

1 Running head: Race/ethnicity and retention in TBI research

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3 Race/Ethnicity and Retention in Traumatic Brain Injury Outcomes Research:

4 A Traumatic Brain Injury Model Systems National Database Study

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6 Angelle M. Sander, Ph.D., Anthony H. Lequerica, Ph.D., Jessica M. Ketchum, Ph.D.,

7 Flora M. Hammond, Ph.D., Kelli Williams Gary, Ph.D., Monique R. Pappadis, Ph.D.,

8 Elizabeth R. Felix, Ph.D., Douglas Johnson-Greene, Ph.D., Tamara Bushnik, Ph.D.

9 From the Departments of Physical Medicine and Rehabilitation & Psychiatry, Baylor College of  
10 Medicine/Harris Health System and Brain Injury Research Center, TIRR Memorial Hermann,  
11 Houston, TX (Sander); Kessler Foundation and Rutgers, New Jersey Medical School, West  
12 Orange, NJ (Lequerica); Craig Hospital, Englewood, CO (Ketchum); Department of Physical  
13 Medicine and Rehabilitation, Indiana University School of Medicine, Indianapolis, IN  
14 (Hammond); Departments of Physical Medicine and Rehabilitation/Neuropsychology and  
15 Occupational Therapy, Virginia Commonwealth University, Richmond, VA (Gary); Division of  
16 Rehabilitation Sciences, University of Texas Medical Branch, Galveston, TX and Brain Injury  
17 Research Center, TIRR Memorial Hermann, Houston, TX (Pappadis); University of Miami  
18 Miller School of Medicine, Miami, FL (Felix and Johnson-Greene); Rusk Rehabilitation, New  
19 York University Langone School of Medicine, New York, NY (Bushnik)

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38 Correspondence to Angelle M. Sander, Ph.D., TIRR Memorial Hermann Research Center, 1333  
39 Moursund St., Houston, TX 77030, Email: [asander@bcm.edu](mailto:asander@bcm.edu); Phone: 713-797-7161; Fax: 713-  
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43 **ABSTRACT**

44 **Objective:** To investigate the contribution of race/ethnicity to retention in traumatic brain injury  
45 (TBI) research at 1 to 2 years post-injury. **Setting:** Community. **Participants:** 5548 Whites,  
46 1347 Blacks, and 790 Hispanics enrolled in the Traumatic Brain Injury Model Systems National  
47 Database with dates of injury between October 1, 2002 and March 31, 2013. **Design:**  
48 Retrospective database analysis. **Main Measure:** Retention, defined as completion of at least  
49 one question on the follow-up interview by the person with TBI or a proxy. **Results:** Retention  
50 rates 1-2 years post-TBI were significantly lower for Hispanic (85.2%) than for White (91.8%)  
51 or Black participants (90.5%) and depended significantly on history of problem drug or alcohol  
52 use. Other variables associated with low retention included older age, lower education, violent  
53 cause of injury, and discharge to an institution versus private residence. **Conclusions:** The  
54 findings emphasize the importance of investigating retention rates separately for Blacks and  
55 Hispanics rather than combining them or grouping either with other races or ethnicities. The  
56 results also suggest the need for implementing procedures to increase retention of Hispanics in  
57 longitudinal TBI research.

58 **Keywords:** *Traumatic brain injury, Cultural Competency, Follow-Up Studies*

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60 **LIST OF ABBREVIATIONS:**

61 IRB – Institutional Review Board

62 NIDILRR – National Institute on Disability, Independent Living and Rehabilitation Research

63 PTA – posttraumatic amnesia

64 TBI – Traumatic Brain Injury

65 TBIMS – Traumatic Brain Injury Model Systems

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78 **INTRODUCTION**

79 Cognitive,<sup>1</sup> emotional,<sup>2</sup> and physical<sup>3</sup> impairments resulting from traumatic brain injury  
80 (TBI) contribute to decreased independent living,<sup>4</sup> employment,<sup>5</sup> and participation in leisure  
81 activities.<sup>6</sup> Approximately 3.2 million United States residents are estimated to have long-term or  
82 life-long disability resulting from TBI.<sup>7</sup> Unfortunately, minorities are disproportionately  
83 represented among those who sustain TBI<sup>8</sup> and those with poor outcomes.<sup>9</sup> Blacks and Hispanics  
84 with TBI have been shown to have poorer outcomes than Whites in overall functioning,<sup>10</sup>  
85 functional independence,<sup>11</sup> independence in home activities,<sup>12</sup> employment outcomes,<sup>13,14</sup> and  
86 satisfaction with participation.<sup>15</sup> Minorities have also been shown to utilize rehabilitation  
87 services less than Whites in both civilian<sup>16</sup> and military<sup>17</sup> samples. These findings emphasize the  
88 need for inclusion of minorities in longitudinal research and clinical trials targeting TBI, as their  
89 exclusion can yield a biased view of outcomes.

90 Recruitment and retention of minorities is challenging for health research as a whole.  
91 National Institutes of Health investigators are less likely to meet recruitment goals for minorities  
92 compared to Whites.<sup>18</sup> Minimal empirical evidence exists to support specific retention  
93 strategies.<sup>19</sup> Greater loss of minorities to follow-up is a common problem in research on TBI  
94 outcomes, posing a threat to internal and external validity.<sup>20</sup>

95 The relationship between race/ethnicity and loss to follow-up in TBI research has been  
96 investigated in prior studies. Corrigan and colleagues<sup>21</sup> studied predictors of loss to follow-up in  
97 three longitudinal samples, including the Colorado TBI registry, five TBI Model System  
98 (TBIMS) centers, and a single brain injury rehabilitation unit. Minorities with TBI were less  
99 likely to be followed at 1 year compared to Whites in two of the three samples investigated.  
100 Other variables that predicted loss to follow-up included violent injury, elevated blood alcohol

101 level at hospital admission, lower FIM<sup>TM</sup> motor score at rehabilitation admission, non-private  
102 health insurance, and discharge to an institution. Krellman and colleagues<sup>22</sup> studied predictors of  
103 longitudinal follow-up patterns in the TBIMS National Database. Each participant had the  
104 opportunity to complete follow-up at four time points- 1, 2, 5, and 10 years post-injury. Findings  
105 were that non-responders (did not complete any follow-ups, but did not formally withdraw) and  
106 wave responders (completed some follow-ups and skipped others) were more likely to be  
107 minorities; however, Whites were also more likely to be in one of these groups if they were  
108 missing data on pre-injury education. Missing data on pre-injury education, acute care payer, or  
109 pre-injury employment status was also associated with non-responding and wave responding.  
110 Recently, Jourdan and colleagues<sup>23</sup> studied a sample of 504 adults with severe TBI in Paris.  
111 While they did not include race/ethnicity as a variable, they found other associations with loss to  
112 follow-up that can inform covariate analyses. Specifically, loss to follow-up at 1 year post-injury  
113 was associated with pre-injury unemployment and violent mechanism of injury. Pre-injury  
114 unemployment and alcohol abuse were predictive of loss to follow-up at 4 years post-injury.

115         Research findings to date indicate that race/ethnicity likely contributes to retention in  
116 longitudinal TBI research, with the pattern being lower retention of minorities; however, the  
117 extant research is limited by methodological issues. First, prior studies have either combined  
118 Blacks with Hispanics or grouped Hispanics with other minorities and compared them to Blacks  
119 and Whites.<sup>21,22</sup> The importance of investigating retention of Hispanics as a separate group is  
120 justified by the fact that Hispanics currently represent the largest racial/ethnic minority group in  
121 the United States, comprising 17% of the total population.<sup>24</sup> Persons of Hispanic ethnicity make  
122 up approximately 10% of current enrollees in the TBIMS National Database.<sup>25</sup> Given their  
123 substantial numbers and their likelihood of having poor outcomes compared to Whites,

124 investigation of retention of Hispanics as a separate group is warranted. Additionally, prior  
125 studies have not investigated the potential interaction of race/ethnicity with other variables that  
126 may impact retention in longitudinal TBI studies. For example, prior research has shown that  
127 minorities with TBI are more likely to be unemployed at the time of injury and to be injured via  
128 violence.<sup>26,27</sup> As these variables have also been shown to predict loss to follow-up, they may  
129 interact with race/ethnicity to impact retention.

130         The aims of the current study are: (1) to investigate retention in the TBIMS database for  
131 Whites, Blacks, and Hispanics; (2) to investigate the contribution of being White, Black, or  
132 Hispanic to retention at 1-or 2-years post-injury, after controlling for other variables that may  
133 impact retention; and (3) to investigate the interaction of race/ethnicity with other variables that  
134 may impact retention.

## 135 **METHODS**

### 136 **Participants**

137         Participants included were those enrolled in the National Database of the National  
138 Institute for Disability, Independent Living, and Rehabilitation Research (NIDILRR) TBIMS  
139 program. The TBIMS National Database includes individuals with newly acquired TBI who  
140 receive comprehensive inpatient rehabilitation services at one of the NIDILRR-funded centers in  
141 the US. Twenty-two centers contributed to the dataset for this analysis, with 7685 individuals  
142 with dates of injury between October 1, 2002 and March 31, 2013. The start and end dates were  
143 selected based on the availability of key variables (variables are periodically added and deleted  
144 from the National Database) and to ensure all subjects had become eligible for 2-year follow-up.

145         Criteria for inclusion in the TBIMS National Database include: age  $\geq$  16 at time of injury;  
146 medically documented complicated mild, moderate, or severe TBI (emergency department

147 Glasgow Coma Scale score  $\leq 12$  or duration of posttraumatic amnesia  $> 24$  hours or loss of  
148 consciousness  $> 30$  minutes or evidence of intracranial trauma on neuroimaging); admission to a  
149 TBIMS acute-care hospital within 72 hours of injury; completion of inpatient rehabilitation  
150 within the TBIMS; and informed consent obtained. During the interval covered by this study,  
151 race/ethnicity was coded as a mixed variable rather than two separate variables in the TBIMS  
152 National Database. Race/ethnicity was coded as White, Black, Asian/Pacific Islander, Native  
153 American, Hispanic Origin, Other, or Unknown. Only participants coded as White, Black, or  
154 Hispanic origin were included in the current analysis because the numbers in the other categories  
155 were too low to provide a meaningful comparison. As shown in Figure 1, 348 people were  
156 excluded for race/ethnicity other than White, Black, or Hispanic.

## 157 **Procedure**

158 IRB approval was obtained at all participating TBIMS institutions. Medical and injury  
159 information was abstracted from participants' medical records according to TBIMS National  
160 Database standardized procedures.<sup>40</sup> Demographic information was obtained by trained research  
161 personnel who interviewed the individual with TBI or a proxy.

162 Follow-up interviews were conducted in person, via phone, or through the mail at 1 ( $\pm 2$   
163 months) and 2 years ( $\pm 3$  months) post-injury. Sample derivation is shown in the flowchart in  
164 Figure 1. In the TBIMS National Database, follow-up status is coded as followed, lost, refused,  
165 withdrew, expired, incarcerated, or follow-up not attempted due to a center losing TBIMS  
166 funding. Persons eligible for 1 or 2 year follow-up were excluded from the sample if they had  
167 expired prior to 1 year follow-up, were incarcerated at both follow-ups, or if no attempt was  
168 made to contact them at either follow-up due to loss of funding. Participants were considered to  
169 be retained if the interview status variable was coded as "followed" at either year 1 or year 2.

170 Participants were considered to be not retained if interview status was coded as lost, refused, or  
171 withdrew at both year 1 and year 2.

172 Standard follow-up procedures used by all centers included: 1) attempting contact as soon  
173 as the follow-up window opened; 2) making at least 12 phone contact attempts during various  
174 times of day and night and days of the week (including weekends) using the most reliable phone  
175 numbers available; 3) sending a letter to the participant and any known contacts at their last  
176 known mailing addresses; 4) using phone directory assistance in the last known city of residence,  
177 internet searches, fee-based location services, and medical records to identify updated phone  
178 numbers, addresses, or other contact information; 5) conducting a search for potential death  
179 information; and 6) conducting a search of an inmate database to determine if the participant was  
180 incarcerated.

## 181 **Measures**

182 Race/ethnicity category was preferentially determined by asking the person with injury or  
183 their caregiver, but medical record information was used if information could not be obtained in  
184 the preferred way. The outcome variable, retention, was a dichotomous variable defined as  
185 completion of at least one question on either the 1 or 2 year follow-up interview by the person  
186 with TBI or a proxy.

187 Covariates:

188 Injury severity was measured by the duration of post-traumatic amnesia (PTA) – a period  
189 marked by confusion and inability to form new memories after TBI that is predictive of global  
190 outcomes after moderate-severe TBI.<sup>28</sup> Duration of PTA was calculated as the number of days  
191 between the TBI and the first of two occasions within a 72-hour period in which the participant  
192 was fully oriented, as defined by a score  $\geq 76$  on the Galveston Orientation and Amnesia Test,<sup>29</sup>

193 a score over 25 on the Orientation Log,<sup>30</sup> or documentation of two days with consistent  
194 orientation within a three day period in the acute medical record with no intervening days at less  
195 than full orientation. For the 1442 individuals discharged before emerging from PTA, missing  
196 values were imputed by using total length of stay (acute plus rehabilitation)+ 1 day.<sup>31</sup> Injury  
197 severity categories, based on the Mississippi PTA Intervals, were: moderate (0 to 14 days);  
198 moderate-severe (15 to 28 days); severe (29 to 70 days); and extremely severe (>70 days).<sup>32</sup>

199 The FIM™ is an 18-item rating scale of functional independence.<sup>33</sup> Rasch analysis has  
200 indicated that items can be divided into a motor factor ranging from 13 to 91 and a cognitive  
201 factor ranging from 5 to 35.<sup>34,35</sup> Each item is rated on a scale of 1 (total assistance required) to 7  
202 (complete independence), and higher scores indicate greater independence. FIM™ has good  
203 internal consistency (Cronbach's  $\alpha$  between .86 and .97) and has been shown to be sensitive to  
204 changes in functional ability from admission to discharge and follow-up.<sup>36, 37</sup>

205 History of problem substance use was determined by questions adapted from the Centers  
206 for Disease Control and Prevention's Risk Factor Surveillance System.<sup>38</sup> These questions pertain  
207 to frequency of alcohol consumption and average quantity consumed per occasion. Using  
208 established criteria,<sup>38,39</sup> participants were classified as having a history of problem substance use  
209 if they endorsed more than 7 drinks per week for women, more than 14 drinks per week for men,  
210 or had consumed more than 5 or more drinks on one occasion in the month prior to injury or had  
211 used illicit drugs in the year before injury.

212 Residence at the time of rehabilitation discharge was categorized as private or non-  
213 private (nursing home, adult home, correctional institution, hotel/motel, homeless, hospital,  
214 subacute care, other). Job stability was defined as the number of weeks worked in the year prior  
215 to injury. Cause of injury was classified as violent (gunshot wound; assault with blunt

216 instrument; stabbing; impalement; explosions) or non-violent (vehicular; sports-related; falls;  
217 auto-pedestrian; hit by falling or flying object). Sex and pre-injury marital status, education, and  
218 incarcerations were categorized as shown in Table 1.

## 219 **Data Analysis**

220 The demographic and injury characteristics of the sample were summarized separately  
221 for each of the three race/ethnicity groups using means and standard deviations for continuous  
222 variables and frequency counts and percentages for categorical variables. These characteristics  
223 were compared between the race/ethnicity groups using chi-square tests and ANOVA models.

224 The probability of being retained was initially modeled as a function of race/ethnicity  
225 using logistic regression unadjusted for other patient characteristics. Multivariate logistic  
226 regression was then used to model the relationship between race/ethnicity and retention status  
227 controlling for 12 patient characteristics that may impact retention in longitudinal studies (age,<sup>41</sup>  
228 gender,<sup>42</sup> marital status,<sup>42</sup> education,<sup>41</sup> residence at rehabilitation discharge,<sup>21</sup> pre-injury  
229 incarceration, problem substance use,<sup>21,23</sup> violent cause of injury,<sup>21,23</sup> PTA, FIM™ scores at  
230 rehabilitation discharge,<sup>21</sup> and job stability for the year prior to injury<sup>23</sup>). The assumption of  
231 linearity in the logit was assessed for all continuous variables and was found to be adequate.  
232 Significant interactions between race/ethnicity and patient characteristics were also examined  
233 and included in the final adjusted model if significant. All statistical analyses were conducted  
234 using SAS v.9.4 with a significance level of 0.05. Significant interactions were investigated  
235 using a Bonferroni correction for the level of significance, as shown in Table 3.

## 236 **RESULTS**

237 **Description of the Sample**

238 The demographic and injury characteristics of the sample are summarized by  
239 race/ethnicity in Table 1. Overall, the sample was primarily White and single, with at least a high  
240 school education and moderate to severe TBI. A substantial number had a history of pre-injury  
241 problem substance use and most were discharged from rehabilitation to a private residence. The  
242 race/ethnicity groups showed significant differences in all patient characteristics (all  $p$ 's  $\leq$   
243 0.0004) except for pre-injury problem substance use ( $p = 0.9906$ ). Compared to Whites, Blacks  
244 and Hispanics were less likely to be female, less likely to have a high school education, more  
245 likely to have been incarcerated prior to injury, and more likely to have violent cause of injury.  
246 Blacks were less likely to be married, and Hispanics were more likely to have less than an 8<sup>th</sup>  
247 grade education.

248 **Unadjusted Relationship between Race/Ethnicity and Retention Status**

249 As shown in Table 2, there was a significant difference in retention rates among the three  
250 race/ethnicity groups (chi-square = 32.5,  $df = 2$ ,  $p$ -value < 0.0001). Retention rates were 91.8%  
251 for Whites, 90.5% for Blacks, and 85.2% for Hispanics. The unadjusted odds of being retained  
252 were 1.9 times greater for Whites as compared to Hispanics ( $p$ -value < 0.0001) and 1.7 times  
253 greater for Blacks as compared to Hispanics ( $p$ -value = 0.0002). There was not a significant  
254 difference in unadjusted retention rates between Whites and Blacks (OR = 1.18,  $p$ -value =  
255 0.1239).

256 **Adjusted Relationship between Race/Ethnicity and Retention Status**

257 There was a significant interaction effect between race/ethnicity and pre-injury problem  
258 substance use ( $p = 0.0330$ ) on retention rates. Table 3 shows the effects of race/ethnicity on  
259 retention status for those with and without a pre-injury history of problem substance use, as well

260 as the effect of a pre-injury history of problem substance use on retention status for each  
261 race/ethnicity group. Odds ratios with a  $p$ -value less than a Bonferroni adjusted significance level  
262 of  $\alpha = 0.05/9 = 0.0056$  were considered significant. For subjects without a history of pre-injury  
263 problem substance use, the odds of being retained were 2.09 times greater for Whites as  
264 compared to Hispanics and 2.45 times greater for Blacks as compared to Hispanics; the odds of  
265 retention did not differ between Whites and Blacks without a history of substance problem use.  
266 For subjects with a history of pre-injury problem substance use, the odds of being retained did  
267 not differ among the race/ethnicity groups. The odds of being retained were 1.28 greater for  
268 Whites without a history of problem use as compared to those with a history and 1.81 greater for  
269 Blacks without a history of problem substance use as compared to Blacks with a history. For  
270 Hispanics, the odds of retention did not differ between those with and without a history of  
271 problem substance use. The relationship between retention and race/ethnicity was not found to  
272 depend significantly on any of the other examined covariates.

### 273 **Adjusted Relationship between Covariates and Retention Status**

274 There was a significant relationship between retention status and age ( $p = 0.0011$ ),  
275 education ( $p < 0.0001$ ), residence ( $p = 0.0019$ ), and violent cause of injury ( $p = 0.0006$ ). As  
276 shown in Table 4, the odds of being retained were 0.99 times lower for each year increase in age  
277 at injury, 1.44 times greater for those discharged to a private versus non-private residence, and  
278 1.57 times greater for those with injuries due to non-violent causes. Furthermore, increases in  
279 levels of pre-injury education were associated with increases in the odds of retention. No other  
280 variables were associated with retention status.

### 281 **DISCUSSION**

282           The findings are consistent with prior studies that have shown lower retention of  
283 minorities in TBI outcomes research;<sup>21,22</sup> however, the results are unique in showing that  
284 Hispanics are less likely to be retained than Whites or Blacks, with retention rates being similar  
285 for Whites and Blacks. The findings emphasize the importance of investigating Blacks and  
286 Hispanics separately, rather than combining them or grouping either with other races or  
287 ethnicities, when investigating retention in longitudinal rehabilitation research. This would  
288 increase the probability of study samples accurately reflecting the broader population, as  
289 Hispanics are currently the largest minority group in the United States. The results justify efforts  
290 to facilitate Hispanics' participation in research through targeted retention strategies. A unique  
291 finding is that pre-injury problem substance use interacts with race/ethnicity. Hispanics did not  
292 differ from Whites or Blacks in the group with pre-injury problem substance use. Problem  
293 substance use history was associated with a slight decrease in retention rates for Whites and a  
294 more substantial decrease for Blacks, while no decrease was noted for Hispanics. It is possible  
295 that sociocultural factors associated with Hispanic race/ethnicity impact retention in research to  
296 the extent that problem substance abuse does not have any additive predictive value. Such a  
297 hypothesis could be investigated in future research.

298           Findings are consistent with previous research that showed a lower retention rate for  
299 persons with TBI injured by violent means<sup>21,23</sup> and those discharged to an institution versus a  
300 private residence.<sup>21</sup> In addition, older persons and those with lower education were less likely to  
301 be retained. These variables were predictive of lower retention regardless of race/ethnicity and  
302 can be used to target retention strategies.

303           Factors influencing retention of study participants may be participant-specific or study-  
304 specific. Public health studies report a lesser likelihood of study retention for males and those

305 with multiple comorbidities,<sup>43</sup> persons with low income,<sup>44</sup> and immigrants.<sup>45</sup> Our results showed  
306 no relationship between sex and retention, but the other factors were not included in our study  
307 and may have impacted retention, particularly for our Hispanic participants. Relocation to their  
308 country of origin is common among Hispanic research participants at some centers included in  
309 this analysis and may have influenced retention. Study-specific factors that might have  
310 influenced lower retention of Hispanic participants include cultural and linguistic barriers  
311 between research staff and participants, inexperience of data collectors with the Hispanic  
312 population, and few bilingual data collectors. In recent years, the TBIMS national data and  
313 statistical center has implemented procedures to increase cultural competence of data collectors  
314 and investigators, including training in cultural sensitivity. However, this may not substitute for  
315 in-person contact with a bilingual research staff member and/or person of similar race/ethnicity.

316         Retaining participants from minority groups in rehabilitation research has been  
317 recognized as challenging.<sup>20,46</sup> Creative recruitment/retention strategies that focus on cultural  
318 factors, language preferences, and community resources are needed to maximize retention. To  
319 enhance retention of U.S. born and non-U.S. born Hispanic participants, acknowledging cultural  
320 values of *familismo* (importance of family), *personalismo* (building rapport or personal  
321 connection), *confianza* (being trustworthy), and *respeto* (being respectful) are key to conducting  
322 culturally competent research.<sup>44</sup> Employing research staff from the same cultural and linguistic  
323 background as participants can increase rapport, reduce mistrust, and increase comfort with  
324 discussing sensitive information. These strategies have been shown to increase Hispanics’  
325 satisfaction with and motivation to participate in psychological research.<sup>47</sup> Community  
326 partnerships can also be effective for recruiting and retaining minority groups. Hispanic research  
327 participants referred by community agencies/activities have been shown to have greater

328 engagement and study completion.<sup>48</sup> The researcher's connection with community-based  
329 organizations familiar to Hispanic participants fosters trust and motivates consistency in  
330 research involvement through social networking.<sup>48</sup>

331 Making research participation convenient and less burdensome can increase retention.  
332 Transportation can be a major problem for persons with TBI,<sup>49</sup> and this problem can be  
333 exacerbated for newer immigrants and persons with low income. Compensating participants for  
334 the cost of transportation and parking may increase engagement and retention. In addition,  
335 offering follow-up outside normal work hours could facilitate participation by those who work in  
336 industries with irregular work hours.

### 337 **Study Limitations**

338 This study assessed the impact of race/ethnicity on study retention among individuals  
339 who received inpatient rehabilitation following primarily moderate-to-severe TBI and were  
340 enrolled in the TBIMS National Database. Findings may differ among individuals with mild  
341 TBI, veterans with TBI, and those with moderate-to-severe TBI who received acute care but not  
342 inpatient rehabilitation. Analyses were also limited to variables available in the TBIMS database  
343 during the study period. Retention was defined as being followed at a specific time point (1 or 2  
344 years post-injury). This study was also limited by using a combined race/ethnicity variable, not  
345 allowing for distinctions between White Hispanics and Black Hispanics. Race and ethnicity are  
346 coded separately in other federally funded databases. The TBIMS has recently changed its  
347 coding to reflect this, although not for the period covered by current analyses. We also  
348 acknowledge that there is a plethora of environmental and sociopolitical factors that are  
349 associated with race/ethnicity and that may impact retention in longitudinal rehabilitation

350 research. These factors were not quantified in this retrospective database study, but are important  
351 to consider for future prospective studies.

## 352 **Conclusions**

353 Lower retention of Hispanic participants in TBI research can bias outcomes and threaten  
354 external validity. Researchers should implement strategies to improve retention of Hispanic  
355 participants in TBI research. Other variables, including primary language spoken, acculturation,  
356 citizenship or visa status, country of residence at time of injury, and proximity of residence to  
357 rehabilitation hospital, may contribute to retention and should be investigated in future studies.  
358 Future research should examine whether longitudinal patterns of retention differ for Hispanics  
359 compared to Blacks and Whites.

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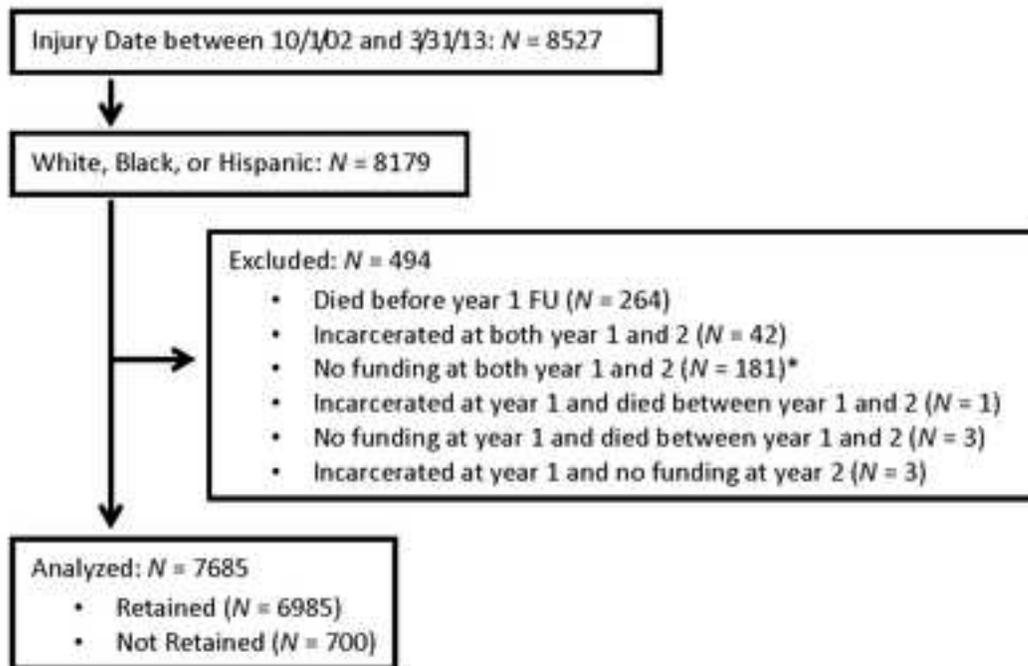
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Figure 1



\*Traumatic Brain Injury Model Systems centers are funded for 5-year periods and then must compete for another funding cycle. This sometimes results in existing centers losing funding for one or more cycles, and thus participants in the national database may not be followed due to lack of funds.

Table 1: Summary of Sample Characteristics by Race/Ethnicity

	White (N = 5548)	Black (N = 1347)	Hispanic (N = 790)	Total Count	p-value
Sex					< 0.0001
Male	3991 (71.9%)	1049 (77.9%)	613 (77.6%)	5653	
Female	1557 (28.1%)	297 (22.1%)	177 (22.4%)	2031	
Pre-Injury Marital Status					< 0.0001
Married	2063 (37.2%)	267 (19.9%)	217 (27.5%)	2547	
Not Married	3485 (62.8%)	1078 (80.1%)	571 (72.5%)	5134	
Pre-Injury Education					< 0.0001
≤ 8 <sup>th</sup> Grade	186 (3.4%)	84 (6.3%)	196 (25.0%)	466	
9 <sup>th</sup> – 11 <sup>th</sup> Grade	844 (15.3%)	366 (27.4%)	199 (25.4%)	1409	
12 <sup>th</sup> Grade (HS/GED)	2074 (37.7%)	523 (39.1%)	216 (27.6%)	2813	
> 12 <sup>th</sup> Grade	2411 (43.6%)	366 (27.3%)	172 (22.1%)	2950	
Residence at Discharge*					0.0004
Private Residence	4549 (82.1%)	1098 (81.8%)	691 (87.7%)	6338	
Non-Private Residence	989 (17.9%)	244 (18.2%)	97 (12.3%)	1330	
Pre-Injury Penal Incarcerations					< 0.0001
No	5081 (92.9%)	1080 (81.0%)	691 (89.6%)	6852	
Yes	390 (7.1%)	254 (19.0%)	80 (10.4%)	724	
Pre-Injury Substance Problem Use					0.9906
No	3061 (57.8%)	753 (57.9%)	426 (57.6%)	4240	
Yes	2236 (42.2%)	548 (42.1%)	314 (42.4%)	3098	
PTA Group					< 0.0001
Moderate	1852 (34.24%)	384 (29.20%)	207 (27.79%)	2443	
Moderate/Severe	1200 (22.19%)	274 (20.84%)	150 (20.13%)	1624	
Severe	1247 (23.05%)	321 (24.41%)	183 (24.56%)	1751	
Extremely Severe	1110 (20.52%)	336 (25.55%)	205 (27.52%)	1651	
Cause of Injury					< 0.0001
Violent	336 (6.1%)	318 (23.6%)	136 (17.3%)	790	
Not Violent	5204 (93.9%)	1029 (76.4%)	651 (82.7%)	6884	
	Mean (SD)	Mean (SD)	Mean (SD)		
Age	42.82(19.96)	38.58(17.03)	35.86(17.56)		<0.0001
FIM <sup>TM</sup> Motor at Discharge	66.44(18.24)	63.22(17.86)	66.02 (17.53)		<0.0001
FIM <sup>TM</sup> Cognitive at Discharge	24.00(6.72)	22.80(6.63)	23.40(6.82)		<.00001
Job Stability**	29.87 (24.15)	23.41(24.08)	30.76(23.77)		<0.0001

\* Non-private residence=nursing home, adult home, correctional institution, hotel/motel, homeless, hospital, subacute care, or other

\*\*number of weeks worked in the year prior to injury, modeled as a continuous variable

Table 2: Differences in Retention Rates Between Whites, Blacks, and Hispanics

	Retained		Total
	No	Yes	
White	455 (8.2%)	5093 (91.8%)	5548
Black	128 (9.5%)	1219 (90.5%)	1347
Hispanic	117 (14.8%)	673 (85.2%)	790
Total	700 (9.1%)	6985 (90.9%)	7075

Table 3: Odds Ratios Comparing Race/Ethnicity and Pre-Injury Problem Substance Use Groups from Adjusted<sup>§</sup> Model

History of Pre-Injury Problem Substance Use	Race/Ethnicity	OR <sup>†</sup>	95% CI	<i>p</i> -value
No	White vs. Black	0.853	(0.607, 1.200)	0.3608
	White vs. Hispanic	2.091	(1.489, 2.936)	< 0.0001 ‡
	Black vs. Hispanic	2.451	(1.607, 3.739)	< 0.0001 ‡
Yes	White vs. Black	1.212	(0.883, 1.666)	0.2347
	White vs. Hispanic	1.341	(0.904, 1.989)	0.1453
	Black vs. Hispanic	1.106	(0.710, 1.723)	0.6567
No vs. Yes	White	1.275	(1.012, 1.606)	0.0388
No vs. Yes	Black	1.812	(1.211, 2.712)	0.0038 ‡
No vs. Yes	Hispanic	0.818	(0.518, 1.290)	0.3866

<sup>§</sup>Model variables include race/ethnicity, age, gender, marital status, education, residence at rehabilitation discharge, pre-injury incarceration, problem substance use, violent cause of injury, PTA, discharge FIM, pre-injury job stability, and race/ethnic by problem substance use

<sup>†</sup> Odds ratios represent the odds of being retained versus not retained for one sub group versus another subgroup

<sup>‡</sup> Significant at a Bonferroni corrected level of significance  $\alpha = 0.05/9 = 0.0056$

Table 4: Odds Ratios Comparing Covariate Subgroups from Adjusted<sup>§</sup> Model

Variable	Comparison	OR <sup>†</sup>	95% CI	<i>p</i> -value
Age	1 year increase	0.991	(0.986, 0.997)	0.0011
Sex	Female vs. Male	1.193	(0.963, 1.478)	0.1070
Marital Status	Married vs. Not Married	1.232	(0.999, 1.519)	0.0512
Education	> 12 <sup>th</sup> Grade vs. ≤ 8 <sup>th</sup> Grade	2.832	(2.042, 3.927)	< 0.0001
	9 <sup>th</sup> – 11 <sup>th</sup> Grade vs. ≤ 8 <sup>th</sup> Grade	1.638	(1.177, 2.279)	0.0034
	12 <sup>th</sup> Grade (HS/GED) vs. ≤ 8 <sup>th</sup> Grade	1.739	(1.279, 2.365)	0.0004
	> 12 <sup>th</sup> Grade vs. 9 <sup>th</sup> – 11 <sup>th</sup> Grade	1.730	(1.329, 2.250)	< 0.0001
	12 <sup>th</sup> Grade (HS/GED) vs. 9 <sup>th</sup> – 11 <sup>th</sup> Grade	1.062	(0.838, 1.347)	0.6195
	> 12 <sup>th</sup> Grade vs. 12 <sup>th</sup> Grade (HS/GED)	1.628	(1.309, 2.026)	< 0.0001
Residence	Private vs. Not Private	1.443	(1.145, 1.818)	0.0019
Incarcerated	No vs. Yes	1.013	(0.767, 1.338)	0.9275
PTA Group	Moderate vs. Moderate/Severe	0.855	(0.670, 1.091)	0.2082
	Moderate vs. Severe	0.813	(0.634, 1.042)	0.1019
	Moderate vs. Extremely Severe	0.878	(0.649, 1.189)	0.4001
	Moderate/Severe vs. Severe	0.951	(0.727, 1.243)	0.7112
	Moderate/Severe vs. Extremely Severe	1.027	(0.753, 1.402)	0.8664
	Severe vs. Extremely Severe	1.081	(0.807, 1.447)	0.6038
FIM Motor	1 unit increase	0.998	(0.992, 1.005)	0.6195
FIM Cognitive	1 unit increase	0.991	(0.973, 1.009)	0.3050
Job Stability	1 week increase	1.003	(0.999, 1.007)	0.1170
Violent Injury	No vs. Yes	1.565	(1.212, 2.021)	0.0006

<sup>§</sup>Model variables include race/ethnicity, age, gender, marital status, education, residence at rehabilitation discharge, pre-injury incarceration, problem substance use, violent cause of injury, PTA, discharge FIM, pre-injury job stability, and race/ethnic by problem substance use

<sup>†</sup> Odds ratios represent the odds of being retained versus not retained for one subgroup versus another subgroup