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## Self-Reported Lifetime Concussion Among Adults: Comparison of 3 Different Survey Questions

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### Abstract

**Objective**—Because of limitations in current national data sets, respondent self-report may be critical to obtaining concussion prevalence estimates. We examined whether self-report of lifetime concussion among adults varies with the provision of a concussion definition and by the content of that definition

**Setting and Participants**—A convenience sample of 6427 American adults who participated in the 2018 Porter Novelli SpringStyles survey

**Design**—Cross-sectional

**Main Measures**—Frequency of self-reported concussion by variation in concussion definition.

**Results**—A quarter of respondents (28.9%) reported experiencing a concussion in their lifetime. While concussion prevalence varied by demographic characteristics, it did not vary significantly by concussion definition. Variation in concussion definition did not result in differences related to recency of last concussion, mechanism of injury, or respondent activity engaged in during which they sustained their most recent concussion

**Conclusion**—The current study suggested that in this sample of adults, the percentage reporting a concussion did not significantly vary by whether a concussion definition was provided or by the content of the definition. However, research suggests that prompting about mechanism of injury, listing symptoms individually, and considering only athletic populations may affect estimates and these factors should be included in future question comparisons

### Keywords

concussion; injury prevention; survey methodology

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CONCUSSION, ALSO KNOWN AS A MILD TRAUMATIC BRAIN INJURY (TBI), affects the lives of hundreds of thousands of Americans nationwide. The latest estimates from the Centers for Disease Control and Prevention (CDC) indicate that TBIs, including

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concussions, contribute to approximately 2.8 million emergency department (ED) visits, hospitalizations, and deaths annually.<sup>1</sup> This number has increased dramatically—more than 50%—since 2006.<sup>1</sup> However, as these estimates are based solely on healthcare administrative data, they present a limited picture of the overall burden of TBI and concussion in the United States.<sup>2</sup> Patients seen in primary care offices, urgent care, and specialty clinics, patients treated in military facilities, and those who do not seek care within the healthcare setting are not included in current national data sets based on ED visits and hospitalizations.<sup>3</sup> One study that examined pediatric concussions in a regional healthcare system suggested that estimates based solely on hospital visits may be missing as many as 80% of concussion-related visits.<sup>3</sup> Furthermore, many concussions go untreated; therefore, even if prevalence estimates could capture the entirety of the healthcare setting, it would still be an underestimate of the public health burden of concussion.

One potential way to produce more comprehensive estimates of concussion prevalence is to conduct surveillance using self-report surveys. However, given that there is difficulty even for trained clinicians in diagnosing a concussion,<sup>4,5</sup> it cannot be assumed that a particular question or questions produce valid reports by untrained respondents as to whether they have experienced a concussion. One central question that has been examined is how providing a definition of concussion affects estimates based on self-report.<sup>6,7</sup> Relatedly, it is important to examine how estimates are affected by whether particular aspects of the definition—such as concussion symptoms—are provided.

The provision of a definition of concussion in self-report questions has been suggested as a means of improving the accuracy of retrospective concussion reporting. Two previous studies have examined the effect of providing a definition of concussion in a self-report question and compared it with that providing no definition.<sup>6,7</sup> Using the same concussion definition, which included 14 symptoms (eg, headache, dizziness, seeing stars), these studies found stark differences in the estimates. Current and former athletes who were predominantly male, and ranged in age from 20 to 85 years, self-reported twice as many concussions after being given a definition of concussion.<sup>6</sup> Another study found that former NFL players self-reported 5 times as many concussions after being provided a definition of “concussion” versus before being provided the definition.<sup>7</sup>

Given the difficulty in obtaining comprehensive estimates by other means, self-reported estimates of concussion may be essential; however, ensuring self-reports of concussion are valid is a significant and ongoing challenge. Thus, to examine specifically whether the percentage of adults who self-report having had a concussion in their lifetime varies on the basis of the inclusion or exclusion of a concussion definition and the signs and symptoms included in that definition, this study surveyed a large sample of American adults. Furthermore, differences in the percentage of adults reporting a concussion were examined by demographic variables and in relation to concussion circumstances (eg, mechanism of injury). Moving beyond studies that have examined this issue among athletes, the findings from this study can help inform how inclusion of a concussion definition and the symptoms included in that definition may affect self-reporting of lifetime concussions among adults.

## METHODS

### Sample

Self-report data were collected from the spring wave of Porter Novelli's 2018 ConsumerStyles survey called SpringStyles. This is an annual, voluntary, Web-based survey that gathers information about the health experiences, attitudes, and behaviors of American adults 18 years and older. Porter Novelli uses an online panel that is representative of the noninstitutionalized US population. Existing panel members are randomly recruited for a particular survey by mail using probability-based sampling by address to reach respondents regardless of whether or not they have access to a landline telephone or Internet access. Households are provided with a laptop or tablet and Internet access if needed. Respondents receive cash-equivalent reward points for their participation in these surveys, which can be redeemed online for gift cards and prizes. Between March 21 and April 11, 2018, Porter Novelli randomly sent an email to 10 904 adults 18 years or older from the already existing panel that invited them to complete the survey. In addition to questions about concussion, respondents were asked about topics ranging from Internet usage to health promotion behaviors to vaccination beliefs. Survey completion took approximately 35 minutes on average, and 58.9% of those who were invited to participate completed the survey ( $n = 6427$ ). The CDC licensed the results of the survey from Porter Novelli after data were collected. The CDC's analyses were exempt from institutional review board approval because personal identifiers were not included in the data file.

### Measures

**Demographics**—Respondents were asked to report their sex, age, race/ethnicity, household income, and educational attainment. Their US census region was determined by the state in which they live.

**Concussion information**—To determine the percentage of respondents who reported a concussion in their lifetime, and whether the question wording affected this percentage, respondents were randomly assigned to receive one of 3 different questions and definition formats:

1. A definition that only included loss or alteration of consciousness (“short definition”) that was consistent with the signs and symptoms assessed as part of a commonly used self-report measure, the Ohio State University Traumatic Brain Injury Identification Method (OSU TBI-ID).<sup>8</sup> The question reads as follows: A concussion has occurred anytime a blow to the head caused you to have 1 or more symptoms, whether just for a short time or lasting a while. Symptoms include being dazed or confused, trouble remembering, or being knocked out. In your lifetime, do you believe that you have had a concussion?

The 3 signs and symptoms listed in this question (being dazed or confused, trouble remembering, and loss of consciousness) are consistent with the American Congress of Rehabilitation Medicine and World Health Organization definitions of mild TBI and are associated with more certainty that a concussion has occurred.<sup>9,10</sup>

2. A definition with 15 signs and symptoms (“long definition”): A concussion can happen anytime a blow to the head caused you to have 1 or more symptoms, whether just for a short time or lasting a while. Symptoms include blurred or double vision, being bothered by light or noise, headaches, dizziness or balance problems, nausea, vomiting, trouble sleeping, feeling tired, being dazed or confused, trouble remembering, trouble concentrating, or being knocked out. In your lifetime, do you believe that you have had a concussion?

This second question builds on the first question and includes additional symptoms that may be indicative of a mild TBI.<sup>11</sup> This definition of concussion is supported by the Mayo TBI Severity Classification System and is considered to be more inclusive and allows for the reporting of possible (vs definite) concussion.

3. A question that did not include a definition (“no definition”): In your lifetime, do you believe that you have had a concussion?

In addition, respondents answering in the affirmative to the concussion question were asked how many concussions they have had in their lifetime, how long ago their most recent concussion occurred (during the past year, between 1 and 3 years ago, more than 3 years ago), the mechanism of injury when they sustained their most recent concussion (“When you sustained your most recent concussion, were you...?” in a motor vehicle crash; riding a bicycle; experiencing a trip, slip, or fall; in a blast or explosion; struck by or against something during a fight or an argument; struck by or against something by accident, doing something else), and additional information about the activity they were engaged in when they sustained their most recent concussion (“When you had your most recent concussion, were you...”? working for pay, engaging in a sport or recreational activity, engaging in regular activities around the home, or doing something else).

### Data analysis

We hypothesized that responses will differ on the basis of the number of signs and symptoms and which symptoms were included in the concussion definition. Specifically, we anticipated that the long definition that included 15 signs and symptoms would receive a higher proportion of endorsement than the shorter definition, which includes stricter inclusion criteria. All data were analyzed using SAS 9.4 (SAS Institute Inc, Cary, North Carolina). Frequency distributions were calculated for each question. To determine whether concussion experience (whether respondent had ever had a concussion, number of concussions experienced, how long ago their most recent concussion occurred, mechanism of injury, and activity) was associated with the wording of the initial concussion question,  $\chi^2$  tests were conducted. A Kruskal-Wallis test was conducted to determine whether there were differences by question in the median number of concussions reported. Cramer’s *V* statistics were also computed to determine practical significance. Generally, a Cramer’s *V* of 0.1 represents a small effect size, a Cramer’s *V* of 0.3 represents a medium effect size, and Cramer’s *V* of 0.5 represents a large effect size.<sup>12</sup> Medium and large effects were considered to indicate a practical or substantive difference. To determine whether certain demographic

groups are influenced differentially by the variation in question, as measured by the frequency of responding affirmatively to the question, logistic regression models were used to examine the interaction between demographic characteristics (sex, age, race/ethnicity, US region, household income, and educational attainment) and the specific concussion question a respondent received. The reference categories for the model parameters in the logistic regression models were female for sex, 18 to 29 for age, non-Hispanic white for race/ethnicity, Northeast for US region, less than \$50000 for household income, and bachelor's degree or higher for educational attainment.

The interaction of the demographic characteristic and the specific concussion question was considered to have a statistically significant effect on the percentage of respondents who have had a concussion in their lifetime if the Wald  $\chi^2$  test for the interaction term had a *P* value of .05 or less in the joint test. For chi-square tests that indicated significant differences for demographic characteristics with more than 2 levels, differences in proportions (ie, risks differences) with a Bonferroni adjustment for multiple comparisons were run for pairwise comparisons using SPSS.

## RESULTS

### Sample description

Of a total of 6427 respondents, approximately 54.8% were women (see Table 1). About 9.9% of participants in the sample were aged 18 to 29 years, 26.0% were aged 30 to 44 years, 35.4% were aged 45 to 59 years, and 28.7% were aged 60 years or older. Nearly three-fourths (74.2%) of the sample was non-Hispanic white. In terms of household income, about half of the sample reported earning less than \$75000 annually. About 4 in 10 respondents had a bachelor's degree or more.

### Lifetime concussion prevalence by concussion definition

Overall, 28.9% of respondents reported experiencing at least 1 concussion in their lifetime (see Table 2). This proportion did not vary significantly (*P* = .31) or practically (Cramer's *V* = 0.02) by question wording. The overall median number of concussions reported was 2, and a vast majority (87.9%) of concussions were experienced more than 3 years ago. Neither of these measures varied significantly or practically by whether the concussion question was preceded by a definition or definition version. When asked about mechanism of injury of their most recent concussion, about a quarter of respondents reported that it was caused by either being struck by or against something by accident (24.7%) or by doing "something else" (26.8%). About 20.8% reported the concussion was due to a trip, slip, or fall. Separately, when asked what they were doing at the time of injury, 37.2% respondents reported that they were engaged in a sport or recreational activity and 34.3% were doing "something else." Of those who reported the mechanism of injury was "something else," 65.4% reported that they were engaged in a sport or recreational activity at the time of their injury (analysis not shown). About a third of those who responded that they were doing "something else" as their activity reported that their concussion was due to a motor vehicle crash. Neither mechanism of injury nor activity significantly or practically varied by concussion question.

### Lifetime concussion prevalence by demographic characteristics

Lifetime concussion prevalence varied by sex, age, race/ethnicity, and educational attainment of respondent (see Table 3). A significantly greater percentage of men (34.8%) than women (24.0%) reported having experienced a concussion ( $P < .0001$ ). Respondents who were aged 45 to 59 years at the time of the survey were more likely to report having experienced a concussion than those in any other age group. A higher percentage of non-Hispanic white respondents (30.3%) reported having experienced a concussion than both non-Hispanic black (22.6%) and Hispanic respondents (25.0%), whereas a lower percentage of those with a high school education or less reported a concussion (24.8%) than those with either some college (31.9%) or a bachelor's degree or higher (29.4%). However, lifetime concussion prevalence did not vary on the basis of the interaction of any of the demographic characteristics and concussion question.

## DISCUSSION

This study found that nearly 30% of adults self-reported having had a concussion in their lifetime. While there was variation by demographic characteristics in the prevalence of self-reported concussion, the percentage of adults reporting a concussion did not vary on the basis of the provision of a concussion definition or by definition content that varied by number and type of signs and symptoms provided. More explicitly, concussion prevalence among those responding to the question with the short definition, which included the 3 signs and symptoms that may confer an increased probability of detecting a lifetime history of TBI, did not differ from the question with additional concussion-related symptoms (including those symptoms that may be caused by other injuries or illnesses) that may be indicative of possible concussion<sup>11</sup> or the question with no concussion signs or symptoms. This finding suggests that it may not be necessary to include a definition of concussion with signs and symptoms with a concussion question. Our findings do not allow us to conclude that responses differ on the basis of the signs and symptoms included in the concussion question. In other words, the results do not support the rejection of the null hypothesis that the number and type of signs and symptoms in the definition affect the percentage of people reporting a lifetime history of concussion. Furthermore, the percentage of adults reporting a concussion did not vary because of an interaction between question wording and demographic characteristics, suggesting that the provision of a definition and the inclusion of additional symptoms did not alter response patterns overall or for specific demographic subgroups.

The percentage of adults reporting having had a concussion (28.9%) was more than double what was reported in a previous meta-analysis of lifetime TBI in the general US population (12.1%).<sup>14</sup> However, the meta-analysis was limited to studies examining “traumatic brain injury” with loss of consciousness, and these differences may explain the discrepancy in estimates. A 2016 statewide survey in Colorado found that 42.5% of adults self-reported a TBI in their lifetime, a percentage that is much higher than that reported in this study.<sup>15</sup> The Colorado study utilized the OSU TBI-ID and inquired about similar symptoms as the short definition of concussion in the current study. However, in contrast to the current study, the survey asked first about head injuries and then about each of the 3 symptoms individually.



Furthermore, there were multiple head injury questions that focused the respondents on specific ways in which they may have injured their head (eg, vehicle crash, fall) and this may have improved respondents' recall of head injuries. Future research could examine whether separating signs and symptoms into multiple questions, or prompting respondents with specific mechanisms of injury, might measurably impact self-reported concussion estimates.

While the variation in TBI and concussion definition, survey content, and study population may have contributed to the varying estimates among previous studies,<sup>6,7,11</sup> the results presented here suggest that, at least currently and among a general population of adults, the prevalence of self-reported lifetime concussion may not be affected by whether the question includes a definition of concussion. Increased awareness of concussion has been hypothesized as a reason for an increase in TBI-related ED visits over the past 10 to 15 years,<sup>1</sup> and this increase in awareness of concussion may have reduced the impact of providing a concussion definition for self-reported concussions. Alternatively, perhaps the lack of a significant difference found in this study, in contrast to the previous studies, may have been due to the population examined. Previous studies examined current and former athletes and former NFL players, whereas the current study examined a broad sample of adults.

To provide more comprehensive estimates of concussion and allow for comparisons between studies, continued development and validation of self-report questions is needed. The current study did not find significant differences related to whether a definition of concussion was provided or the particular signs and symptoms were included in the definition. However, there are other elements of TBI and concussion self-report questions that may influence estimates and these should be systematically examined. For example, prompting respondents with cues related to common ways in which they may have experienced a head injury (eg, motor vehicle crashes, sports) could improve recall. Asking about concussion signs and symptoms individually, rather than as part of a long list, could also affect reporting. Another potential issue to examine is whether variation in these question elements might differentially affect responses to lifetime concussion questions relative to past-year concussion questions. It is possible that providing cues to improve memory of head injuries might have a greater impact on the recall of lifetime concussions. Given the results of prior studies, it may also be valuable to test questions among subpopulations, such as among athletes and former athletes.

A separate gap is the validation of TBI and concussion self-report questions in relation to a gold standard. For TBI, the closest thing to a gold standard is a clinical diagnosis of TBI or the use of one of a number of validated symptom inventories. However, it should be acknowledged that even these methods contain a certain level of subjectivity and ambiguity, owing much to the nonspecific nature of some TBI and concussion signs and symptoms and the reliance of these on the self-report of patients.<sup>4</sup> Nevertheless, validating concussion self-report questions against these criteria would be useful in providing greater confidence in the estimates provided by self-report surveys.

## Limitations

This study is subject to a number of limitations. First, although this survey was large and included a diverse sample, the results are not nationally representative and may be biased in ways that limit generalizability to the US population or to specific subpopulations. For example, the sample is disproportionately non-Hispanic white and with a higher level of educational attainment than the US population at large. Second, the data are retrospective and cross-sectional in nature and subject to recall bias. Third, the concussion questions used in the study have not been validated and affirmative responses were not validated, such as by independent medical diagnosis. Fourth, both the first and second questions used in the survey include the 3 signs and symptoms (being dazed or confused, trouble remembering, and loss of consciousness) that may be indicative of a greater certainty that a concussion has been sustained. The results only indicate that adding additional symptoms of possible concussion did not make a difference in self-reported lifetime concussion prevalence.

## CONCLUSION

The current study suggested that, at least among a broad group of adults, the percentage reporting a concussion did not significantly vary by whether a concussion definition was provided or by the content of the definition. However, to improve confidence in the use of self-report surveys in providing comprehensive estimates of concussion, further testing and validation of self-report questions are needed.

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TABLE 1

## SpringStyles 2018 sample description

Characteristic	Frequency	%
Sex		
Male	2907	45.2
Female	3520	54.8
Total	6427	100.0
Age		
18–29 y	637	9.9
30–44 y	1670	26.0
45–59 y	2274	35.4
60 y	1846	28.7
Total	6427	100.0
Race/ethnicity		
Non-Hispanic white	4769	74.2
Non-Hispanic black	547	8.5
Non-Hispanic other <sup>a</sup>	436	6.8
Hispanic	675	10.5
Total	6427	100.0
US region		
Northeast	1154	18.0
Midwest	1583	24.6
South	2252	35.0
West	1438	22.4
Total	6427	100.0
Annual household income		
<\$50 000	1998	31.1
\$50 000–\$74 999	1193	18.6
\$75 000–\$99 999	1072	16.7
\$100 000–\$149 999	1186	18.5
\$150 000	978	15.2
Total	6427	100.0
Educational attainment		
High school or less	1784	27.8
Some college	1990	31.0
Bachelor's degree or higher	2653	41.3
Total	6427	100.0

<sup>a</sup>Includes those who answered that they were “non-Hispanic, 2 or more races.”

**TABLE 2**  
Lifetime concussion prevalence, number, recency of last concussion, and mechanism of injury by definition type

	Total		Short definition <sup>a</sup>		Long definition <sup>b</sup>		No definition <sup>c</sup>		$\chi^2$	P	Cramer's V
	Frequency	%	Frequency	%	Frequency	%	Frequency	%			
Self-reported lifetime concussion									2.37	.31	0.02
Yes, I have had a concussion	1847	28.9	597	27.7	629	29.8	621	29.1			
No, I have not	4547	71.1	1556	72.3	1480	70.2	1511	70.9			
Median number of lifetime concussions <sup>de</sup>	2	...	2	...	2	...	1	...	1.14	.56	...
Interquartile range of number of lifetime concussions	(1, 2)		(1, 2)		(1, 2)		(1, 2)		7.83	.10	0.05
How long ago was most recent concussion <sup>d</sup>											
During the past year	81	4.4	31	5.2	29	4.7	21	3.4			
Between 1 and 3 y ago	141	7.7	57	9.6	45	7.2	39	6.3			
More than 3 y ago	1614	87.9	506	85.2	550	88.1	558	90.3			
Mechanism of injury for most recent concussion <sup>d</sup>									11.29	.50	0.06
Motor vehicle crash	294	16.0	90	15.1	89	14.2	115	18.7			
Riding a bicycle	97	5.3	33	5.5	36	5.8	28	4.6			
Trip, slip, or fall	383	20.8	119	20.0	125	20.0	139	22.6			
Blast or explosion	18	1.0	8	1.3	6	1.0	4	0.7			
Struck by or against something during a fight or argument	98	5.3	34	5.7	32	5.1	32	5.2			
Struck by or against something by accident	454	24.7	150	25.2	156	24.9	148	24.1			
Something else	493	26.8	162	27.2	182	29.1	149	24.2			
What respondent was doing during most recent concussion <sup>d</sup>									1.34	.97	0.02
Working for pay	170	9.3	60	10.1	57	9.1	53	8.6			
Engaging in a sport or recreation	682	37.2	219	36.9	229	36.7	234	37.9			
Engaging in regular activities around home	353	19.2	113	19.1	125	20.0	115	18.6			
Something else	629	34.3	201	33.9	213	34.1	215	34.9			

Abbreviations: IQR, interquartile range; Q1, quarter 1; Q3, quarter 3.

<sup>a</sup>, A concussion has occurred anytime a blow to the head caused you to have 1 or more symptoms, whether just for a short time or lasting a while. Symptoms include being dazed or confused, trouble remembering, or being knocked out. In your lifetime, do you believe that you have had a concussion?"

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<sup>q</sup>A concussion can happen anytime a blow to the head caused you to have 1 or more symptoms, whether just for a short time or lasting a while. Symptoms include blurred or double vision, being bothered by light or noise, headaches, dizziness or balance problems, nausea, vomiting, trouble sleeping, feeling tired, being dazed or confused, trouble remembering, trouble concentrating, or being knocked out. In your lifetime, do you believe that you have had a concussion?"

<sup>c</sup>"In your lifetime, do you believe that you have had a concussion?"

<sup>d</sup>For those respondents who answered "yes" to any of the concussion prevalence questions.

<sup>e</sup>For differences in the median number of lifetime concussions by question type, the extreme outlier values were dropped by using the Q1 – 3 IQR and Q3 + 3 IQR formula.<sup>13</sup> A Kruskal-Wallis test was performed to determine statistical significance.

**TABLE 3**

Frequency and percentage of respondents who self-report a concussion in their lifetime, by question type and select demographic variables

Characteristic	Overall		χ <sup>2</sup>	P	Short definition <sup>a</sup>		Long definition <sup>b</sup>		No definition <sup>c</sup>		Wald χ <sup>2</sup> of interaction term <sup>d</sup>	P value of interaction
	Frequency	%			Frequency	%	Frequency	%	Frequency	%		
Sex			90.38	<.0001							1.37	.50
Male	1006	34.8			328	33.5	332	35.0	346	36.0		
Female (ref)	841	24.0			269	22.9	297	25.6	275	23.5		
Age			16.43	.0009							4.54	.60
18–29 y (ref)	163	25.7			50	21.6	61	31.8	52	24.6		
30–44 y	456	27.5			153	26.9	160	28.2	143	27.5		
45–59 y <sup>e</sup>	722	31.9			232	31.3	238	32.2	252	32.2		
60 y	506	27.5			162	26.5	170	27.9	174	28.1		
Race/ethnicity			20.60	.0001							9.84	.13
Non-Hispanic white (ref) <sup>f</sup>	1439	30.3			478	29.8	481	30.7	480	30.5		
Non-Hispanic black	122	22.6			38	20.4	45	25.6	39	21.9		
Non-Hispanic other	118	27.3			36	28.4	34	23.6	48	29.8		
Hispanic	168	25.0			45	19.2	69	31.4	54	24.7		
US region			6.15	.10							10.40	.11
Northeast (ref)	309	26.9			90	22.8	122	31.5	97	26.4		
Midwest	438	27.7			153	28.7	140	28.3	145	26.4		
South	659	29.5			205	27.4	218	29.0	236	32.1		
West	441	30.8			149	31.3	149	31.3	143	29.9		
Annual household income			3.64	.46							4.55	.80
>\$50 000 (ref)	570	28.7			188	28.0	198	30.1	184	28.1		
\$50 000–\$74 999	332	28.0			113	27.1	109	29.3	110	27.9		
\$75 000–\$99 999	318	29.7			92	26.9	108	29.1	118	33.1		
\$100 000–\$149 999	361	30.6			116	28.4	123	33.2	122	30.4		
\$150 000	266	27.3			88	28.0	91	26.9	87	26.9		
Educational attainment			23.62	<.0001							1.43	.84
High school or less <sup>e</sup>	438	24.8			145	23.5	151	26.0	142	25.0		

Characteristic	Overall		Short definition <sup>a</sup>		P	Long definition <sup>b</sup>		No definition <sup>c</sup>		Wald $\chi^2$ of interaction term <sup>d</sup>	P value of interaction
	Frequency	%	Frequency	%		Frequency	%	Frequency	%		
Some college	632	31.9	205	31.5	204	31.4	223	32.6			
Bachelor's degree or higher (ref)	777	29.4	247	27.9	274	31.2	256	29.1			

<sup>a</sup>..A concussion has occurred anytime a blow to the head caused you to have 1 or more symptoms, whether just for a short time or lasting a while. Symptoms include being dazed or confused, trouble remembering, or being knocked out. In your lifetime, do you believe that you have had a concussion?''

<sup>b</sup>.. A concussion can happen anytime a blow to the head caused you to have 1 or more symptoms, whether just for a short time or lasting a while. Symptoms include blurred or double vision, being bothered by light or noise, headaches, dizziness or balance problems, nausea, vomiting, trouble sleeping, feeling tired, being dazed or confused, trouble remembering, trouble concentrating, or being knocked out. In your lifetime, do you believe that you have had a concussion?''

<sup>c</sup>..In your lifetime, do you believe that you have had a concussion?''

<sup>d</sup>Wald  $\chi^2$  of interaction term was obtained from the logistic regression modeling.

<sup>e</sup>Percentage is significantly different from those of all others at the  $P < .05$  level.

<sup>f</sup>Percentage for non-Hispanic white is significantly different from those of non-Hispanic black and Hispanic.