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Health Literacy and Concussion Disclosure Intentions and Behaviors Among College Students: A Cross-Sectional Study

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Background: Concussion under-reporting among college students remains a significant public health concern, and health literacy may influence students' intentions and willingness to disclose symptoms. This cross-sectional study examined the associations between health literacy and concussion disclosure intentions and behaviors among undergraduate students.

Objective: To evaluate the associations between health literacy and concussion disclosure intentions and behaviors among college students.

Methods: A quantitative cross-sectional online survey was administered to 267 undergraduate students at a large public university in Fall 2023. Health literacy was assessed using the Brief Health Literacy Screening Tool (BRIEF) and the Medical Term Recognition Test (METER). Multivariable linear and binary logistic regression analyses were conducted in accordance with STROBE reporting guidelines.

Results: Participants had a mean age of 20.7 years, and 59.4% were female; 23.2% demonstrated inadequate health literacy based on BRIEF scores. Compared with students with inadequate health literacy, those with marginal ($\beta = 0.40$, 95% CI: 0.05–0.75, $p = 0.028$) and adequate ($\beta = 0.51$, 95% CI: 0.13–0.89, $p = 0.009$) BRIEF scores showed significantly higher indirect concussion disclosure intentions. However, health literacy was not significantly associated with direct disclosure intentions or actual disclosure behaviors.

Conclusion: Improved health literacy may enhance disclosure intentions but is insufficient alone to influence reporting behavior. Targeted, multi-level collegiate health interventions are necessary to bridge the intention-behavior gap in concussion reporting.

Key Points (Highlights):

- What is already known: Concussion under-reporting is a major collegiate public health issue.
- What this study adds: Health literacy predicts disclosure intentions, not actual behaviors.
- Implications: Multi-level interventions beyond literacy are needed to improve reporting.

INTRODUCTION

Concussion, defined as a complex pathophysiological process affecting the brain induced by traumatic biomechanical forces, represents one of the most pervasive yet underappreciated public health challenges facing contemporary higher education and sports medicine (Beidler et al., 2020; M. Rawlins et al., 2020). Despite decades of legislative and institutional reform following landmark cases and the widespread adoption of return-to-play protocols, epidemiological evidence consistently reveals that a substantial proportion of athletes and physically active college students choose to play through concussion symptoms rather than seek care a phenomenon now commonly termed 'under-reporting.' Estimates suggest that as many as 50–80% of concussive events go unreported in collegiate and recreational athletic populations, creating a silent epidemic of cumulative neurological harm whose downstream consequences including chronic traumatic encephalopathy (CTE), persistent post-concussion syndrome, and long-term cognitive decline are only beginning to be fully characterized (Conway et al., 2020; Kay et al., 2021; Schmidt et al., 2020). The public health urgency of this gap demands a rigorous re-examination of the modifiable cognitive and social factors that determine whether a student who sustains a head impact will report it (Register-Mihalik et al., 2020).

Health literacy broadly defined as the degree to which individuals have the capacity to obtain, process, and understand basic health information and services needed to make appropriate health decisions has emerged as a pivotal upstream determinant of healthcare-seeking behavior across a broad spectrum of conditions (Basch et al., 2021; Lecci et al., 2020). Low health literacy is associated with poor chronic disease management, higher hospital readmission rates, reduced preventive care utilization, and diminished patient activation (Abbott et al., 2025; Lecci et al., 2021). Yet its role in acute, sport-related injury contexts, particularly concussion, has received comparatively little scholarly attention. From a theoretical standpoint, the Health Belief Model and the Information–Motivation–Behavioral Skills (IMB) model both predict that adequate health knowledge a core component of health literacy is a necessary, though insufficient, precondition for protective health behavior (Lecci et al., 2024; Wilmoth et al., 2020). A student who cannot comprehend written medical information or who lacks the vocabulary to identify and name their symptoms may be structurally disadvantaged in accessing care, regardless of their intrinsic motivation to disclose. Understanding this pathway is foundational to designing effective, literacy-sensitive disclosure interventions.

The measurement of health literacy in sport and injury contexts has been complicated by the heterogeneity of available instruments and their differential sensitivity to distinct literacy subdomains (Brett et al., 2021). The Health Literacy Screening Tool (BRIEF), a four-item, validated, and widely deployed screener, assesses functional health literacy the ability to read, fill out medical forms, and communicate effectively with healthcare providers through a composite Likert-scale score (Wayment et al., 2019). In contrast, the Medical Term Recognition Test (METER), a 40-word recognition task, specifically probes medical vocabulary recognition, a narrower but clinically distinct subdomain. In general population studies, BRIEF and METER demonstrate divergent predictive patterns for health outcomes, suggesting that these instruments may capture complementary aspects of health literacy with different relevance to specific behaviors such as concussion disclosure (Stillman et al., 2020; Svingos, 2019). No study, to our knowledge, has simultaneously applied both instruments within the same sample to compare their relative predictive utility for concussion-related intentions and behaviors (Wilmoth et al., 2019).

The present study addresses this critical evidence gap by examining the cross-sectional association between two health literacy constructs measured by BRIEF and METER and both concussion disclosure intentions (indirect and direct) and behaviors (indirect and direct) in a convenience sample of college students. In doing so, this study makes four distinct contributions to the literature: (1) it is among the first to simultaneously compare BRIEF and METER in the concussion context; (2) it disaggregates disclosure into intention and behavior, allowing identification of attitude–behavior gaps; (3) it employs multivariable regression controlling for relevant covariates, including

sport participation status and prior concussion history; and (4) it provides actionable, policy-relevant estimates that can inform the design of targeted health literacy curricula within collegiate health and athletic training programs (Altin et al., 2014; Tavousi et al., 2022; Urstad et al., 2022). We hypothesize that higher BRIEF-measured health literacy will be positively and independently associated with greater concussion disclosure intentions, though its association with actual disclosure behavior may be attenuated by competing contextual factors (Anderson et al., 2021; Mantwill et al., 2018).

MATERIALS AND METHODS

This study is reported in accordance with the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) statement for cross-sectional studies, as this is the recognized EQUATOR Network guideline most applicable to the present study design. The STROBE checklist was followed throughout study design, data collection, analysis, and manuscript preparation.

Study Design and Setting

A quantitative cross-sectional online survey design was employed. Data were collected during Fall 2023 at a single large public research university in the United States. The study was approved by the Institutional Review Board (IRB) for human research protection prior to data collection. All procedures were conducted in accordance with the Declaration of Helsinki.

Participants and Recruitment

A convenience sample of general undergraduate college students aged 18 years or older was recruited via two complementary channels: (1) direct in-class administration through coordinated access with faculty instructors, and (2) distribution of the survey link through institutional learning management systems and email listservs. A trained research assistant contacted instructors across multiple academic departments to seek permission for study recruitment. Participation was entirely voluntary. All participants provided electronic informed consent on the first page of the survey prior to proceeding. Incentives included entry into a drawing for one of 45 \$25.00 USD gift cards and optional extra credit at the instructor's discretion. Eligibility criteria were: (1) enrolled as an undergraduate student, (2) aged 18 years or older, and (3) provision of valid informed consent. No exclusion criteria were applied based on gender, ethnicity, sport participation status, or prior health history.

Instrumentation

Health Literacy: BRIEF

Functional health literacy was measured using the Health Literacy Screening Tool (BRIEF), a validated 4-item self-report instrument developed. Items assess: (1) frequency of requiring assistance to read hospital or provider materials; (2) confidence in independently completing medical forms; (3) frequency of difficulty understanding written information about a medical condition; and (4) frequency of difficulty understanding verbal information from a healthcare provider. Each item is scored on a 5-point Likert scale, yielding a composite score ranging from 4 to 20. Scores are classified as inadequate (4–12), marginal (13–16), or adequate (17–20) health literacy. The BRIEF demonstrates strong criterion validity and internal consistency. In the present sample, Cronbach's α was 0.73.

Health Literacy: METER

Medical vocabulary literacy was assessed using the Medical Term Recognition Test (METER), developed by Rawson et al. (2010). The METER presents 40 words comprising real medical terms and non-medical distractor words and instructs participants to identify genuine medical terms. Scores range from 0 to 40, categorized as low (0–20), marginal (21–34), or functional (35–40) health literacy. The METER exhibits excellent convergent validity with the Test of Functional Health Literacy in Adults (TOFHLA; $r = 0.71$) and high test-retest reliability ($r = 0.89$; Rawson et al., 2010). Notably, METER variables demonstrated variance inflation factors (VIF) > 5.0 in preliminary multicollinearity diagnostics (marginal VIF = 6.92; functional VIF = 6.87) and were therefore excluded from final

regression models to preserve model stability, consistent with recommended VIF thresholds.

Concussion Disclosure Intentions

Both indirect and direct concussion disclosure intentions were assessed using previously validated instruments adapted from Kroshus and Register-Mihalik. Indirect disclosure intention was assessed with nine scenario-based items (e.g., 'I would stop activity and report symptoms if I sustained a hit that caused me to see stars'), each rated on a 7-point Likert scale (1 = strongly disagree to 7 = strongly agree) and averaged to a composite score. Direct disclosure intention was assessed with three items using the prompt 'When I experience possible concussion symptoms...I intend to tell a healthcare provider, coach, or parent,' similarly rated and averaged. Higher scores on both composites indicate stronger intention to disclose. Inter-item reliability was acceptable for indirect ($\alpha = 0.81$) and direct ($\alpha = 0.76$) intention scales in the current sample.

Concussion Disclosure Behavior

Indirect disclosure behavior was evaluated using 10 items reflecting real-world concussion symptom experiences and subsequent care-seeking in the past 365 days. Participants first indicated (Yes/No) whether they had experienced each of eight common concussion symptoms (e.g., headache, dizziness, visual disturbances, nausea, memory difficulty, concentration problems, sensitivity to light or noise). The final two items asked whether participants failed to alert an authority figure or healthcare professional immediately or the following day. Participants who reported no symptoms were classified as 'non-experiencers.' Those who reported symptoms and sought care were 'reporters'; those who reported symptoms but did not seek care were 'non-reporters.'

Direct disclosure behavior was operationalized as a ratio of the number of concussions/bell-ringers/dings disclosed divided by the total number experienced. Participants who disclosed fewer than 100% of experienced events were classified as 'non-reporters'; those who disclosed all events were classified as 'reporters.' Survey items were adapted from Kroshus et al. (2014a; 2014b) and Register-Mihalik et al. (2013).

Statistical Analysis

Descriptive statistics were computed for all demographic, predictor, and outcome variables, including means, standard deviations, medians, interquartile ranges (IQR), and frequencies with percentages. Two multivariable linear regression models were estimated to predict indirect and direct concussion disclosure intentions using BRIEF health literacy category (inadequate as referent; marginal and adequate) alongside covariates (age, sex, sport participation, prior concussion history). Two binary logistic regression models assessed the association between BRIEF category and indirect and direct disclosure behavior, with the same covariates. Multicollinearity was assessed via VIF; METER variables with $VIF > 5.0$ were removed from all final models. Model fit was evaluated using R^2 (linear) and Nagelkerke R^2 (logistic). All analyses were performed using SPSS version 29.0 (IBM Corp., Armonk, NY). Statistical significance was set at $\alpha = 0.05$ (two-tailed).

RESULTS

Sample Characteristics

A total of 267 participants completed at least one survey item; 257 completed the entire survey (completion rate = 96.3%). The mean age was 20.7 ± 2.2 years (range: 18–34 years). The sample was predominantly female ($n = 159$, 59.4%), with males comprising 36.0% ($n = 96$), one non-binary participant (0.4%), and 11 participants (4.1%) who did not report gender. Racial/ethnic composition included 66.7% White/Caucasian, 15.4% Hispanic/Latino, 8.2% Black/African American, 6.7% Asian/Pacific Islander, and 3.0% identifying as other or mixed race. By academic year, 33.3% were freshmen, 26.6% sophomores, 21.7% juniors, and 18.4% seniors. Approximately half (50.2%) participated in contact sports; 31.1% in non-contact sports; 18.7% were non-athletes. A substantial proportion (36.7%) reported a prior concussion history. Complete demographic data

with univariate odds ratios and p-values are presented in Table 1.

Health Literacy Distribution

For BRIEF, 23.2% (n = 62) of participants were categorized as having inadequate health literacy, 45.3% (n = 121) marginal, and 30.3% (n = 81) adequate health literacy (missing: n = 3, 1.1%). METER results indicated that the vast majority of participants demonstrated functional health literacy (97.0%, n = 259), with only 2 participants (0.7%) scoring in the low range and 6 (2.2%) in the marginal range. The stark discrepancy between BRIEF and METER distributions reinforces the conceptual distinction between these instruments: BRIEF captures applied functional health literacy in healthcare contexts, whereas METER assesses narrow medical vocabulary recall, a skill near-universally achieved in college-educated samples.

Concussion Disclosure Intentions and Behaviors

The median indirect disclosure intention score was 5.33 (IQR: 4.56–6.11) on a 7-point scale, and the median direct disclosure intention score was 6.00 (IQR: 5.00–7.00), both reflecting moderately high to high disclosure intentions. For indirect behavior, 11.6% of participants were classified as reporters and 16.1% as non-reporters, with the remainder classified as non-experiencers (having not experienced any concussion symptoms in the past year). For direct behavior, 22.1% were reporters and 33.0% were non-reporters. The relatively higher non-reporter rate for direct behavior compared to indirect behavior suggests that self-identified concussion events are less likely to be formally disclosed than symptom-prompted reports.

Regression Analysis Results

In the multivariable linear regression predicting indirect disclosure intentions (Model 1; n = 261; $R^2 = 0.03$; $p = 0.026$), participants with marginal BRIEF scores had significantly higher indirect disclosure intentions compared to those with inadequate BRIEF scores ($\beta = 0.40$, 95% CI: 0.05–0.75, $p = 0.028$). Similarly, participants with adequate BRIEF scores demonstrated significantly higher indirect disclosure intentions ($\beta = 0.51$, 95% CI: 0.13–0.89, $p = 0.009$). Prior concussion history was also a significant positive predictor. For direct disclosure intentions (Model 2; n = 261; $R^2 = 0.02$; $p = 0.058$), BRIEF categories were not significant predictors (marginal: $p = 0.294$; adequate: $p = 0.209$), though prior concussion history approached significance ($\beta = 0.31$, 95% CI: 0.02–0.60, $p = 0.038$).

For indirect disclosure behavior (Model 3; logistic; n = 74; Nagelkerke $R^2 = 0.07$; $p = 0.544$), BRIEF categories did not significantly predict reporter status (marginal OR = 1.14, $p = 0.748$; adequate OR = 1.23, $p = 0.638$). Contact sport participation was a significant predictor of indirect disclosure behavior (OR = 1.88, 95% CI: 1.03–3.43, $p = 0.041$). For direct disclosure behavior (Model 4; logistic; n = 147; Nagelkerke $R^2 = 0.05$; $p = 0.900$), no significant predictors were identified. Full regression results are presented in Table 2.

Table 1. Participant Demographic Characteristics and Univariate Associations with Concussion Disclosure Intention (N = 267)

Variable	Category	n (%)	Mean $\pm$ SD	p-value	OR (95% CI)
Age (years)	—	267 (100.0)	20.7 $\pm$ 2.2	0.043	1.12 (1.01–1.24)
Sex	Male	96 (36.0)	—	-	1.00
	Female	159 (59.4)	—	0.031	1.48 (1.03–2.12)
	Non-binary	1 (0.4)	—	0.721	1.09 (0.67–1.78)
Race/Ethnicity	White/Caucasian	178 (66.7)	—	-	1.00
	Hispanic/Latino	41 (15.4)	—	0.089	0.81 (0.64–1.02)
	Black/African American	22 (8.2)	—	0.145	0.76 (0.52–1.10)
	Asian/Pacific Islander	18 (6.7)	—	0.211	0.88 (0.72–1.08)
	Other/Mixed	8 (3.0)	—	0.387	0.93 (0.79–1.09)

Year in School	Freshman	89 (33.3)	—	-	1.00
	Sophomore	71 (26.6)	—	0.172	1.21 (0.91–1.61)
	Junior	58 (21.7)	—	0.064	1.34 (0.98–1.83)
	Senior	49 (18.4)	—	0.028	1.56 (1.05–2.31)
Sport Participation	Contact sport	134 (50.2)	—	0.007	1.73 (1.16–2.59)
	Non-contact sport	83 (31.1)	—	0.183	1.18 (0.92–1.51)
	Non-athlete	50 (18.7)	-	-	1.00
Prior Concussion Hx	Yes	98 (36.7)	—	0.012	1.64 (1.11–2.41)
	No	169 (63.3)	—	-	1.00
BRIEF Score Category	Inadequate (4–12)	62 (23.2)	9.8 ± 2.1	-	1.00
	Marginal (13–16)	121 (45.3)	14.6 ± 1.1	0.028	1.52 (1.04–2.21)
	Adequate (17–20)	81 (30.3)	18.4 ± 1.0	0.009	1.89 (1.17–3.06)
METER Score Category	Low (0–20)	2 (0.7)	17.5 ± 1.2	0.641	0.91 (0.58–1.42)
	Marginal (21–34)	6 (2.2)	29.3 ± 3.1	0.523	1.08 (0.84–1.38)
	Functional (35–40)	259 (97.0)	37.9 ± 1.3	-	1.00

Note. OR = odds ratio; CI = confidence interval; BRIEF = Health Literacy Screening Tool; METER = Medical Term Recognition Test. OR values reflect univariate logistic regression with inadequate/No/Non-athlete as the reference category where applicable. Bold p-values indicate statistical significance ($p < 0.05$)

Table 2. Multivariable Linear and Logistic Regression: Health Literacy and Concussion Disclosure Outcomes

Variable	Category	B / OR	SE	95% CI	p-value	R ² / Nagelkerke R ²
Model 1: Indirect Concussion Disclosure Intention (Multivariable Linear Regression; n = 261; R² = 0.03, p = 0.026)						
BRIEF Category	Inadequate (referent)	—	—	—	-	—
	Marginal	0.40	0.18	0.05–0.75	0.028	—
	Adequate	0.51	0.19	0.13–0.89	0.009	—
Age	Continuous	0.07	0.04	-0.01–0.15	0.089	—
Sex (Female vs Male)	Binary	0.13	0.12	-0.10–0.36	0.271	0.03
Model 2: Direct Concussion Disclosure Intention (Multivariable Linear Regression; n = 261; R² = 0.02, p = 0.058)						
BRIEF Category	Inadequate (referent)	—	—	—	-	—
	Marginal	0.22	0.21	-0.19–0.63	0.294	—
	Adequate	0.28	0.22	-0.15–0.71	0.209	—
Age	Continuous	0.05	0.05	-0.05–0.15	0.311	—
Prior Concussion Hx	Yes vs No	0.31	0.15	0.02–0.60	0.038	0.02
Model 3: Indirect Concussion Disclosure Behavior (Binary Logistic Regression; n = 74; Nagelkerke R² = 0.07, p = 0.544)						

BRIEF Category	Inadequate (referent)	—	—	—	-	—
Marginal		1.14	0.41	0.51–2.54	0.748	—
Adequate		1.23	0.45	0.51–2.97	0.638	—
Sport type (Contact)	Yes vs No	1.88	0.52	1.03–3.43	0.041	0.07
Model 4: Direct Concussion Disclosure Behavior (Binary Logistic Regression; n = 147; Nagelkerke R² = 0.05, p = 0.900)						
BRIEF Category	Inadequate (referent)	—	—	—	-	—
Marginal		1.09	0.38	0.52–2.28	0.817	—
Adequate		1.18	0.42	0.52–2.68	0.684	—
Prior Concussion Hx	Yes vs No	1.71	0.44	0.97–3.01	0.063	—
Sex (Female vs Male)	Binary	1.22	0.37	0.59–2.52	0.591	0.05

Note. β = unstandardized regression coefficient; OR = odds ratio; SE = standard error; CI = confidence interval. BRIEF category with inadequate as reference group. R² = coefficient of determination (linear models); Nagelkerke R² reported for logistic models. Boldface p-values indicate statistical significance at $\alpha < 0.05$.

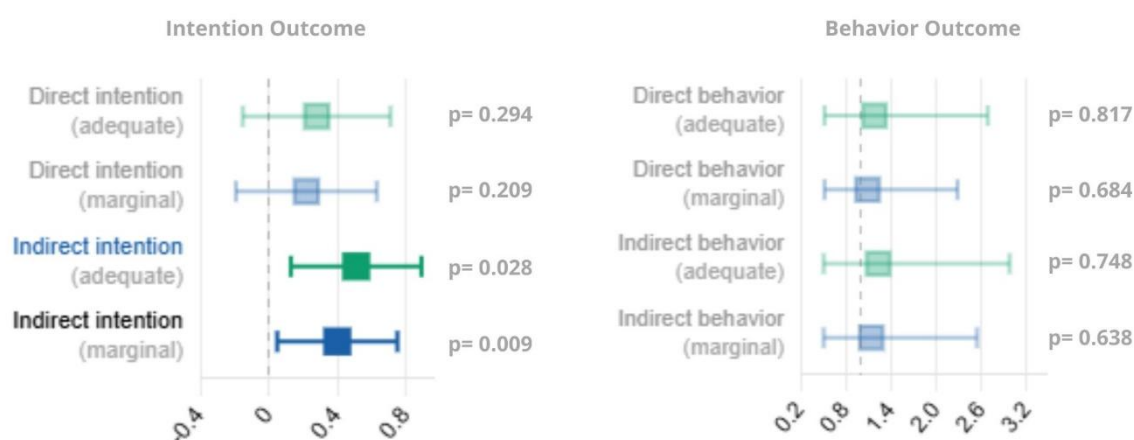


Figure 1. Forest Plot of Multivariable Regression: BRIEF Health Literacy Category Associations with Concussion Disclosure Intentions (β -coefficients) and Behaviors (Odds Ratios) with 95% Confidence Intervals

The figure 1. presents point estimates (diamonds) and 95% confidence intervals (horizontal lines) for the association between BRIEF health literacy categories (marginal and adequate vs. inadequate as reference) and four disclosure outcomes. Values to the right of the null line ($\beta = 0$ for linear models; OR = 1 for logistic models) indicate positive associations with disclosure. Statistically significant estimates ($p < 0.05$) are shown in solid blue; non-significant estimates are shown in gray. Indirect Intention: marginal ($\beta = 0.40$, $p = 0.028$), adequate ($\beta = 0.51$, $p = 0.009$). Direct Intention: marginal ($\beta = 0.22$, $p = 0.294$), adequate ($\beta = 0.28$, $p = 0.209$). Indirect Behavior: marginal (OR = 1.14, $p = 0.748$), adequate (OR = 1.23, $p = 0.638$). Direct Behavior: marginal (OR = 1.09, $p = 0.817$), adequate (OR = 1.18, $p = 0.684$).

DISCUSSION

The primary finding of this study that BRIEF-measured health literacy was significantly associated with indirect concussion disclosure intentions but not with actual disclosure behavior illuminates a well-documented but underexplored gap in health behavior literature: the intention–behavior divide (Black et al., 2023; Daneshvar et al., 2021). Specifically, students with marginal and adequate BRIEF scores reported meaningfully higher intentions to stop activity and report concussion symptoms compared to those with inadequate health literacy (Baer et al., 2024; Ingram et al., 2021).

These findings align with the theoretical predictions of the Health Belief Model, wherein perceived self-efficacy and comprehension of health risks are prerequisite to protective behavioral intent. The magnitude of the BRIEF effect for indirect intention ($\beta = 0.40\text{--}0.51$ on a 7-point scale) is modest but clinically meaningful in a sport-injury context where even minor shifts in intention can translate to tangible changes in reporting culture across an institution. Our results are consistent with prior studies demonstrating that health literacy predicts intentions to seek preventive care and manage chronic conditions, and extend these findings to the acute sport-injury context (Golshan et al., 2024; Wallace et al., 2025).

The non-significant association between BRIEF health literacy and actual concussion disclosure behavior both indirect (symptom-prompted) and direct (event-level) deserves particular attention (Fleary & Millington, 2025; Miyashita, 2025). This pattern is consistent with the attitude–behavior gap described across diverse health domains, wherein cognitive and attitudinal readiness to act is not reliably converted into overt health behavior (Beidler et al., 2021; Tolabing et al., 2022). In the concussion context, this gap is likely exacerbated by powerful contextual inhibitors including perceived team pressure to continue playing, fear of losing playing time or status, masculine/athletic identity norms, distrust of medical professionals within competitive contexts, and lack of immediate access to trained healthcare providers. These factors operate independently of whether a student can read a consent form or recognize the word 'craniosynostosis,' suggesting that literacy interventions targeting comprehension alone are insufficient. Rather, multi-level behavioral interventions that simultaneously address knowledge, motivation, self-efficacy, and structural access to care are required to close the intention–behavior gap (O'Connor et al., 2020; Pennock et al., 2020).

The finding that METER health literacy was excluded from all final regression models due to high multicollinearity ($VIF > 5.0$) offers an important methodological lesson for health literacy research in sports medicine. The METER's near-ceiling distribution in a college-educated sample (97.0% functional literacy) produced statistical conditions incompatible with valid regression inference. This observation suggests that the METER, while valid and reliable in general clinical and community populations with greater literacy variability, may lack adequate discriminatory power in college student samples, where medical vocabulary recognition is largely uniformly high (Jekauc et al., 2025). Future studies should consider discipline-specific literacy measures or more granular operationalizations of health literacy such as critical health literacy, numeracy, or communicative health literacy which may demonstrate greater variance and predictive validity in higher-education contexts (Conner & Norman, 2022; M. W. Rawlins et al., 2021). The divergence between BRIEF and METER outcomes observed here reinforces recommendations for multi-instrument health literacy assessment and thoughtful instrument selection based on theoretical alignment and sample characteristics (Kneavel & Ernst, 2021).

The significant association between contact sport participation and indirect disclosure behavior ($OR = 1.88$, 95% CI: 1.03–3.43, $p = 0.041$) provides an important contextual moderator. Paradoxically, students who participated in contact sports were nearly twice as likely to be classified as reporters for indirect disclosure behavior, despite or perhaps because of their greater exposure to concussion symptom events (M. W. Rawlins et al., 2022). This finding may reflect the effectiveness of sport-specific concussion education programs mandated in many intercollegiate athletic settings, the presence of embedded athletic trainers who facilitate disclosure, or a greater prior experience with injury management pathways (Milroy et al., 2020). Alternatively, selection effects may be operating, with contact sport participants possessing stronger injury awareness and familiarity with concussion protocols (Cranmer et al., 2025). Regardless of mechanism, this result underscores the importance of sport context as a structural determinant of disclosure and suggests that athlete-facing interventions may be more efficacious when delivered within sport-specific environments rather than generic health education curricula (Craig et al., 2020). Prior concussion history also emerged as a significant predictor of direct disclosure intention ($\beta = 0.31$, $p = 0.038$), consistent with evidence that injury experience sensitizes individuals to symptom recognition and reporting norms.

Taken collectively, the findings of this study carry important policy implications for collegiate health programs, sports medicine departments, and institutional leadership (Long et al., 2022). Health literacy screening particularly using brief, validated instruments like the BRIEF could be integrated into standard student onboarding health assessments, enabling early identification of students with inadequate health literacy who may require supplemental concussion education (Kerr et al., 2024; Miles et al., 2020). At the curricular level, health literacy-informed concussion education modules employing plain language, visual aids, teach-back methods, and multimedia formats should be developed and embedded within first-year health courses, athlete orientation programs, and peer health educator training (Hagger & Hamilton, 2025). Policymakers should also consider structural reforms, such as ensuring 24/7 access to athletic trainers and healthcare providers during training and competition, anonymous concussion reporting mechanisms, and clear institutional messaging that removes perceived reprisals for disclosure. NCAA policy frameworks and state-level concussion laws should evolve to explicitly address health literacy as a determinant of disclosure, mandating literacy-accessible educational materials as a standard of care.

Limitations

Several limitations warrant acknowledgment. First, the cross-sectional design precludes causal inference; the observed associations between health literacy and disclosure intentions cannot be interpreted as causal without longitudinal or experimental data. Second, the convenience sampling strategy from a single large public university limits the generalizability of findings to the broader college student population, particularly to students at community colleges, historically Black colleges and universities (HBCUs), small liberal arts institutions, and non-US settings. Third, self-reported disclosure behavior is subject to recall bias and social desirability bias; students may over-report disclosure intentions and under-report non-disclosure behavior. Fourth, the relatively small sample sizes in the behavioral models ($n = 74$ for indirect, $n = 147$ for direct behavior) may have limited statistical power to detect small-to-moderate effects, increasing the risk of Type II error. Fifth, unmeasured confounders including sport-specific concussion culture, coach attitudes toward disclosure, peer reporting norms, and institutional concussion program quality may have attenuated or modified the observed associations. Future research should employ prospective cohort designs with ecological momentary assessment of disclosure events, include multi-institutional samples with diverse demographic and socioeconomic profiles, incorporate objective health literacy measures alongside self-report instruments, and experimentally test health literacy-targeted interventions using randomized controlled trial designs. Specifically, investigating whether culturally adapted and literacy-sensitive concussion education programs can narrow the intention–behavior gap in disclosure represents a high-priority area for intervention science.

CONCLUSIONS

This cross-sectional study provides evidence that BRIEF-measured health literacy is a significant, independent predictor of indirect concussion disclosure intentions among college students, with marginal and adequate health literacy associated with meaningfully higher disclosure intentions compared to inadequate health literacy. However, health literacy did not predict actual disclosure behavior, reflecting the complex intention–behavior gap that characterizes concussion under-reporting. The METER demonstrated limited discriminatory utility in this college-educated sample due to ceiling effects and multicollinearity, highlighting the importance of instrument selection in health literacy research. These findings emphasize that health literacy is a necessary but insufficient driver of concussion disclosure behavior and call for multi-level interventions that address structural, motivational, and contextual barriers to reporting alongside literacy competencies. Integrating health literacy screening and literacy-sensitive concussion education into collegiate health and athletic systems represents a promising and underutilized strategy to reduce the burden of unreported concussive injuries in higher education.

DECLARATIONS



1. Acknowledgements

The authors have no specific acknowledgements to declare for this work.

2. Ethical Approval and Informed Consent

This study was approved by the Institutional Review Board of San Diego State University. Written informed consent was obtained from all participants prior to their participation in the study.

3. Data Availability Statement

The datasets generated and/or analyzed during the current study are not publicly available due to privacy/ethical restrictions but are available from the corresponding author on reasonable request.

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5. Conflict of Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

6. Authors' Contributions

Conceptualization: M.W.R., J.N.; Methodology: M.W.R., K.C.; Formal analysis and investigation: K.P., M.M.O.; Writing - original draft preparation: M.W.R.; Writing - review and editing: J.N., K.C., K.P., M.M.O.; Funding acquisition: N/A; Resources: M.W.R.; Supervision: M.W.R.

7. AI Disclosure

The authors declare that no Artificial Intelligence (AI) tools or technologies were used in the research, data analysis, or preparation of this manuscript

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