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Predictors of discharge destination from acute care in patients with traumatic brain injury

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ABSTRACT

Introduction Many studies have assessed the predictors of morbidity/mortality of patients with traumatic brain injury (TBI) in acute care. However, with the increasing rate of survival after TBI, more attention has been given to discharge destinations from acute care as an important measure of clinical priorities. This study describes the design of a systematic review compiling and synthesising studies on the prognostic factors of discharge settings from acute care in patients with TBI.

Methods and analysis This systematic review will be conducted on peer-reviewed studies using seven databases including Medline/Medline in-Process, Embase, Cochrane Database of Systematic Reviews, Cochrane CENTRAL, PsycINFO, CINAHL and Supplemental PubMed. The reference list of selected articles and Google Scholar will also be reviewed to determine other relevant articles. This study will include all English language observational studies that focus on adult patients with TBI in acute care settings. The quality of articles will be assessed by the Quality in Prognostic Studies tool.

Ethics and dissemination The results of this review will provide evidence that may guide healthcare providers in making more informed and timely discharge decisions to the next level of care for patient with TBI. Also, this study will provide valuable information to address the gaps in knowledge for future research.

Trial registration number Trial registration number (PROSPERO) is CRD42016033046.

Strengths and limitations of this study

- To the best of our knowledge, this study will be the first systematic review on predictors of discharge destination from acute care in patients with traumatic brain injury.
- The results of this study will assist healthcare providers in discharge planning from acute care.
- To mitigate the risk of bias in observational studies, we plan to report the risk of bias for each study using the Quality in Prognostic Studies tool for assessing prognostic studies.

INTRODUCTION

Traumatic brain injury (TBI) is one of the most disabling neurological disorders worldwide and is predicted to rank as the major cause of death and disability by the year 2020.[1] This injury imposes a wide range of psychosocial and economic burden on patients, their families and society. As reported by the Neurological Health Charities and the Public Health Agency of Canada, 'hospitalised TBI will continue to have the greatest number of individuals experiencing severe disability by 2031'.[2] Various levels of care are available to patients with TBI. Acute care is the beginning of the pathway of care after initial emergency treatment.[3 4] The Centers for Disease Control and Prevention (CDC) in the USA reported that, between 2001 and 2010, the rate of TBI emergency department visits and acute care hospitalisations increased by approximately 70% and 11%, respectively.[5] Although with improving quality of early medical interventions, the survival rate has been improved, this also has led to increasing the number of patients with long-lasting disabilities.[6 7] The effects of TBI on cognitive, behavioural and physical functions can cause significant limitations such as inability to return to work, reintegrate into the community[8] and function independently in activities of daily living.[9–11] Therefore, many patients require healthcare resources such as inpatient rehabilitation or admission to long-term care facilities with various intensities of rehabilitation services.[6 11] Furthermore, the cost of hospitalisation, longer length of stay (LOS) in acute care and alternate level of care are of major concern for governments and funders of healthcare.[12] Hence, improving the efficiency of care, reducing LOS, unplanned hospital readmissions and providing sufficient supports to patients and their caregivers are priorities in acute care discharge planning.[13–15] However, discharge planning becomes a challenging issue for acute care providers from the first few days of trauma admission.[14 16] At the time of discharge, a wide range of discharge

settings are possible, including home with/without supports, inpatient rehabilitation facilities (IRFs), skilled nursing facilities (SNFs) and long-term/short-term care settings.[11 17 18]Although home is the preferred discharge destination for most patients, many patients with remaining impairments would benefit from discharge to settings with rehabilitation services.[19] Many studies have demonstrated that intensive inpatient rehabilitation is associated with greater improvement in cognitive and physical recovery in patients with TBI.[11 19–21] Nonetheless, with respect to the cost and intensity of rehabilitation in different facilities, it is necessary to identify factors that influence discharge disposition in order to optimise both patient care and resource utilisation.[4 12] During the last decade, improving quality of care and increasing the number of survivors have gradually shifted the focus of research from discharge status (morbidity or mortality)[22–24] to that of discharge destination.[25–27] In order to use discharge destination as a measure of clinical priorities and pathway of care, it is important to understand the factors that contribute to this outcome. While some studies suggest that discharge to a rehabilitation setting is mostly related to preinjury functioning and overall severity of injury,[25 27 28] others indicate that demographic and socio-economic factors are the main elements that correlate with discharge to rehabilitation facilities versus home and other institutionalised care settings.[26 29]

Despite the increasing number of prognostic studies on discharge destination, there is a paucity of literature that systematically reviews predictors of discharge destinations from acute care in patients with TBI.

General objectives

The main goal of this systematic review is to review and synthesise the studies on the prognostic factors of discharge destinations from acute care in patients with TBI.

Research questions

1. What are the most common discharge destinations from acute care in patients with TBI?
2. What are the predictors of discharge to any rehabilitation facility versus home from acute care in patients with TBI?
3. What are the predictors of discharge to IRFs versus SNFs/other institutions from acute care in patients with TBI?

METHODS AND ANALYSIS

This systematic review has been registered with an international prospective register of systematic reviews (PROSPERO) (registry number: CRD42016033046).[30] This study will be conducted and reported using the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines.[31] The PRISMA checklist is also available as an online supplementary file to this protocol .

ELIGIBILITY CRITERIA

Population

The population of interest will be adults (men and women ≥16 years old) who were admitted to acute care settings with a clinical diagnosis of TBI. According to the Brain Injury Association of America, TBI is ‘an alteration in brain function, or other evidence of brain pathology, caused by an external force’.[32]

For the purposes of this study, patients with a primary clinical diagnosis of TBI were considered as the target population. The operational definitions for the clinical identification of TBI included: diffuse axonal injury (extensive tearing of nerve tissue throughout the brain), concussion (with/without loss of consciousness), contusion (bleeding or haemorrhagic), coup/countra-coup injury (injury at both the site and opposite side of the impact) and open/closed injuries (penetrating or blunt injury).[33]

Settings

This study will focus on patients with TBI who were hospitalised in acute care settings. Hirshon *et al* in 2013 provided a comprehensive definition for ‘acute care’ based on standards of the WHO terminology.[34] They defined acute care as ‘the most time-sensitive, individually-oriented diagnostic and curative actions whose primary purpose is to improve health’.[34] Acute care settings include ‘emergency medicine, trauma care, pre-hospital emergency care, acute care surgery, critical care, urgent care and short-term inpatient stabilisation’.[34]

Prognostic factors

Clinical and non-clinical factors will be reported in two main categories. (1) Clinical factors included (a) severity of injury, (b) intensive care unit LOS and acute care LOS, (c) clinical assessments and treatments (ie, medications/ interventions), (d) acute care functional status, (e) premorbidities and comorbidities and (f) discharge against medical advice. (2) Non-clinical factors included (a) demographic characteristics (ie, age, sex/gender, educational and marital status, socioeconomic factors such as race/ethnicity and insurance status/ payer system), (b) environmental factors (ie, hospital volume and geographical region of hospitals), (c) social factors (patient and family preference, preinjury location of living, living situation).

Outcomes

Discharge destinations from acute care will be assessed as the primary outcome of interest. Destinations include: IRFs, SNFs or other institutions such as long-term facilities, postacute residential and home (with and without support). According to CDC, inpatient rehabilitation is defined as an inpatient admission to an acute rehabilitation hospital or specialised brain injury unit where the patients benefit from a minimum of 3 hours of therapy per day.[11] An extended care facility such as an SNF refers to a setting out of hospital in which individuals may receive interdisciplinary therapy delivered at a lower

intensity.[11] To be admitted to a long-term care hospital and post-acute residential setting, patients must have a medically complicated status (such as pulmonary and cardiac disease), requiring ongoing support and therapeutic behavioural monitoring respectively.[11]

Types of studies

All English peer-reviewed observational studies including cohort (prospective and retrospective), cross-sectional, case-controlled and high-quality population-based studies that reported prognostic models will be included in this review. Studies that did not meet the above criteria such as case studies, case series, dissertations and paediatric and animal studies will be excluded from this review. Also, articles that focused on discharge against medical advice as an outcome measure will be excluded from this study.

Search strategies

The comprehensive search strategy for reviewing studies on predictors of discharge destinations from acute care was designed in collaboration with medical experts and specialists in TBI care in November 2016. The types of database and search terms were discussed and developed with a librarian at the Toronto Rehabilitation Institute (TRI) and by reviewing previous literature (online supplementary file 2). Three search strategies will be used to extract the relevant literature. For the first strategy, seven databases including Medline/Medline in-Process, Embase, Cochrane Database of Systematic Reviews, Cochrane CENTRAL, PsycINFO, CINAHL and Supplemental PubMed will be searched electronically. Second, we will review the reference list of selected articles to distinguish related studies that may have been missed in the above search strategy. Thirdly, we will search the remaining literature, high-quality population-based studies by assessing the first 100 results from the three main search terms queries on the Google internet search engine.

Study selection

All retrieved articles from databases will be combined and duplicates will be removed using Endnote X_7 software and manually. Titles and abstracts of the remaining articles will be screened independently by two reviewers (SZ and LT) based on inclusion and exclusion criteria. The same reviewers will then assess the full text of articles that passed the first step of screening to ensure eligibility criteria are met. Two reviewers will meet regularly to discuss progress and potential difficulties. Any discrepancies between reviewers will be resolved by discussion or consultation with clinical and research experts (NC, AC and SMA). We will present the process of study selection in the flowchart format. The rationale for excluding articles from systematic review will be reported in a separate table. Both reviewers will participate in the pilot study exercise on the first 100 articles to discuss possible challenges.

Data extraction

Information from each article will be abstracted and entered into data extraction tables (Box 1). This abstracted data will include:

Box 1 Characteristics of included studies

Author(s), country, year.
Title of study, objective(s), inclusion and exclusion criteria, origin of samples/time frame of data gathering.
Number of samples, age (mean±SD), sex/gender (%).
Study design, attrition.
Predictors.
Confounding factors.
Outcome measures and related statistics.
Method of data analysis (ie, univariate/multivariate logistic regression).
Results (ie, OR/risk ratio, β-coefficient, p value, 95% CI).

1. Publication details: author (s) name, year of publication and country in which the study was conducted.
2. Methodology and design of study: objectives, inclusion and exclusion criteria, type of study (cohort (prospective, retrospective), cross-sectional, case control and population-based studies) and methods of statistical analysis (single variable/multivariable models and type of regressions).
3. Participant details: number of patients with TBI, patient characteristics (such as age, sex), severity of TBI and LOS.
4. Discharge locations: IRFs, SNFs and other institutions such as long-term care facilities, postacute residential settings and home (with and without support).
5. Prognostic factors: associated/related factors with discharge destinations from acute care that were assessed in the predictive model.
6. Confounding factors: factors that are related to both predictors and outcome measures and may either increase or decrease the likelihood of the outcome such as severity of injury, age and preinjury location, family/caregivers' preference and cultural competency.
7. Results: statistical methods, OR/risk ratio (RR), β-coefficient and calculated p values and/or 95% CI.

Missing methodological information

For studies with missing data, the corresponding author will be contacted for further explanation on any important missing information such as definition of the proposed discharge destination, predictors and methodology of study.

Risk of bias and quality assessment

The quality of the studies will be assessed independently by two reviewers using the Quality in Prognostic Study (QUIPS) tool for assessing prognostic studies.[35] The QUIPS tool contains six categories assessing potential sources of bias: (1) study participation, (2) study attrition, (3) prognostic factors measurement, (4) outcome measurement, (5) study confounders and (6) statistical analysis and reporting. Potential bias of prognostic studies will be

evaluated and rated as 'high', 'moderate', 'low' for each section (online supplementary file 3).[35]

To summarise the level of evidence, we will use the Scottish Intercollegiate Guidelines Network Methodology for prognostic studies: (i) '+++' or 'high-quality studies' when greater than 80% of QUIPS tool total scores were fulfilled, (ii) '++'or 'moderate-quality studies' when 60%–80% of criteria were fulfilled and (iii) '+' when less than 60% of criteria were fulfilled (online supplementary file 3).[36] To determine significant predictors of discharge destination, OR/RR, calculated p values and/or 95% CI will be extracted from the included articles. A p value ≤0.05 or 95% CI that did not cross a null value of 1.0 will be considered as statistically significant for the proposed research question and therefore included as significant factors.

Data synthesis

Meta-analysis will be done using the Rev-Man V.5.3 software. The heterogeneity testing will be used to determine the more appropriate model for meta-analysis using the χ^2-based Q statistic. Two models of meta-analysis will be considered for outcomes based on the effect size variation (Q statistic): the fixed-effect model and the random-effect model. A funnel plot will be employed to visualise the publication bias in selected study for meta-analysis. Pooled effect size will be calculated by OR and/or RR and corresponding 95% CIs. A subgroup meta-analysis will be considered for different outcomes. Where statistical pooling (meta-analysis) is not possible, findings will be reported narratively from including tables.[37]

Presenting and reporting the results

This review will report the results according to PRISMA reporting guidelines.[31] Process of selecting studies and the exclusion criteria will be explained in a flow chart.

We will report a percentage and frequency of studies that were conducted on each predictor. All evidence will be reported using three phases of explanatory prognosis investigation described by Hayden *et al*.[38] These three phases include: identifying association (phase I), testing independent association (phase II) and understanding prognostic pathway (phase III). While phase I evidence identifies associations between various potential prognostic factors and a health outcome, phase II studies examine the independence of the association between a prognostic factor and the outcome of interest while controlling for confounding factors. Phase III studies describe the complexity of the prognostic pathways or processes. The direction of association will be coded with (+) for positive direction, (−) for negative direction and (0) for lack of association. Additionally, the quality of studies for each predictor will be reported in three categories based on result of quality assessment.

Ethics and dissemination

For the purpose of this study, we will review pre-existing published articles, and therefore, ethical permissions will not be required. The findings of this study will be submitted for publication in a peer-reviewed journal. The results of this study will be presented at national and international related conferences such as the Annual Brain Injury Association of Canada Conference and International Brain Injury Association World Congress.

CONCLUSION

To the best of our knowledge, this study will be the first systematic review on predictors of discharge destinations from acute care in patients with TBI. Recognising predictors of discharge destination early in the recovery period of acute care will help healthcare providers to design more accurate and realistic care and referral plans. In addition, healthcare providers can inform patients and their families of the most likely discharge destination so that they can prepare themselves for potential changes in living location. Thus, patients will transition to the next level of care in a more timely way and with lower cost, which will lead to improved quality of care for patients with TBI. The results of this study may provide reliable evidence for governments and policy makers to prioritise their support to patients with TBI and researchers. Researchers also will be informed of the current gaps of knowledge in this area and necessary elements to develop referral/discharge guideline for patients with TBI.

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Contributors SZ developed the idea and designed the protocol with oversight from NC and AC. SZ and LT reviewed all articles. NC and AC provided advice on each level of review. NC, AC and SMA helped in revising the manuscript critically. SMA provided advice on methodology of synthesis and analysis of the findings. All authors gave final approval of this manuscript.

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Competing interests None declared.

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