The Power of Linked Data: Investigating the Social Determinants of Child Health and Their Implications in Reducing Pediatric Traumatic Injury

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Introduction

Traumatic physical injuries are one of the leading causes of death in children in Canada and have significant societal and individual level impacts. As over 90% of childhood injuries are preventable, prevention programs fueled by evidence are needed[1].

Social determinants of child health (SDoCH) are a broad category of social and environmental factors that influence a child's health.

The Canadian Pediatric Society (CPS) has long been advocating for a child injury prevention plan that uses a public health approach which includes the social determinants of health associated with injury risk. However, the CPS also states that research is currently lacking to support this approach due to difficulties understanding the mechanisms, causes, and risk factors associated with child injury[2].

Aim

The objective of this study was to identify SDoCH that increase the risk of physical traumatic injury in children in Manitoba, Canada.

Identifying groups of children that are at an increased risk of injury will help to fill in established literature gaps and will inform the development of targeted injury prevention programs

Methods

- This project used a seventeen-year retrospective case control study to identify SDoCH that increase the risk of physical traumatic injury in children in Manitoba, Canada
- **Cases** were defined as children ≤ 17 years of age hospitalized with injuries at the Children's Hospital of Winnipeg between 2002-2019 (n=10000)
- **Controls** were defined as uninjured children ≤ 17 years of age from the general population (n=50000)
- Cases and controls were matched 1:5 based on age, sex, and geographic location

Databases

The trauma registry at the Children's Hospital of Winnipeg was used to identify clinical data bout the case cohort

Administrative data housed at the Manitoba Centre for Health Policy (MCHP) was used to identify information about SDoCH for both the case and control cohort

- The clinical data from the trauma registry was then linked with the administrative data from the MCHP – this allowed for the identification of SDoCH that were associated with an increased risk of injury
- Fourteen different SDoCH were measured in this study – these were all determinants that were measurable using data from the MCHP

Statistical Analysis

- Descriptive statistics were generated on the case and control cohorts
- Univariate conditional regression models were created for each individual SDoCH
- A correlation matrix was created and reviewed to examine the overlap between the different SDoCH categories
- A conditional univariate logistic regression model was created and was used as the final model to calculate adjusted odds ratios for each individual SDoCH
- **Statistical significance was defined as $p \leq 0.005$**

Results

Table 1 shows descriptive statistics from the case and control cohorts

Table 2 shows the results from the final multivariable model

In the final multivariable model, we identified five SDoCH that were associated with an increased risk of pediatric injury

	Cases (n=10000)	Controls (n=50000)	Test Statistic	P value
Age	9.83 (5.18)	9.83 (5.18)	0.00	0.998
Sex, male	6450 (64.5%)	32250 (64.5%)	0.00	1.00
Rural	4766 (47.7%)	23473 (46.9%)	1.70	0.19

Table 1: Descriptive statistics of the case and control cohorts. No significant differences existed between the case and control cohorts in terms of age, sex, or geographic location, indicating our matching was successful.

Social Determinant	Adjusted Odds Ratio (95% CI)	P value
Rural Status	**6.63 (4.63, 9.49)**	<.0001
Child in Care	**1.42 (1.31, 1.54)**	<.0001
Child born to teen Mom	**1.33 (1.26, 1.41)**	<.0001
Parental Criminal Justice Involvement	**1.27 (1.21, 1.33)**	<.0001
Parental Income Assistance	**1.13 (1.06, 1.21)**	0.0003
Child Living in Social Housing	1.08 (1.00, 1.17)	0.0417
Maternal axis I Mental Disorder	1.07 (1.02, 1.12)	0.0111
Maternal Physical Disorder	1.05 (1.00, 1.10)	0.0439

Table 2: Conditional multivariate logistic regression including only covariates with an AOR 95% CI > 1. In our final multivariable model we found children living in a rural area, children in care, children born to teenage mothers, children with a parent(s) who has received income assistance, and children with a parent(s) involved in the criminal justice system were at an increased risk of physical injury.

Haddon's Matrix

After identifying which SDoCH were associated with injury risk, we created a Haddon's Matrix for pediatric injury (Table 3).

We then used Haddon's Matrix to identify unique intervention points for injury prevention targeted towards the high risk groups that were identified in this study (Table 4)

	Human	Physical Environment	Socioeconomic Environment
Pre-injury	1	2	3
injury	4	5	6
Post-injury	7	8	9

Table 3: Haddon's Matrix for pediatric injury. Haddon's matrix is a validated framework that breaks the injury timeline down into the pre-injury, injury, and post-injury timelines and examines the interaction between the individual, the physical environment, and the socioeconomic environment. It is used to understand how injuries occur and to identify intervention points for injury prevention.

Interventions	Targeted population	Haddon's Matrix
Providing education about the importance of helmet use for bicycles and all-terrain vehicles	Rural	1,2,4,5
Provide easier access and affordability to injury prevention devices through combined purchasing and installation subsidies (e.g smoke detectors, bicycle helmets, child proof locks, life jackets)	Income assistance, Child in care, Teen mom	2,3,5,6
Education for foster parents in injury prevention, first aid, and home safety	Child in care	1,2,3,4,5,7
In-jail or parole injury prevention training for parents	Criminal justice	1,2,4,5

Table 4: Interventions for targeted injury prevention. Shown in this table is four examples of targeted interventions towards the high risk groups identified in this study.

Conclusion

We conducted a seventeen-year retrospective case control study matching injured children 1:5 with uninjured children from the general population and compared fourteen measures of social determinants of child health between the two cohorts

Our study showed that social determinants of child health influence injury risk in children living in a rural area, children in care, children with a parent(s) who has received income assistance, children with a parent(s) involved in the criminal justice system, and children born to a teenage mother

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