index (HDDI) for the four-year period of 2008 - 2011. The Oregon Health Authority (OHA) manages this database. The Oregon Health and Science University Institutional Review Board approved this study.

Study Population

The HDDI contains records on patient demographics, admission/discharge information, diagnoses, treatment, insurance, charges and nature of each discharge for every patient admitted into an Oregon hospital. For the current study, we included adults aged 18 years and older who had been hospitalized for an unintentional TBI in Oregon between the years 2008 – 2011. We excluded TBI cases coded as intentional in nature (i.e., assaults and suicides) because we expected post-hospitalization care to be systematically different for this cohort (i.e., potentially greater proportions discharged to psychiatric care). Patients admitted for TBI were identified based on International Classification of Diseases – 9th Revision – Clinical Modification (ICD-9-CM) codes using the same series as the CDC for national TBI surveillance[2]. Mechanism and intentionality of injuries were determined using ICD-9-CM external cause of injury codes (e-codes). Those patients indicated as having died, left the hospital against medical advice, or discharged/transferred to another facility or to hospice care were excluded from analyses. After accounting for inclusion/exclusion criteria, 6,997 patients were included in the study. Figure 1 depicts this process.

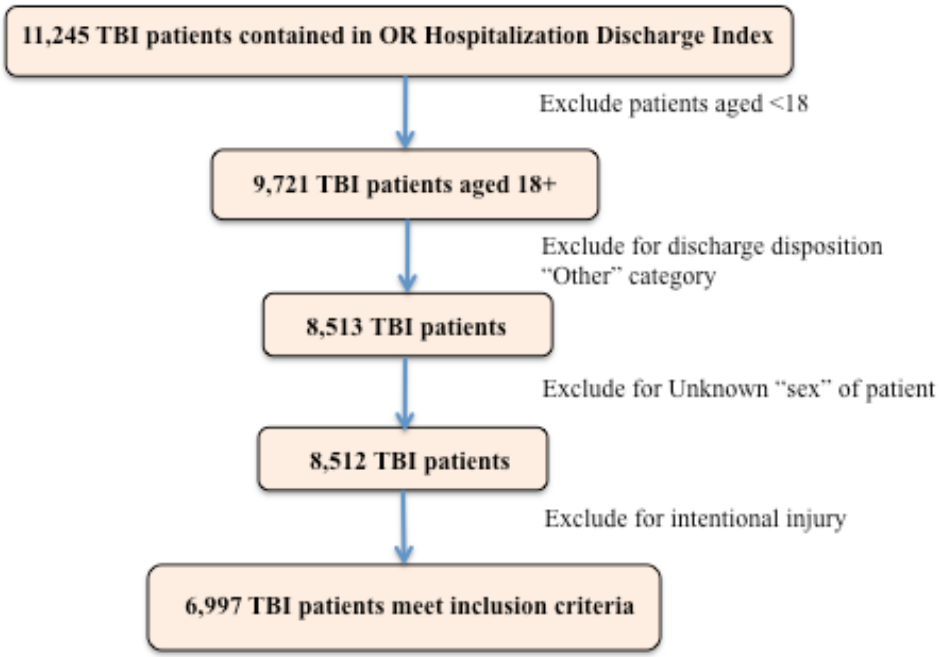

Figure 1. Study Inclusion/Exclusion Criteria, Oregon Hospital Discharge Data Index, 2008 – 2011

Measures

The main outcome of interest was post hospital discharge destination, identified in the database as "discharge disposition". We categorized this variable dichotomously to differentiate patients who were discharged to post-hospitalization care (in a hospital, outpatient facility, skilled nursing facility, or home health services) from those who were discharged home with no additional services.

There were two independent variables in this study: race/ethnicity and insurance status. Race/ethnicity was categorized as Non-Hispanic White (NHW), Non-Hispanic Black (NHB), Hispanic, and Non-Hispanic Other (NHO). There was a relatively high level of missing data for race/ethnicity across years, ranging from 7% to 33% (the highest level occurring in 2008,

when race/ethnicity was first collected in the HDDI). For purposes of the current analyses, "missing/unknown" race/ethnicity was included as a separate category.

Patients' primary insurance status was categorized as private (commercial insurance), public (Medicare, Medicaid), other government (Military health coverage, Indian Health Services), worker's compensation, uninsured and other. The category "other" included patients who received charity, were not charged, were self-insured, or had 'other payer' listed.

Other variables of interest included age, gender, injury severity score (ISS), mechanism of injury, length of stay (LOS), and hospital trauma level. We categorized age as 18 – 24, 25 – 44, 45 – 64, and 65+ years. As done in prior research[9, 17], we used ISS, an anatomic injury severity scoring system[18], to characterize the overall severity of patients' traumatic injuries. This system provides an overall score (ranging from 0 to 75) for patients with multiple injuries, with higher scores indicating more severe trauma. We used ICDPIC Version 3.0 to translate ICD-9-CM diagnosis codes to ISS levels[19]; past research has suggested this tool has good validity for estimating ISS[20]. Overall injury severity was categorized as mild (ISS ≤ 8), moderate (ISS 9 – 15), and severe (ISS > 15)[19].

Mechanisms of injury, based on e-codes, were categorized as falls, motor vehicles, struck by/against, firearms, and other. We categorized LOS as 1, 2 – 7, and 8+ days to reflect short, medium, and long hospital stays, as done in previous research[21, 22]. Finally, hospital trauma level was identified using the Oregon Trauma Registry Report, 2010-2011[23], and was categorized as Trauma Level I, II, III, IV, or not a trauma level hospital. Trauma level I / II

hospitals offer the most specialized levels of care[24]. Please refer to Appendix A for a list of key variables utilized.

Statistical Analysis

Descriptive analyses were performed to summarize all key variables. Multivariable logistic regression was used to examine the associations between race/ethnicity and insurance status and discharge to post-hospitalization care facilities while controlling for potentially confounding variables. Please refer to Appendix B for a table of significant predictors of discharge disposition. We estimated odds ratios (ORs) and 95% confidence intervals (CIs) using generalized estimating equations to account for clustering within individual hospitals[25]. Potential confounding factors were identified using an *a priori* causal model generated based on previous trauma literature, investigator knowledge, and hypothesized associations between variables[26]. Figure 2 depicts our hypothesized causal model. The following covariates were included in our multivariable model: gender, age, LOS, trauma level, and ISS. The possibility of an interaction between insurance status and ISS was explored, based on previous research findings[13]. However, the small sample size in the uninsured group did not allow for reliable estimates, so this interaction term was excluded. Alternatively, we examined cross-tabulations of discharge disposition broken out by ISS and insurance status. All analyses were performed using Stata/MP, version 12.1 (StataCorp, College Station, TX).

Sensitivity Analysis

Based on past research, post-hospitalization care may be appropriate for patients with all levels of TBI. To examine this possibility, we categorized TBI severity as mild versus

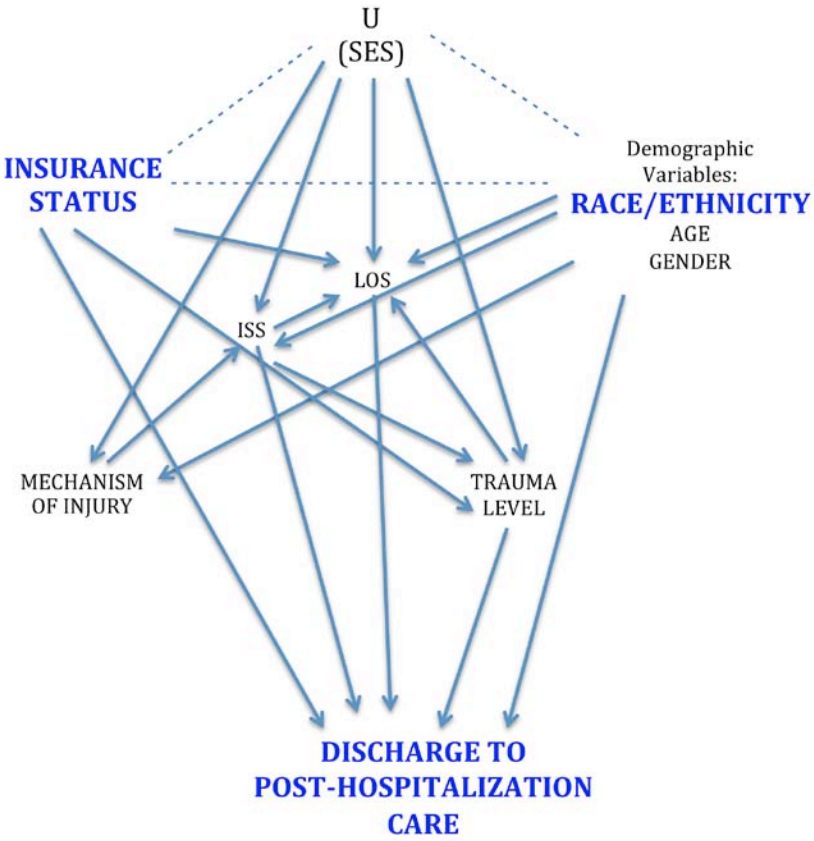

Figure 2. Causal Model

moderate/severe and conducted the same logistic regression analyses on only those with moderate/severe TBI. This categorization was based on a series of codes used by the CDC to identify mild TBI; this code series has been found to have acceptable validity[6,27]. Results of these analyses were similar to those from the primary analysis using patients with all levels of TBI severity and are therefore not separately reported.

RESULTS

Demographics for the 6,997 included patients are presented in Table 1, stratified by discharge destination. Overall, more patients were male (63%) and NHW (66%). Among the

TABLE 1. Characteristics of Patients admitted to Oregon Hospitals for TBI between 2008 and 2011, by Discharge Disposition

	Home (n = 5031)		Post-hospitalization care (n = 1966)		Total (n = 6997)
	n	(%)	n	(%)	n
Race/ethnicity					
Non-Hispanic White	3165	(68)	1473	(32)	4638
Non-Hispanic Black	63	(83)	13	(17)	76
Hispanic	316	(89)	40	(11)	356
Non-Hispanic Other	793	(80)	198	(20)	991
Missing/unknown	694	(74)	242	(26)	936
Insurance Status					
Private	1540	(82)	344	(18)	1884
Public	1411	(52)	1319	(48)	2730
Other Government	116	(79)	30	(21)	146
Worker's Compensation	255	(84)	50	(16)	305
Uninsured	745	(97)	23	(3)	768
Other*	964	(83)	200	(17)	1164
Gender					
Male	3335	(77)	977	(23)	4312
Female	1696	(63)	989	(37)	2685
Age (years)					
18 – 24	751	(90)	86	(10)	837
25 – 44	1403	(89)	165	(11)	1568
45 – 64	1594	(83)	330	(17)	1924
65+	1283	(48)	1385	(52)	2668
Injury Mechanism					
Fall	2429	(63)	1418	(37)	3847
Motor vehicle collision	1658	(82)	372	(18)	2030
Struck	168	(87)	26	(13)	194
Firearm	7	(70)	3	(30)	10
Other	769	(84)	147	(16)	916
Length of Stay (LOS)					
1 day	1656	(95)	81	(5)	1737
2 – 7 days	2902	(73)	1052	(27)	3954
8+ days	473	(36)	833	(64)	1306
Hospital Trauma Level					
1	2936	(84)	577	(16)	3513
2	761	(63)	443	(37)	1204
3	368	(62)	230	(38)	598
4	123	(61)	79	(39)	202
Not a trauma hospital	843	(57)	637	(43)	1480
ISS					
≤ 8 (mild)	1287	(89)	161	(11)	1448
9 - 15 (moderate)	1962	(77)	586	(23)	2548
> 15 (severe)	1782	(59)	1219	(41)	3001

*Includes Charity, No charge, Self insured, Other payer

entire population, over half of the injuries (55%) were associated with falls, with motor vehicle collisions accounting for 29%, and the remaining 16% caused by being struck by/against an object, or another mechanism of injury. Overall, 28% of patients were discharged to post-hospitalization care. More NHW patients (32%) than NHO (20%), NHB (17%), and Hispanic patients (11%) were discharged to post-hospitalization care. Relative to insurance status, those with public insurance were the most frequently discharged to post-hospitalization care (48%) while uninsured patients were discharged to post-hospitalization care less than any other insurance category (3%). Patients with worker's compensation had the next lowest frequency of being discharged to post-hospitalization care (16%), followed by private (18%) and other government (21%). Of patients treated in hospitals identified as Level I trauma centers, 16% were discharged to post-hospitalization care, compared to an average of 40% for all other hospitals.

Results of our multivariable logistic regression analyses are presented in Table 2. We found that, while controlling for gender, age, LOS, hospital trauma level, ISS, and insurance status, Compared to NHW patients, Hispanics were less likely to be discharged to post-hospitalization care (OR 0.62; CI 0.42 – 0.91), but the difference with NHB, NHO, and those with missing/unknown race/ethnicity were not significant. While controlling for potential confounders, including race/ethnicity, uninsured patients were less likely to be discharged to post-hospitalization care (OR 0.21; CI 0.11 – 0.41) compared to patients with private insurance. Contrarily, patients with public insurance and worker's compensation were more likely to be discharged to post-hospitalization care (OR 1.74; CI 1.42 – 2.14 and

TABLE 2. Adjusted Odds Ratios of Discharge Disposition by Race/Ethnicity and Insurance Status

	Post-hospitalization care Adjusted OR (95% CI)
Race/Ethnicity*	
Non-Hispanic White	Reference
Non-Hispanic Black	0.56 (0.31, 1.02)
Hispanic	0.62 (0.42, 0.91)
Non-Hispanic Other	0.84 (0.63, 1.12)
Missing/unknown	0.84 (0.68, 1.04)
Insurance Status†	
Private	Reference
Public	1.74 (1.42, 2.14)
Other Government	1.08 (0.65, 1.79)
Worker's Compensation	1.57 (1.13, 2.18)
Uninsured	0.21 (0.11, 0.41)
Other‡	

*Analyses controlled for gender, age, LOS, hospital trauma level, ISS and insurance status

†Analyses controlled for gender, age, LOS, hospital trauma level, ISS and race/ethnicity

‡Includes Charity, No charge, Self insured, Other payer

OR 1.57; CI 1.13 – 2.18, respectively). Overall, patients without insurance were less likely discharged to post-hospitalization care than all other insurance categories.

The proportions of patients discharged either home or to post-hospitalization care by ISS and insurance status are presented in Table 3. Across all levels of injury severity, greater proportions of patients with public insurance received post-hospitalization care than patients with any other form of insurance. These proportions increased from an ISS of mild (34%) to moderate (45%) and severe (54%). Receipt of post-hospitalization care was either non-

TABLE 3. Proportions of Patients Discharged Home versus Post-hospitalization care by ISS and Insurance Status

ISS	Insurance Status	Home (n = 5031) n	(%)	Post-hospitalization care (n = 1966) n	(%)	Total (n = 6997) n
Mild	Private	348	(95)	18	(5)	366
	Public	261	(66)	132	(34)	393
	Other Government	40	(95)	2	(5)	42
	Worker's Compensation	83	(99)	1	(1)	84
	Uninsured	210	(100)	0	(0)	210
	Other*					
Moderate	Private	636	(86)	103	(14)	739
	Public	476	(55)	394	(45)	870
	Other Government	47	(84)	9	(16)	56
	Worker's Compensation	103	(87)	16	(13)	119
	Uninsured	333	(98)	6	(2)	339
	Other*					
Severe	Private	556	(71)	223	(29)	779
	Public	674	(46)	793	(54)	1467
	Other Government	29	(60)	19	(40)	48
	Worker's Compensation	69	(68)	33	(32)	102
	Uninsured	202	(92)	17	(8)	219
	Other*					

*Includes Charity, No charge, Self insured, Other payer

existent or rare for uninsured patients, but proportions discharged to post-hospitalization care also increased as ISS increased from mild (0) to moderate (2%) and severe (8%).

DISCUSSION

This is the first study, to our knowledge, to utilize hospital discharge data to examine racial/ethnic and health insurance disparities in post-acute care among patients hospitalized

with TBI. This study demonstrates that race/ethnicity as well as insurance status matter with regard to receiving this desired level of care. Non-Caucasian patients were less likely to receive post-hospitalization care than their Caucasian counterparts. There were also remarkable disparities associated with insurance status, as odds of receiving post-hospitalization care for uninsured patients were less than one-fourth that of patients with private insurance. These patterns by insurance status were apparent regardless of ISS level.

There is growing recognition of the existence of ethnic or racial disparities in healthcare access and outcomes in the US[11]. It is unknown what proportion of these disparities is due to discrimination, lower socioeconomic status (SES), or some combination of both. SES is typically defined by income and education, with low SES associated with poor access to healthcare and worse outcomes for many ailments, including injury[28]. In addition, low SES is associated with a variety of risk factors for trauma. Risky driving behaviors, automobiles that lack safety features, and driving while intoxicated are associated with SES and the propensity for, and severity of, motor vehicle crash injuries[13]. In addition, those at the lowest SES levels have been found to possess higher rates of injuries of all types[29]. Lack of insurance was similarly related to these risk factors[30]. We did not have a measure of SES in the current study; however, we theorize that race/ethnicity and lack of insurance serve as markers for disadvantaged SES.

Our results are consistent, in both magnitude and direction of association, with those of several other studies that examined disparities in trauma care by race and ethnicity. In a national study with 136,239 patient admissions from National Trauma Data, Black and

Hispanic patients had lower rates of discharge to post-hospitalization care (relative risks = 0.61 and 0.44 respectively) compared to White patients[10]. In another study with 56,482 trauma center patients with TBI, Black and Hispanic patients categorized together also were significantly less likely to be discharged to rehabilitation services (OR = 0.68)[31]. Taken together, these bodies of work consistently find evidence of disparities in care for patients hospitalized for TBI, whether or not in specialized trauma care settings.

Our results are also consistent with past studies examining disparities by insurance status. Prior work found that uninsured patients were less likely to be discharged to a skilled nursing facility (OR 0.76, CI 0.73-0.80), home health (OR 0.51, CI 0.49-0.53), or rehabilitation (OR 0.45, CI 0.44-0.46) after trauma than did patients with commercial insurance[9]. Our study found that patients with public insurance were more likely to be discharged to post-hospitalization care (OR 1.76) compared to those with private insurance. This pattern was consistent across injury severity levels. In this analysis, public insurance consisted of Medicare and Medicaid, with Medicare accounting for 87% of this category.

A study by Granger et al. showed Medicare to be the most frequent payer of inpatient rehabilitation services for patients with TBI, covering more than twice as many patients as commercial insurance[32]. Medicare Part A is known to cover the majority of cost of care when a patient stays at an inpatient rehabilitation facility[33]. Medicare Part B, which is only available to participants already on Part A for a monthly fee, reimburses for home health services and outpatient treatments[34]. Those who qualify for Medicare are > 65 years, and thus may require inpatient rehabilitation more frequently than outpatient rehabilitation due to

increased complications and comorbidities[35]. A study by the New England Journal of Medicine found that spending on post-acute care is the largest portion of total Medicare spending (total spending includes inpatient care, post-acute care, diagnostic testing, outpatient procedures, prescription drugs, emergency care and ambulances)[36]. Reimbursement for post-hospitalization care by Medicare also applies to stroke patients, spinal cord injuries, hip fractures and those with a neurological disorder, such as Parkinson's or Multiple Sclerosis[37].

Our data showed that a lower proportion of patients treated in hospitals identified as Level I trauma centers were discharged to post-hospitalization care (16%), compared to those treated in Levels II, III, IV trauma centers, or non-trauma center hospitals (40% combined). This was a surprising finding, given the assumption that trauma centers would be providing care based on the best evidence. Additionally, one would expect a greater proportion of those admitted to a trauma Level I hospital to have incurred trauma of greater severity, thus requiring additional services after discharge. Past research showed Level I trauma centers did not discharge to post-hospitalization care at a higher rate than Level II trauma hospitals[38]. One possible explanation for this unexpected finding is that Level I trauma hospitals have a combination of specialized equipment and specially trained providers not available to other hospitals, potentially making post-hospitalization care less necessary. Further research should examine this and other potential reasons for lower rates of discharge to post-hospitalization care from Level 1 trauma hospitals.

Several key limitations should be taken into context with the results of this study. First,

patients with TBI who are admitted as inpatients often have comorbidities, including additional trauma as well as underlying mental or physical health problems. We attempted to control for trauma severity by including ISS in our multivariate models; however, this does not rule out potential residual confounding due to comorbid health conditions. Second, there is the potential for misclassification or information bias due to missing race/ethnicity. These missing data points may result in systematic bias if those of mixed race/ethnicity are not identified accurately. Third, our work relies on ICD-9-CM codes to identify unintentional TBI-related hospitalizations. The validity/variability of coding practices in this particular dataset are unknown. Last, common indicators of SES, such as household income, occupation and education level[39], were not available to us but would be useful to examine in context with race/ethnicity and insurance status in subsequent work.

Millions of individuals are living with TBI-related disabilities, resulting in large medical care costs as well as loss of productivity and decreased quality of life. Post-hospitalization care after TBI is often an essential element to help patients regain functionality and independence. Those patients who experience a TBI who are uninsured or non-Caucasian are disadvantaged with regard to acquiring post-hospitalization care, regardless of injury severity. Future work should examine potential sources of these disparities in more detail, with an eye toward developing interventions that could decrease disparities to such care.

PUBLIC HEALTH IMPLICATIONS

Traumatic Brain Injury is a major public health problem in Oregon, with 2,842 hospitalizations and 768 deaths in 2011[40]. Assessing disparities for discharge disposition for patients with traumatic brain injury has been limited, with no such research present in the state of Oregon. Looking at these disparities by race/ethnicity and insurance status can help to better characterize this patient population and provide timely results for Oregon to address underserved populations. Currently, it's estimated that Oregon is expected to gain 197,000 people through immigration alone between 1995 and 2025[41]. It's also known that the Latino population, in Oregon, is the largest minority group in the state and growing. Additionally, approximately 1 in 6 Oregonians are uninsured[42].

While Oregon has been progressive on various fronts, the state does not fare well when ranked against others on health outcomes. According to the Commonwealth Fund National Scorecard from 2009, Oregon ranks 45th in access to primary care and 43rd on equity measures out of a possible 51 possibilities (50 states plus the District of Columbia)[43]. There is much room for improvement.

There are several national efforts that are followed locally here in Oregon to specifically address disparities, access and overall equity to healthcare services. The Healthy People 2020 Initiative contains several projects related to disparities, access and injury reduction. In particular, their goal is to focus on health disparities for those who face greater obstacles based on their race or ethnicity[44].

In addition, the concept of The Triple Aim is followed closely in Oregon with the three-pronged approach called, "Better Health, Better Care, Lower Cost"[45]. This concept is a systems approach to help better identify problems and solutions outside of acute health care. Patients can expect more coordinated care and the burden of illness will decrease. It's more integrated and patient-centered with a focus on safety and access to care.

An example of The Triple Aim in action is that of Oregon's Coordinated Care Organizations (CCOs). This holistic approach to healthcare utilizes a network of various providers, (physical, behavioral and oral) who coordinate care for patients in local communities. The focus is on prevention, improving access, increasing trust and reducing disparities that currently exist. There is a global budget with incentives in place to keep the local populations healthy. Meeting specific health outcomes is a part of this process. While this endeavor is only for Medicaid patients presently, there is a goal of expanding to other patient populations. Through this expansion, more individuals will be able to access needed health care services.

Last, there is the Affordable Care Act, our national effort to provide health insurance for all, starting in 2014. While there are many unknowns as to how this will unfold, there is hope that more people will have access to health care services than currently do and that this legislature will directly impact the disparities that presently exist with regard to the uninsured. All these efforts can provide improvements to the current system, allowing more patients to receive the level of care needed to improve their quality of life and contribute to society.

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APPENDIX A: Key Variables

Variable Title	Description	Data Type	Value
Age in years	Age of patient, at time of discharge, in years	Integer	
Diagnosis codes	Diagnosis codes with dx1 being the principle diagnosis	String (6)	All years use ICD-9-CM codes
Discharge status	Status of discharge	Integer	1=Routine discharge (to home or self care) 2=Discharge/transferred to another short-term hospital 3=Discharge/transferred to skilled nursing facility (SNF) 4=Discharge/transferred to intermediate care facility (ICF) 5=Discharge/transferred to another type institution 6=Discharge/transferred to home health care service 7=Left against medical advice 8=Discharged/transferred to home under care of a home iv provider (discontinued as of 10/01/05) 9=Admitted as an inpatient to this hospital (Medicare only) 10=Discharged - no longer covered by Medicaid 11=Discharged - TSFD to another category of service 20=Expired (or did not recover-Christian scientist patient) 21=Expired - not covered by Medicaid on date of death 30=Still patient or expected to return for outpatient services 31=Still patient - no longer covered by Medicaid 40=Expired at home (Medicare claims for hospice care) 41=Expired in medical facility (Medicare claims for hospice care) 42=Expired - place unknown (Medicare claims for hospice care) 43=Discharged/transferred to a federal hospital 50=Hospice - home 51=Hospice – medical facility 61=Discharge/transfer within inst to hosp based Medicare swing bed 62=Discharge/transfer to rehab facility or hospital unit 63=Discharge/transfer to long-term care hospital 64=Discharge/transfer to nursing facility certified under Medicaid – not Medicare 65=Discharged/transferred to a psychiatric hospital or psychiatric distinct part unit of a hospital 66=Discharged/transferred to a critical access hospital (effective 1/1/2006) 70=Another type of institution (beginning 10/1/2007) 71=Discharge/transfer /referred to another institution for outpatient services by discharge plan (discontinued as of 10/1/2003) 72=Discharge/transfer/referred to institution for outpatient service by discharge plan 0=Missing/invalid/unknown
Ethnicity	Patient's ethnicity	Integer	1 = Hispanic or Latino 2 = Non Hispanic or Latino 8 = Patient refused 9 = Unknown
External cause of injury codes		String (6)	
Gender	Gender of patient	Text (1)	F = Female M = Male U = Unknown
Length of Stay (LOS)	Length of stay in days		
Major diagnosis category		String (3)	
Payer primary	State specific codes	String (3)	11=Medicare (Managed Care) 12=Medicare (Fee-for-service) 21=Medicaid (Managed care) 22=Medicaid (Fee-for-service) 25=Medicaid – Out of State 51=HMO/Managed care 511=Kaiser Permanente

			52=Private health insurance - indemnity 521=Commercial indemnity 522=Self insured 61=Regence Blue Cross managed care 62=Regence Blue Cross indemnity 81=Self pay 84=Hill Burton free care 82=No charge 821=Charity 83=Refused to pay/bad debt 31=Department of defense 311=Tricare (Champus) 32=Department of Veterans Affairs 33=Indian Health Service or tribe 34=HRSA program 36=State government 37=Local government 95=Workers Compensation 98=Other payer ZZZ=Missing data
Payer secondary		String (3)	See payer primary
Payer tertiary		String (3)	See payer primary
Race	Race of patient	Integer	1 = American Indian or Alaska native 2 = Asian 3 = Black or African American 4 = Native Hawaiian or Pacific Islander 5 = White 7 = Patient refused 8 = Unknown 9 = Other
State	Patients state of residence	Integer	
Year	Year of discharge	Integer	
Zip code	Postal zip code of patients residence	Integer	

APPENDIX B: Table of Significant Predictors

Significant Predictors of Discharge Disposition

Predictor	Odds Ratio	95% CI	*p*
Insurance Status			
Private	1.0 Reference		
Public	1.74	1.42 – 2.14	< 0.001
Worker's Compensation	1.57	1.13 – 2.18	0.0070
Uninsured	0.21	0.11 – 0.41	< 0.001
Race/Ethnicity			
Non-Hispanic White	1.0 Reference		
Hispanic	0.62	0.42 – 0.91	0.0150
Gender			
Male	1.0 Reference		
Female	0.58	0.52 – 0.65	< 0.001
Age (years)			
18 – 24	1.0 Reference		
45 – 64	1.38	1.16 – 1.64	< 0.001
65+	6.18	5.12 – 7.45	< 0.001
Length of Stay (LOS)			
1 day	1.0 Reference		
2 – 7 days	5.68	4.61 – 7.01	< 0.001
8+ days	66.85	47.15 – 94.80	< 0.001
Trauma Level			
1	1.0 Reference		
2	3.05	2.07 – 4.52	< 0.001
3	2.54	1.57 – 4.11	< 0.001
4	3.03	1.78 – 5.16	< 0.001
Not a trauma hospital	2.96	1.96 – 4.46	< 0.001
ISS			
≤ 8 (mild)	1.0 Reference		
9 - 15 (moderate)	1.34	1.01 – 1.80	0.0450
> 15 (severe)	1.64	1.25 – 2.14	< 0.001

Non-significant variables include: Insurance: Other Government, Race: Non-Hispanic Black, Non-Hispanic Other, Missing/Unknown, Age: 25 - 44