**Supplemental Materials**

**Results**

*Semi-Structured Interview Data*

Some participants reported LOC or PTA outside the mild severity range for their Qualifying TBI during at least one visit (16 at one visit; 4 at two visits), with six instances of participants who reported LOC > 30 minutes (1 at SA visit; 3 at EC; 2 at LC) and 18 who reported PTA > 24 hours (5 at SA; 9 at EC; 4 at LC). Similarly, for the Remote TBIs, there were two instances of participants reporting LOC > 30 minutes (1 at EC; 1 at LC) and six who reported PTA > 24 hours (2 at SA; 3 at EC; 1 at LC) during at least one visit. The actual durations of injury characteristics were confirmed by medical personnel as part of the study inclusion criteria into the study. However, these data points were included in the analyses even though they were outside of the traditional mTBI range given the primary aim to examine reliability. One participant failed to report their Qualifying TBI at both the EC and LC visits. For another participant, the semi-structured interview was not completed due to experimenter error at the EC visit. These two participants were not included in the following analyses.

Supplemental Tables 2 (Qualifying TBI) and 3 (Remote TBI) provide results for each of the different types of reliability coefficients examined in the current study. As expected, both Gwet’s AC1 and Gwet’s AC2 provide the same result for nominal binary variables given that there are only two possible outcomes. As seen in Supplemental Tables 2 and 3, Gwet’s AC2 produces the highest reliability values for binary (nominal), categorical (ordinal) and continuous (ratio) variables. However, for some variables, such as LOC and PTA, the differences between Gwet’s and ICC values were minimal. Gwet’s AC2 is preferable for ordinal scale categorical variables because the application of a weighted matrix on the response distribution estimates proximal as opposed to absolute agreement. In other words, ordinal categorical responses that are close in order, but not exact, would still exhibit high agreement between responses. Finally, for continuous data that presents a zero-inflated and positively skewed distribution, applying a base 10 log transformation (with a constant added to address zero value responses) prior to estimating the ICC increases the reliability compared with ICC estimation on the original distribution. This is primarily due to reducing the impact of extreme outliers and influential observations.

*Simulation Results*

Additional calculations based on known distributions were conducted to determine how estimated reliability for both ICC and Gwet’s AC1/AC2 can be moderated by different data types (binary, categorical, and continuous) with different distributions and varying degrees of ‘true’ correlations. Specifically, for continuous distributions, 250,000 values were randomly sampled from a bivariate normal distribution [X~*N*(=0; =1) and Y~*N*(=0; =1)] across varying levels of correlation strength (i.e., the ICC; 0.0 to 0.9 in increments of 0.1; rows of Supplemental Table 5). This sample distribution was then transformed to create a separate distribution, whereby all negative values were converted to zeros, thus creating the scenario mirroring the zero-inflated data obtained from the semi-structured interview in which approximately half of the bivariate sample report zeros (Column 4). Simulation of categorical variables was performed in two different ways with zeroes from the previously created distribution remaining as zeroes and the remaining values split into four categories as either an even distribution (i.e., each with 12.5%; Columns 2 and 6) or a distribution weighted towards lower ordinal categories (i.e., 20% each in categories 1 and 2, 5% each in categories 3 and 4; Columns 3 and 7). Finally, simulation of binary variables were achieved by splitting below (0) and above (1) the median for the X and Y values on the original bivariate normal distribution (Columns 1 and 5). Given the very large number of generated samples, the computed correlations and measures of agreement are essentially population summaries as the margin of error is less than 0.001.

Supplemental Table 5 examines how ICC and Gwet’s AC1/AC2 estimates are impacted by the transformations described above. Notably, ‘true’ correlation and ICC would be the same if using an unaltered normal bivariate distribution because marginal distributions are identical [i.e., X/Y ~ N(µ=0;σ2=1)]. As expected, taking the zero-inflated data and reducing it to binary data reduces ICC and AC2 (compare Supplemental Column 1 to 5), with both providing identical output. However, those ordinal scale categorical data with linear probability assumptions of non-zero endorsements (Columns 2 and 3) give ICC values approximately close to those from zero-inflated continuous data (Column 4). On the other hand, categorical AC2 results (Columns 6 and 7) indicate increased values relative to zero-weighted ratio scale ICC (Column 4) when ICC is small or moderate. AC2 increases with the value of ICC but not as fast as the ICC based on the categorized scores. Importantly, continuous data was not assessed with Gwet’s AC2 as it was developed for categorical data.

**Supplemental Table 1.** Comparing participants with three visits and two visits.

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | **pmTBI** | |  | **HC** | |  |
|  | **3 Visits**  **n=129** | **2 Visits**  **n=55** | ***p*** | **3 Visits**  **n=102** | **2 Visits n=54** | ***p*** |
| Female Sex – Count (%) | 58 (45.0%) | 22 (40.0%) | .53 | 48 (47.1%) | 19 (35.2%) | .15 |
| Age at Enrollment | 13.73 (2.73) | 13.75 (2.78) | .97 | 14.05 (2.70) | 13.02 (2.82) | .03 |
| Mother Years of Education | 14.85 (2.66) | 14.89 (2.62) | .93 | 16.30 (1.67) | 16.69 (1.60) | .16 |
| Father Years of Education | 14.41(3.05) | 14.80 (3.47) | .47 | 16.80 (2.62) | 16.59 (2.65) | .65 |
| LOC at SA (min) | 2.2 (11.11) | 2.32 (4.73) | .93 | - | - |  |
| PTA at SA (min) | 315.28 (1360.24) | 113.49 (340.97) | .12 | - | - |  |
| # TBIs at SA | 1.27 (0.56) | 1.35 (0.8) | .47 | - | *-* |  |
| SA-PCSI # Symptoms | 10.95(4.83) | 10.82 (4.86) | .86 | - | *-* |  |
| SA-PCSI Symptom Burden | 40.65 (23.68) | 38.18 (21.79) | .51 | - | *-* |  |

Notes. HC = Healthy Controls; LOC = Loss of Consciousness; PCSI = Post-concussion Symptom Inventory; pmTBI = Pediatric Mild Traumatic Brain Injury; PTA = Post-Traumatic Amnesia; SA = Sub-Acute; SD = Standard Deviation; TBI = Traumatic Brain Injury. All data are presented as Mean (SD) unless indicated otherwise.

**Supplemental Table 2**. Qualifying TBIs – All Reliability/Agreement Coefficients

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Measure** | **Visit** | **AC1** | **AC2** | **ICC** | **Log(ICC)** |
| LOC Binary | SA to EC | **0.67** | 0.67 | 0.67 | 0.67 |
| SA to LC | **0.62** | 0.62 | 0.61 | 0.61 |
| EC to LC | **0.75** | 0.75 | 0.75 | 0.75 |
| LOC Category | SA to EC | 0.64 | **0.87** | 0.70 | 0.71 |
| SA to LC | 0.62 | **0.85** | 0.58 | 0.61 |
| EC to LC | 0.64 | **0.90** | 0.77 | 0.78 |
| LOC Continuous | SA to EC | 0.54 | 0.86 | 0.17 | **0.65** |
| SA to LC | 0.48 | 0.85 | 0.13 | **0.54** |
| EC to LC | 0.56 | 0.92 | 0.57 | **0.80** |
| PTA Binary | SA to EC | **0.56** | 0.56 | 0.48 | 0.48 |
| SA to LC | **0.53** | 0.53 | 0.45 | 0.45 |
| EC to LC | **0.59** | 0.59 | 0.46 | 0.46 |
| PTA Category | SA to EC | 0.55 | **0.74** | 0.48 | 0.49 |
| SA to LC | 0.56 | **0.72** | 0.41 | 0.44 |
| EC to LC | 0.63 | **0.77** | 0.47 | 0.48 |
| PTA Continuous | SA to EC | 0.55 | 0.81 | 0.04 | **0.45** |
| SA to LC | 0.54 | 0.79 | 0.01 | **0.34** |
| EC to LC | 0.61 | 0.84 | 0.01 | **0.44** |
| Retrograde Amnesia Binary | SA to EC | **0.68** | 0.68 | 0.25 | 0.25 |
| SA to LC | **0.66** | 0.66 | 0.28 | 0.28 |
| EC to LC | **0.81** | 0.81 | 0.65 | 0.65 |
| Retrograde Amnesia Category | SA to EC | 0.72 | **0.87** | 0.30 | 0.29 |
| SA to LC | 0.67 | **0.86** | 0.25 | 0.27 |
| EC to LC | 0.78 | **0.91** | 0.64 | 0.66 |
| Retrograde Amnesia Continuous | SA to EC | 0.72 | 0.89 | 0.00 | **0.28** |
| SA to LC | 0.68 | 0.89 | 0.00 | **0.22** |
| EC to LC | 0.74 | 0.92 | 0.24 | **0.59** |
| Confusion/ Disorientation Binary | SA to EC | **0.74** | 0.74 | 0.36 | 0.36 |
| SA to LC | **0.77** | 0.77 | 0.32 | 0.32 |
| EC to LC | **0.76** | 0.76 | 0.28 | 0.28 |
| Confusion/ Disorientation Category | SA to EC | 0.31 | **0.52** | 0.35 | 0.34 |
| SA to LC | 0.29 | **0.54** | 0.38 | 0.38 |
| EC to LC | 0.31 | **0.53** | 0.39 | 0.34 |
| Confusion/ Disorientation Continuous | SA to EC | 0.13 | 0.53 | 0.09 | **0.40** |
| SA to LC | 0.11 | 0.45 | 0.07 | **0.36** |
| EC to LC | 0.15 | 0.54 | 0.19 | **0.44** |
| Acute-PCSI Number of Symptoms | SA to EC | 0.05 | 0.78 | 0.65 | **0.65** |
| SA to LC | 0.06 | 0.71 | 0.59 | **0.52** |
| EC to LC | 0.05 | 0.80 | 0.74 | **0.72** |
| Acute-PCSI Symptom Burden | SA to EC | 0.02 | 0.77 | 0.68 | **0.67** |
| SA to LC | 0.00 | 0.74 | 0.64 | **0.59** |
| EC to LC | 0.01 | 0.75 | 0.71 | **0.67** |

*Notes*. EC = Early Chronic; ICC = Intra-Class Correlation Coefficient; LC = Late Chronic; LOC = Loss of Consciousness; PCSI = Post-Concussion Symptom Inventory; PTA = Post-Traumatic Amnesia; SA = Sub-Acute; TBI = Traumatic Brain Injury; Bold text denotes values used in the main manuscript.

**Supplemental Table 3.** Test-retest reliability coefficients for TBI Characteristics for Qualifying TBI; Participants with different parents present across visits.

|  |  |  |  |
| --- | --- | --- | --- |
|  | **SA to EC** | **SA to LC** | **EC to LC** |
| LOC Binary1 | 0.61 | 0.73 | 0.73 |
| LOC Category2 | 0.86 | 0.89 | 0.86 |
| LOC Continuous3 | 0.46 | 0.28 | 0.57 |
| PTA Binary1 | 0.59 | 0.64 | 0.58 |
| PTA Category2 | 0.75 | 0.79 | 0.85 |
| PTA Continuous3 | 0.28 | 0.28 | 0.31 |
| RGA Binary1 | 0.79 | 0.72 | 1.00 |
| RGA Category2 | 0.89 | 0.87 | 0.97 |
| RGA Continuous3 | 0.26 | 0.00\* | 0.65 |
| Confusion/Disorientation Binary1 | 0.86 | 0.76 | 0.74 |
| Confusion/Disorientation Category2 | 0.60 | 0.53 | 0.50 |
| Confusion/Disorientation Continuous3 | 0.38 | 0.19 | 0.35 |
| Acute-PCSI Number of Symptoms3 | 0.61 | 0.29 | 0.63 |
| Acute-PCSI Symptom Burden3 | 0.62 | 0.45 | 0.61 |

*Notes*. EC = Early Chronic; ICC = Intra-Class Correlation Coefficient; LC = Late Chronic; LOC = Loss of Consciousness; PCSI = Post-Concussion Symptom Inventory; PTA = Post-Traumatic Amnesia; RGA = Retrograde Amnesia; SA = Sub-Acute; TBI = Traumatic Brain Injury; \*Actual value was negative, but constrained to zero to increase interpretability; 1Gwet’s AC1; 2Gwet’s AC2; 3Intraclass Correlation Coefficient (Log transformed) +1.

**Supplemental Table 4**. Remote TBIs – All Reliability/Agreement Coefficients

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Measure** | **Visit** | **AC1** | **AC2** | **ICC** | **Log ICC** |
| # of Reported Remote TBIs -  Full Sample | SA to EC | 0.89 | **0.97** | 0.70 | 0.68 |
| SA to LC | 0.87 | **0.94** | 0.59 | 0.59 |
| EC to LC | 0.93 | **0.98** | 0.65 | 0.70 |
| # of Reported Remote TBIs -  Only individuals with a history of Remote TBI (N=59) | SA to EC | 0.25 | **0.70** | 0.38 | 0.20 |
| SA to LC | 0.14 | **0.44** | 0.08 | 0.00 |
| EC to LC | 0.53 | **0.77** | 0.36 | 0.40 |
| LOC Binary | SA to EC | **0.75** | 0.75 | 0.67 | 0.67 |
| SA to LC | **0.60** | 0.60 | 0.59 | 0.59 |
| EC to LC | **1.00** | 1.00 | 1.00 | 0.79 |
| LOC Category | SA to EC | 0.76 | **0.93** | 0.68 | 0.70 |
|  | SA to LC | 0.71 | **0.86** | 0.58 | 0.61 |
|  | EC to LC | 0.79 | **0.93** | 0.89 | 0.96 |
| LOC Continuous | SA to EC | 0.68 | 0.91 | 0.17 | **0.53** |
|  | SA to LC | 0.52 | 0.82 | 0.01 | **0.29** |
|  | EC to LC | 0.59 | 0.92 | 0.11 | **0.73** |
| PTA Binary | SA to EC | **0.71** | 0.71 | 0.49 | 0.49 |
|  | SA to LC | **0.66** | 0.66 | 0.53 | 0.53 |
|  | EC to LC | **0.83** | 0.83 | 0.83 | 0.83 |
| PTA Category | SA to EC | 0.75 | **0.85** | 0.57 | 0.55 |
|  | SA to LC | 0.77 | **0.77** | 0.47 | 0.51 |
|  | EC to LC | 0.75 | **0.84** | 0.76 | 0.79 |
| PTA Continuous | SA to EC | 0.72 | 0.90 | 0.44 | **0.54** |
|  | SA to LC | 0.69 | 0.82 | 0.00 | **0.26** |
|  | EC to LC | 0.58 | 0.76 | 0.25 | **0.64** |
| RGA Binary | SA to EC | **0.80** | 0.80 | 0.55 | 0.55 |
| SA to LC | **0.88** | 0.88 | 0.81 | 0.81 |
| EC to LC | **0.70** | 0.70 | 0.60 | 0.60 |
| RGA Category | SA to EC | 0.79 | **0.91** | 0.48 | 0.49 |
| SA to LC | 0.81 | **0.93** | 0.68 | 0.72 |
| EC to LC | 0.65 | **0.88** | 0.62 | 0.63 |
| RGA Continuous | SA to EC | 0.76 | 0.89 | 0.00 | **0.36** |
| SA to LC | 0.69 | 0.93 | 0.37 | **0.69** |
| EC to LC | 0.63 | 0.88 | 0.03 | **0.60** |
| Confusion/Disorientation Binary | SA to EC | **0.65** | 0.65 | 0.60 | 0.60 |
| SA to LC | **0.72** | 0.72 | 0.64 | 0.64 |
| EC to LC | **0.79** | 0.79 | 0.65 | 0.65 |
| Confusion/Disorientation Category | SA to EC | 0.00 | **0.50** | 0.56 | 0.60 |
| SA to LC | 0.44 | **0.66** | 0.73 | 0.71 |
| EC to LC | 0.30 | **0.52** | 0.57 | 0.60 |
| Confusion/Disorientation Continuous | SA to EC | 0.32 | 0.51 | 0.04 | **0.43** |
| SA to LC | 0.30 | 0.77 | 0.72 | **0.78** |
| EC to LC | 0.17 | 0.43 | 0.09 | **0.42** |
| Acute-PCSI Number of Symptoms | SA to EC | 0.13 | 0.78 | 0.73 | **0.58** |
| SA to LC | 0.00 | 0.74 | 0.68 | **0.60** |
| EC to LC | 0.00 | 0.68 | 0.69 | **0.80** |
| Acute-PCSI Symptom Burden | SA to EC | 0.06 | 0.74 | 0.69 | **0.59** |
| SA to LC | 0.00 | 0.71 | 0.09 | **0.57** |
| EC to LC | 0.00 | 0.63 | 0.03 | **0.78** |

*Notes*. EC = Early Chronic; ICC = Intra-Class Correlation Coefficient; LC = Late Chronic; LOC = Loss of Consciousness; PCSI = Post-Concussion Symptom Inventory; PTA = Post-Traumatic Amnesia; RGA = Retrograde Amnesia; SA = Sub-Acute; TBI = Traumatic Brain Injury; Bold text denotes values used in the main manuscript.

**Supplemental Table 5.** Simulation Results

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  | Intraclass Correlation Coefficient | | | | Gwet’s AC2 | | |
| Column Reference | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| ‘True’ *r* | Nominal - Binary | Ordinal – Equal | Ordinal – Weighted | Ratio – Zero-inflated | Nominal - Binary | Ordinal – Equal | Ordinal – Weighted |
| 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.40 | 0.19 |
| 0.10 | 0.06 | 0.08 | 0.08 | 0.08 | 0.06 | 0.44 | 0.24 |
| 0.20 | 0.13 | 0.16 | 0.16 | 0.16 | 0.13 | 0.47 | 0.29 |
| 0.30 | 0.19 | 0.24 | 0.25 | 0.24 | 0.19 | 0.51 | 0.34 |
| 0.40 | 0.27 | 0.33 | 0.34 | 0.33 | 0.27 | 0.54 | 0.39 |
| 0.50 | 0.34 | 0.42 | 0.43 | 0.43 | 0.34 | 0.59 | 0.45 |
| 0.60 | 0.41 | 0.51 | 0.52 | 0.53 | 0.41 | 0.63 | 0.51 |
| 0.70 | 0.50 | 0.61 | 0.62 | 0.64 | 0.50 | 0.68 | 0.58 |
| 0.80 | 0.59 | 0.72 | 0.72 | 0.75 | 0.59 | 0.74 | 0.66 |
| 0.90 | 0.71 | 0.84 | 0.83 | 0.87 | 0.71 | 0.82 | 0.76 |