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The effect of a minor health shock on labour market outcomes: The case of concussions

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NZ Association of Economists, 3 July 2024

Disclaimer

These results are not official statistics. They have been created for research purposes from the Integrated Data Infrastructure (IDI) which is carefully managed by Stats NZ. For more information about the IDI please visit https://www.stats.govt.nz/integrated-data/.

The results are based in part on tax data supplied by Inland Revenue to Stats NZ under the Tax Administration Act 1994 for statistical purposes. Any discussion of data limitations or weaknesses is in the context of using the IDI for statistical purposes, and is not related to the data's ability to support Inland Revenue's core operational requirements.

Research questions

- What effect does suffering a concussion have on future employment and earnings in the short and longer term?
- Do the effects of concussions differ by age, gender, occupational skill level, whether treated by primary health provider or in hospital, multiple injuries or just TBI?
- To what extent does the accident compensation scheme offset earning losses?

Background (1)

- Worldwide, traumatic brain injury (TBI) is the one of the most common causes of disability and death in adults and the leading cause of disability in children and young people
- 36,000 TBIs a year in NZ, 95% are mild (ACC, 2022; Feigin, 2013)
- Mainly caused by falls during everyday activities (ACC, 2022)

Background (2)

- Minor health issues generally do not have long-term effects on labour market outcomes (Pelkowski & Berger, 2004)
- Negative effects increase with the severity of the health shock (Crichton et al., 2011)
- **But….**
- Clinically, mTBIs have persistent symptoms despite being apparently minor (Dean & Sterr, 2013)
- Detrimental and persistent effects on educational outcomes (Wehman et al, 2017), criminal behaviour (Theadom et al., 2023), labour market outcomes (Fallesen & Campos, 2020)

Data (1)

- Stats NZ's Integrated Data Infrastructure (IDI)
  - Rich population-wide linked microdata
  - Information about health events, labour market outcomes, demographics etc.
- Accident Compensation Corporation (ACC) data
  - Compulsory and universal compensation system covering all accidents that occur in NZ
  - Treatment claims lodged by medical providers
  - Covers medical costs and income compensation

Data (2)

- Population of interest
  - Those with mTBIs from January 2012 to June 2022 (ACC data)
  - Individuals between 25 and 65 years old
  - Exclusions: those with prior TBI; those died or lived overseas during study period
- Inland Revenue tax data
  - Monthly wages and salaries
- Personal records
  - Individual characteristics: age, gender, ethnicity, region etc.

Identification strategy (1)

- **Issue 1**: Comparison with those who have not suffered a mTBI => Effects cannot be attributed to the mTBI
  - Unobserved characteristics correlated with both mTBI and labour market outcomes (e.g. risk-taking behaviour)

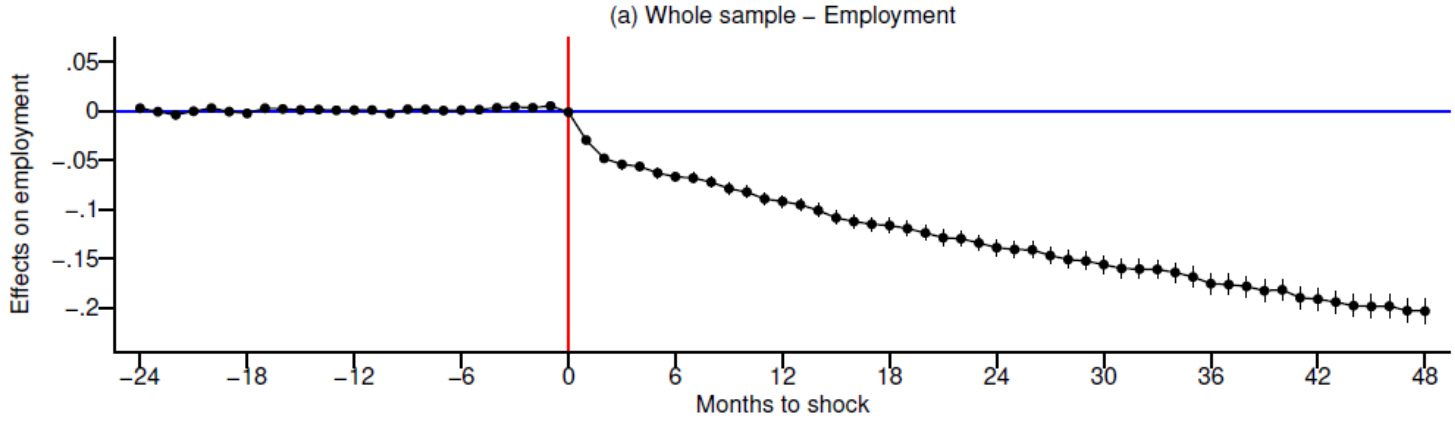
➢ **Solution**: Quasi-experimental design: individuals who experience the same shock in the future as counterfactuals (Fadlon & Nielsen, 2019)

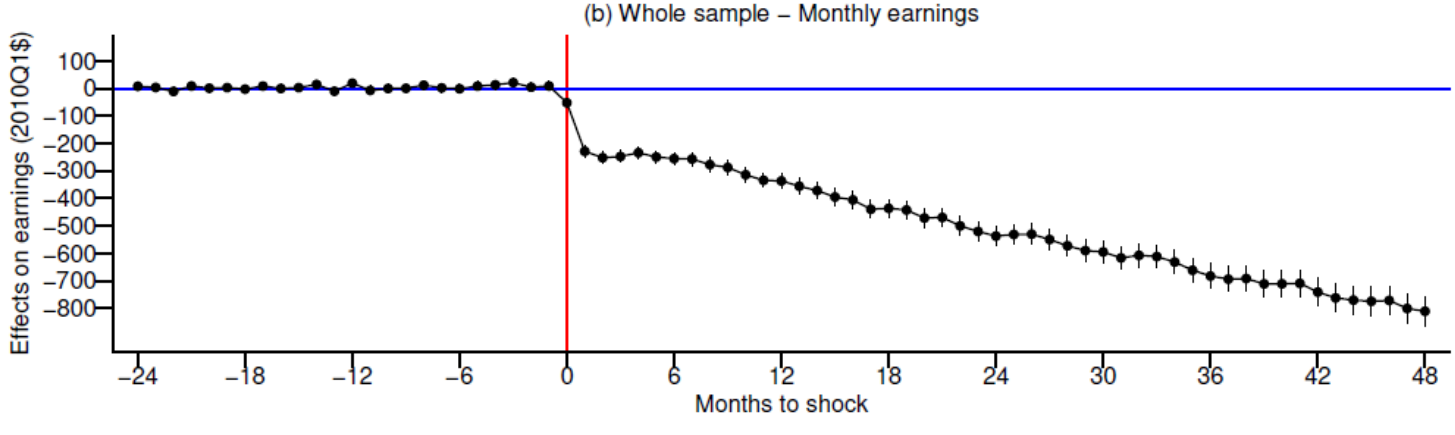
Identification strategy (2)

- **Issue 2**: Individuals in the sample are not treated at the same time
  - Two-way fixed effects regressions may be biased (de Chaisemartin & D'Haultfoeuille, 2020; Callaway & Sant'Anna, 2021; Sun & Abraham, 2021)

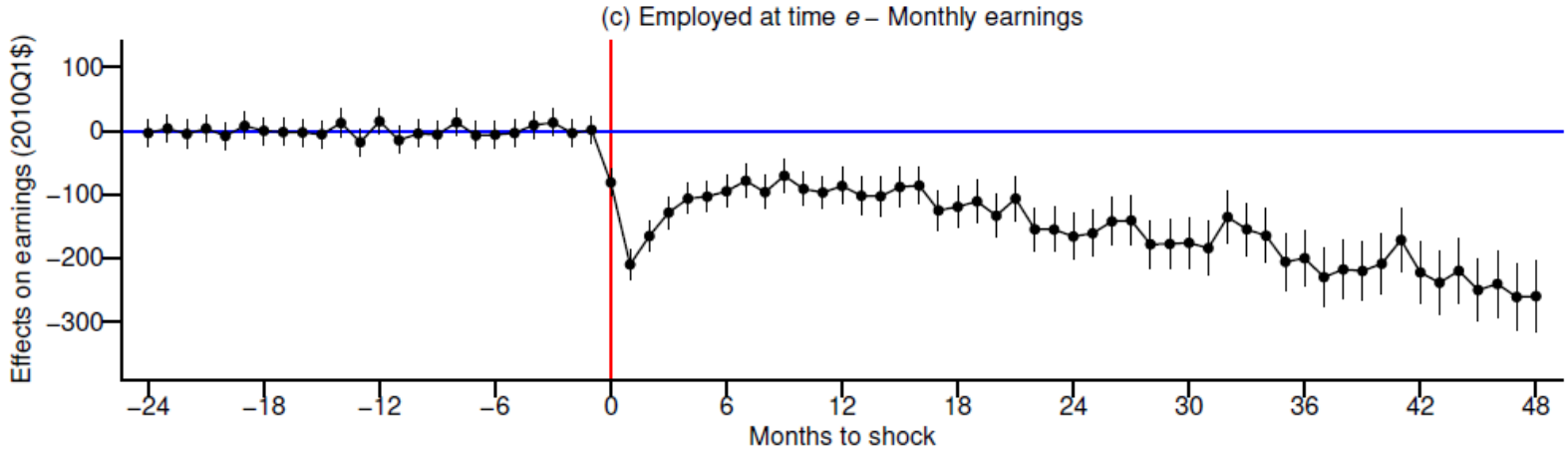
➢ **Solution**: Doubly-robust staggered difference-in-differences estimator (Callaway & Sant'Anna, 2021)

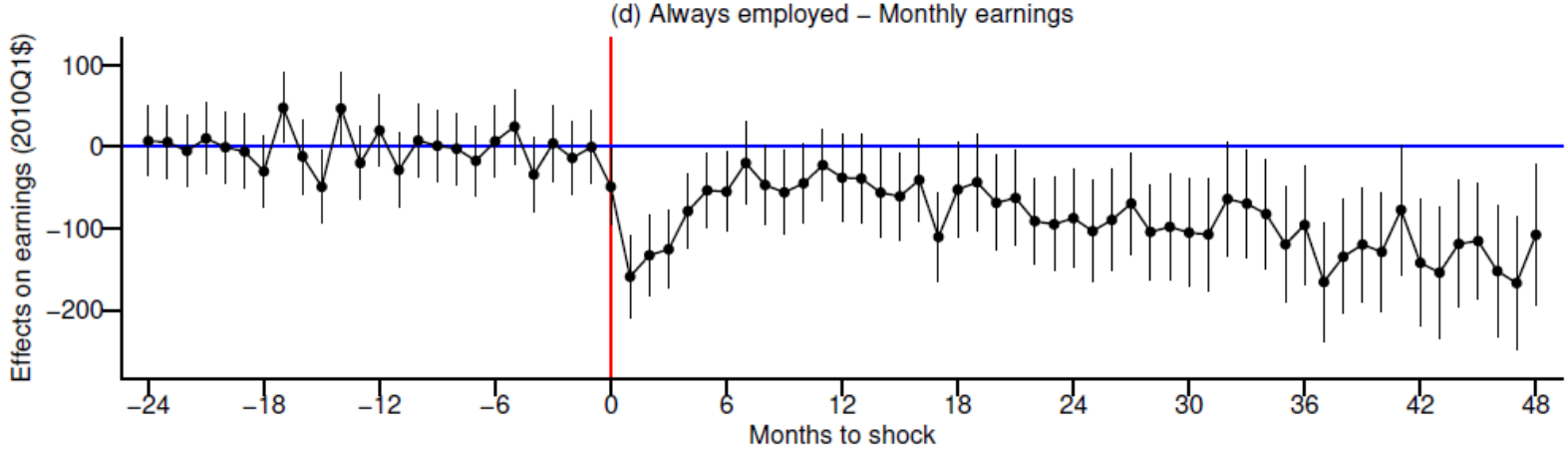
Results: Monthly treatment effects (1)





Results: Monthly treatment effects (2)





Heterogeneity analysis: TBI or TBI+

	1. TBI only (n=14,568 individuals)		2. TBI + other injury/ies (n=20,733 individuals)	
ATT	(a) Monthly earnings	(b) Employment	(a) Monthly earnings	(b) Employment
12 mths	-194.31*** (13.55)	-0.05*** (0.00)	-301.48*** (12.28)	-0.07*** (0.000)
24 mths	-315.13*** (16.23)	-0.08*** (0.00)	-370.78*** (14.27)	-0.09*** (0.00)
36 mths	-404.7*** (18.68)	-0.11*** (0.00)	-446.42*** (16.43)	-0.11*** (0.00)
48 mths	-484.00*** (20.96)	-0.13*** (0.00)	-522.53*** (18.74)	-0.13*** (000)

Heterogeneity analysis: Skill level

	1. Low-to-mid skilled (n=23,505 individuals)		2. High skilled (n=11,796 individuals)	
ATT	(a) Monthly earnings	(b) Employment	(a) Monthly earnings	(b) Employment
12 mths	-217.62*** (10.60)	-0.06*** (0.00)	-328.78*** (17.36)	-0.07*** (0.000)
24 mths	-274.18*** (12.43)	-0.08*** (0.00)	-486.88*** (20.50)	-0.11*** (0.00)
36 mths	-325.85*** (14.15)	-0.10*** (0.00)	-626.25*** (24.03)	-0.14*** (0.01)
48 mths	-380.95*** (15.98)	-0.11*** (0.00)	-748.34*** (27.41)	-0.16*** (001)

Conclusion

Mild Traumatic brain injuries have more than a minor, temporary effect

- Strong adverse effects on employment and earnings
  - Mostly an employment (extensive margin) effect
  - But also an earnings (intensive margin) effect
- Long-term effects: earnings drop after the mTBI, then recover somewhat, then drop again
  - In line with medical literature and clinical observation
- Heterogeneous effects across groups
  - TBI-only vs. TBI+Other injuries strengthens the findings that other injuries are recovered from but TBI effects linger
  - Those in high-skilled jobs have greater negative effects

Thank you

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Model

Staggered DiD model:

$$Y^{g,t} = \alpha_1^{g,t} + \alpha_2^{g,t}.G_g + \alpha_3^{g,t}.1\{T = t\} + \beta^{g,t}.(G_g \times 1\{T = t\}) + \gamma.X + \epsilon^{g,t}$$

Group g is individuals starting treatment at time G.

Average treatment effects $ATT^{g,t}$ given by $\beta^{g,t}$ but not obtained through the standard $ATT^{g,t} = \boldsymbol{E}[Y_t(g) - Y_t(0) | G_g = 1$, rather, re-weighted using propensity scores.

Model assumptions

Five assumptions (Callaway & Sant'Anna, 2021):

- Irreversibility of treatment
- Limited anticipation
- Random sampling
- Parallel trends (should hold conditional on covariates)
- Overlap (timing of treatment uncorrelated with the probability of treatment)