**Supplementary table 1.** Unadjusted estimates of candidate prognostic factors and association with days to recovery using simple linear regression analysis

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| --- | --- | --- | --- | --- | --- |
| **Characteristics** | **Unstandardized ß (SE)** | | **95% CI** | | **R2** |
| **First BCTT result** | | |  | |  |
| Exercise-tolerant | Ref. | |  | |  |
| Exercise-intolerant | 15.1 (2.1) | | **10.8 to 19.3** | | 0.054 |
| **Participant characteristics** | | |  | |  |
| Age | 1.2 (0.4) | | **0.5 to 2.1** | | 0.011 |
| Sex |  | |  | |  |
| Male | Ref. | |  | |  |
| Female | 3.8 (1.8) | | **0.3 to 7.2** | | 0.005 |
| Number of previous concussions | 3.2 (1.1) | | **1.1 to 5.4** | | 0.01 |
| **Injury specific characteristics** | | |  | |  |
| Loss of Consciousness with injury |  | |  | |  |
| No | Ref. | |  | |  |
| Yes | -4.8 (3.8) | | -12.1 to 2.5 | | 0.002 |
| Amnesia with injury |  | |  | |  |
| None | Ref. | |  | |  |
| Anterograde | 2.0 (3.1) | | -4.2 to 8.2 | |  |
| Retrograde | 2.8 (3.2) | | -3.6 to 9.2 | | 0.001 |
| Sport mechanism of injury |  | |  | |  |
| Hockey | Ref. | |  | |  |
| Football/Rugby | 1.1 (2.6) | | -4.1 to 6.2 | |  |
| Soccer/Basketball | 3.0 (2.5) | | -1.8 to 7.8 | |  |
| Volleyball/Cheerleading/Baseball | 10.4 (3.7) | **3.1 to 17.8** | |  | | |
| Other | 3.5 (2.6) | -1.6 to 8.7 | | 0.010 | | |
| Symptom severity score | 1.8 (0.5) | | **0.1 to 0.3** | | 0.017 |
| **Assessment specific characteristics** | | |  | |  |
| Days from injury to assessment | 0.5 (0.2) | | **0.0 to 0.9** | | 0.005 |
| Days from injury to 1st BCTT attempt | 1.5 (0.3) | | **1.0 to 2.0** | | 0.035 |
| **Treatment specific characteristics** | | |  | |  |
| Number of clinical notes on record | 4.3 (0.4) | | **3.5 to 5.1** | | 0.118 |
| Number of clinical notes with visual or vestibular therapy specified | 3.9 (0.6) | | **2.6 to 5.2** | | 0.041 |
| Mean number of BCTT’s performed | 12.0 (1.7) | | **8.7 to 15.3** | | 0.055 |

BCTT: Buffalo concussion treadmill test; ref: reference; y, years

**Supplemental table 2.** STROBE Statement—checklist of items that should be included in reports of observational studies

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| --- | --- | --- | --- | --- |
|  | Item No. | Recommendation | Page  No. | Relevant text from manuscript |
| **Title and abstract** | 1 | (*a*) Indicate the study’s design with a commonly used term in the title or the abstract | Page 1 | Association between first attempt Buffalo Concussion Treadmill Test and days to recovery in 855 children with sport related concussion: a historical cohort study and prognostic factors analysis |
| (*b*) Provide in the abstract an informative and balanced summary of what was done and what was found | Page 2 | A historical clinical cohort study was performed with a network of approximately 150 Canadian multidisciplinary primary care concussion clinics.  Children who were exercise intolerant compared with those exercise tolerant, experienced an increase of 13 days to recovery (95%CI, 9 to 17 days) |
| Introduction | | | |  |
| Background/rationale | 2 | Explain the scientific background and rationale for the investigation being reported | Page 4 | However, little is known about this relationship when the BCTT is performed more than 10 days after SRC, as most studies to date have assessed candidate prognostic factors during the acute phase of concussion |
| Objectives | 3 | State specific objectives, including any prespecified hypotheses | Page 4 | Our objective was to assess the associations between participant, injury, and clinical process characteristics, including exercise-intolerance on a first attempt BCTT performed 10 to 21 days after injury, and days to recovery in a clinical cohort of children with SRC. |
| Methods | | | |  |
| Study design | 4 | Present key elements of study design early in the paper | Page 5 | We conducted a historical clinical cohort study using data from a network of approximately 150 primary care clinics. |
| Setting | 5 | Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection | Page 6 | Our study population was children (≤17 years) with SRC who had a first attempt BCTT between 10 to 21 days after their reported date of SRC injury and received healthcare within the clinical network between 1 January 2016 and 11 April 2019 |
| Participants | 6 | (*a*) *Cohort study*—Give the eligibility criteria, and the sources and methods of selection of participants. Describe methods of follow-up  *Case-control study*—Give the eligibility criteria, and the sources and methods of case ascertainment and control selection. Give the rationale for the choice of cases and controls  *Cross-sectional study*—Give the eligibility criteria, and the sources and methods of selection of participants | Page 6 | Our study population was children (≤17 years) with SRC who had a first attempt BCTT between 10 to 21 days after their reported date of SRC injury and received healthcare within the clinical network between 1 January 2016 and 11 April 2019 |
| (*b*)*Cohort study*—For matched studies, give matching criteria and number of exposed and unexposed  *Case-control study*—For matched studies, give matching criteria and the number of controls per case | N/A |  |
| Variables | 7 | Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable | Page 6, 7 and 8 | Participant characteristics collected included sex, age, and number of previous concussions. Injury characteristics included patient-reported loss of consciousness (LOC) at time of injury, presence and type of amnesia (retrograde or anterograde) at time of injury, sport mechanism of injury grouped by similarity in reported concussion incidence rates for each sport, and symptom severity evaluation at initial visit.  Participants unable to exercise to maximal exertion due to symptom exacerbation on the BCTT were rated as exercise-intolerant.  The outcome, days from injury to recovery, was derived by calculating the difference between the patient-reported date of SRC injury and the date the patient was provided medical clearance and discharged as recorded in the clinical record system |
| Data sources/ measurement | 8\* | For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group | Page 7 | All data were collected at the time of care provision by the attending regulated healthcare practitioner |
| Bias | 9 | Describe any efforts to address potential sources of bias | Page 6 | Participants were excluded if they presented with history of attention deficit disorder (ADD), attention deficit hyperactivity disorder (ADHD), learning disorder, depression, anxiety, autism, sleep disorder, or more than 3 prior concussions, as these factors have been reported to be associated with delayed recovery; or 3) scored < 7 on concussion symptom severity at initial assessment (as normally developing adolescents may present with concussion-like symptoms). |
| Study size | 10 | Explain how the study size was arrived at | Page 9 | Between 1 January 2016 and 11 April 2019, 6,052 candidate pediatric (≤ 17 years) patient records were identified in the study database as having received a concussion diagnosis at a participating clinic. After applying the study inclusion and exclusion criteria, the eligible study population consisted of 855 patients |
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| --- | --- | --- | --- | --- |
| Quantitative variables | 11 | Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why |  |  |
| Statistical methods | 12 | (*a*) Describe all statistical methods, including those used to control for confounding | Page 8 | Hierarchical linear regression modelling was subsequently performed to assess the fit of 4 pre-specified multivariable linear regression models based on clinical reasoning and our study objectives |
| (*b*) Describe any methods used to examine subgroups and interactions | N/A |  |
| (*c*) Explain how missing data were addressed | Page 15 | Our study has several limitations. First, participants lost to follow up or without complete recovery were excluded. |
| (*d*) *Cohort study*—If applicable, explain how loss to follow-up was addressed  *Case-control study*—If applicable, explain how matching of cases and controls was addressed  *Cross-sectional study*—If applicable, describe analytical methods taking account of sampling strategy | Page 15 | Our study has several limitations. First, participants lost to follow up or without complete recovery were excluded. |
| (*e*) Describe any sensitivity analyses | N/A |  |
| Results | | | | |
| Participants | 13\* | (a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed | Page 9 | 6,052 candidate pediatric (≤ 17 years) patient records were identified in the study database as having received a concussion diagnosis at a participating clinic. After applying the study inclusion and exclusion criteria, the eligible study population consisted of 855 patients |
| (b) Give reasons for non-participation at each stage | Page 9 | See figure 1. |
| (c) Consider use of a flow diagram | Page 9 | See figure 1. |
| Descriptive data | 14\* | (a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders | Page 9 | The study sample was primarily male, with an average age of 14 years (range 6 to 17 years). A majority of participants reported no prior concussion history and no LOC or amnesia with injury. First attempt BCTT was performed on average 14 days following the recorded date of injury. Participants took on average 32 days to achieve recovery (median, 25 days to recovery) |
| (b) Indicate number of participants with missing data for each variable of interest | N/A |  |
| (c) *Cohort study*—Summarise follow-up time (eg, average and total amount) | Page 9 | Between 1 January 2016 and 11 April 2019, 6,052 candidate pediatric (≤ 17 years) patient records were identified in the study database  Participants took on average 32 days to achieve recovery (median, 25 days to recovery). |
| Outcome data | 15\* | *Cohort study*—Report numbers of outcome events or summary measures over time | N/A |  |
| *Case-control study—*Report numbers in each exposure category, or summary measures of exposure | N/A |  |
| *Cross-sectional study—*Report numbers of outcome events or summary measures | Page 9 | Participants took on average 32 days to achieve recovery (median, 25 days to recovery). Overall, 684 (80%) participants were rated as exercise-tolerant based on their first attempt BCTT, while 171 (20%) were rated as exercise-intolerant |
| Main results | 16 | (*a*) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included | Page 11 | See supplementary table 1 for unadjusted estimates of participant, injury, and clinical process characteristics, and the BCTT result as candidate prognostic factors and their crude associations with days to recovery  After adjusting for participant, injury and clinical process characteristics, exercise-intolerance, as measured by a first attempt BCTT, was associated with an increased 13 days to recovery (95%CI = 9.0 to 17.4 days) compared with exercise-tolerance |
| (*b*) Report category boundaries when continuous variables were categorized | N/A |  |
| (*c*) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period | N/A |  |

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| --- | --- | --- | --- | --- |
| Other analyses | 17 | Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses | N/A |  |
| Discussion | | | | |
| Key results | 18 | Summarise key results with reference to study objectives | Page 13 | Prior history of concussion, injury during volleyball, cheerleading, and skiing, exercise intolerance on a first attempt BCTT, and increased time from injury to first BCTT attempt were associated with prolonged recovery. However, the result of a first attempt BCTT alone was not a strong prognostic factor for time to recovery |
| Limitations | 19 | Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias | Page 15 and 16 | Our study has several limitations. First, participants lost to follow up or without complete recovery were excluded. It is possible that the profile of these individuals may have differed from those who fully completed their treatment plan. Second, participants in our study received concussion care, which may have had an effect on both exercise tolerance/intolerance at the time of first attempt BCTT, as well as time to recovery. This may have been a possible source of confounding, mediation, or both, that is difficult to disentangle. Although we reported on the intensity of ongoing care within this clinical network, we were unable to report on external care. Third, we acknowledge the possibility of detection bias, as clinicians could not be masked to the BCTT result in our highly pragmatic study. Fourth, practitioners from varying disciplines and forms of health insurance coverages are participants of this clinical network. As a result, patients with access to both private and public insurance coverages may be more likely included. |
| Interpretation | 20 | Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence | Page 16 | This study found that children shown to be exercise-intolerant from the BCTT, 10-21 days after SRC, were associated with delayed recovery. However, this was not a strong prognostic factor for recovery. |
| Generalisability | 21 | Discuss the generalisability (external validity) of the study results | Page 15 and 16 | First a large number participants were recruited from diverse primary care settings across Canada which enhances generalizability of findings  First, participants lost to follow up or without complete recovery were excluded. It is possible that the profile of these individuals may have differed from those who fully completed their treatment plan  Fourth, practitioners from varying disciplines and forms of health insurance coverages are participants of this clinical network. As a result, patients with access to both private and public insurance coverages may be more likely included |
| Other information | |  | | |
| Funding | 22 | Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based | Page 17 | No funding to declare. |

\*Give information separately for cases and controls in case-control studies and, if applicable, for exposed and unexposed groups in cohort and cross-sectional studies.

**Note:** An Explanation and Elaboration article discusses each checklist item and gives methodological background and published examples of transparent reporting. The STROBE checklist is best used in conjunction with this article (freely available on the Web sites of PLoS Medicine at http://www.plosmedicine.org/, Annals of Internal Medicine at http://www.annals.org/, and Epidemiology at http://www.epidem.com/). Information on the STROBE Initiative is available at www.strobe-statement.org.