Data harmonization and synthesis of published evidence on brain health outcomes after traumatic brain injury: Application of the PROGRESS-Plus framework

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Introduction

- Traumatic brain injury (TBI) is a leading cause of death and disability, affecting brain health[1]
- Social parameters may affect brain health outcomes after TBI, but research collecting social data have been sparse and inconsistent[1,2]
- We aimed to integrate social and clinical data using PROGRESS-Plus framework (Fig.1) and harmonise the data to enable data-driven research

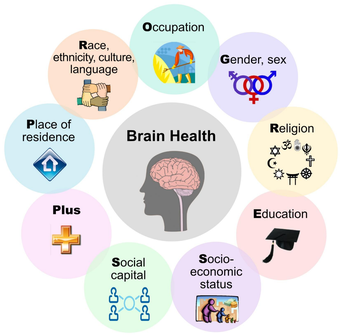

Fig.1: PROGRESS-Plus framework (visuals adapted from Cochrane[3])

Objectives

1. To extract social and clinical data from published research on topics of brain health after TBI
2. To harmonize data for the creation of a common dataset for future data-driven research on research

Methods

- We published the study protocol[3] and registered it on PROSPERO (CRD42024547456)
- We selected published research on the topic of interest
- We extracted clinical and social data into a pre-defined spreadsheet
- We organized the data by semantic matching and transformed the data into numeric values (Fig. 2)

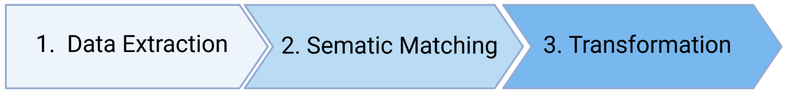

Fig.2: An iterative design process consisting of three larger phases (created in https://BioRender.com)

Results

- We included 82 studies, totaling 5,447,162 participants with TBI (mean age 43.15, 60.76% male); of which 26 studies (31.7%) included participants with mild TBI
- Table 1 displays PROGRESS-Plus semantic matching

PROGRESS	
Place of Residence	Country, State/Province/Region, Setting (urban/rural), Continental region, Place of Recruitment
Race, ethnicity, culture, and language	Race/Ethnicity, Language
Occupation	Employment status, Job type, Change in employment status, Employment duration, Workload, Shift work, Return to employment
Gender and Sex	Gender/Sex
Religion	Religion
Education	Years of education, Degree type, Maternal degree
Socioeconomic Status	Income (weekly, annual), Income Quartile/Quintiles
Social Capital	Relationship/spousal status, Living arrangements
Plus	
Age	Chronological; biological (mean, median, range)
(Dis)ability	Physical, mental, developmental, etc.
Sexual orientation	Sexual orientation
Other parameters	Insurance Status, length of stay at hospital, discharge disposition, etc.

Table 1: Aligning different types of data descriptors to match the PROGRESS-Plus variables

- Table 2 presents an example of the steps of data harmonization including standardization and transformation

Author, Year	Sample (n)	Original Categories	Transformed Categories	%
Race				
Miles, 2015	1278	Caucasian Hispanic/Latino African American Other	White Hispanic Black Unknown	48.3 19.2 27.4 5.1
Schneider, 2023	613592	Non-Hispanic White Non-Hispanic Black Hispanic Other	White Black Hispanic Unknown	37.5 9.2 1.6 1.6
Occupation				21
Andelic, 2021	3354	Working ≥ 35h/week Working < 35h/week Student Retired Not working	Employed (full-time) Employed (part-time) Student Retired Unemployed	39.3 9.2 12.2 23.6 15.6
Vikane, 2016	150	Full-time Part-time Unemployed Student	Employed (full-time) Employed (part-time) Unemployed Student	75 3 6 16

Table 2: Harmonizing the extracted data under unified common categories

Results (continued)

- The number of studies that included each PROGRESS-Plus parameter (Fig. 3)

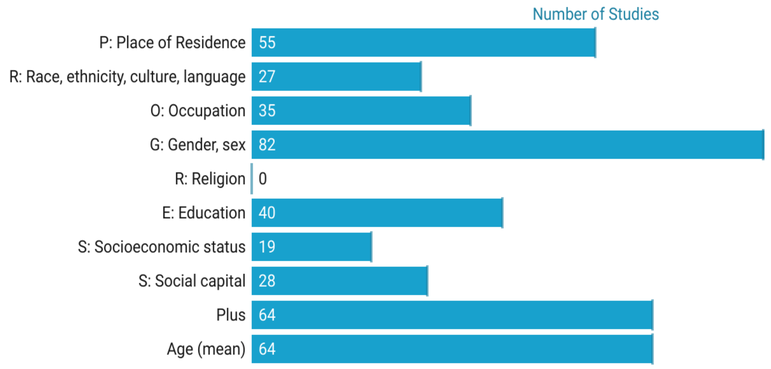

Fig.3: Distribution of PROGRESS-Plus parameters in the 82 included studies

Implications and Next Steps

- We developed a unified dataset, highlighting key gaps in social data in published research on topics of brain health after TBI
- Our harmonized dataset is ready for expansion, and for future research that bridges social and clinical data—key for patient-centered and inclusive care
- We contributed to Brain Health Care Canada goals by building data infrastructure that enables training, equity-focused inquiry, and interdisciplinary collaboration.

References

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