Increased rate of large vessel occlusive stroke following the Christchurch terror attack

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# Author note

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Abstract

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# Introduction

Sudden catastrophic events, such as terror attacks and natural disasters, have clear and immediate consequences for the people directly affected. However less is known about the subacute impact of such events on the physical health of local community members. We investigated the association between the terror attack in Christchurch, New Zealand on the 15th March 2019 in which 50 people died, and the rates of hospital admissions with ischemic stroke, intracranial large vessel occlusion (LVO) and reperfusion treatment in Christchurch hospital.

# Methods

## Sample

Christchurch hospital admits all people with stroke in Christchurch a city of 390 000, and provides endovascular thrombectomy for the South Island of New Zealand, population 4.8 million. Counts of ischemic stroke admissions, the numbers of patients with intracranial LVO, and the numbers who underwent reperfusion therapy (intravenous thrombolysis and/or endovascular thrombectomy) were collected for the week following the terror attack and from 1st January 2018 until 21st April 2019. These counts were repeated for the rest of New Zealand with the Christchurch data omitted.

## Analyses

Data for each measure, and by Christchurch and nationally, were fit with Bayesian Poisson models, using the R1 package *brms*.2 Parameters were given default weakly-informative priors. Four chains of 5000 iterations each were run. The probability of the rate observed in the week following the terror attack being higher than the background rate was calculated for each measure, with a probability higher than 0.99 providing strong evidence of an effect.

## Reproducibility

The code and the anonymised dataset used to conduct the analyses and generate this manuscript are available at <https://github.com/nzbri/terror-attack-stroke>.

# Results

In the week following the 15th March 2019 terror attack there was no evidence of difference in the number of ischemic stroke admissions (Figure 1 top left, mean rate = 27, probability of an increse after the terror attack P = 0.39), but an increase in those receiving reperfusion therapy (Figure 1 bottom left, mean rate= 2.6, probability P = 0.998). Over the same periods in the rest of New Zealand, there was no evidence of a difference in the number of ischemic stroke admissions (Figure 1 top right, mean rate = 105, P = 0.81) nor strong evidence of an increase in the numbers of people treated with reperfusion treatments (Figure 1 bottom left, mean rate= 14, P = 0.96).

Examining the type of strokes, in Canterbury there was an increase in the number of patients with ECRs (Figure 2, left, mean rate = 1.4, P = 0.998), intracranial LVOs (Figure 2 centre, mean rate = 2.4, P = 1.000), and thrombolysed strokes (Figure 2 right, mean rate = 1.9, P = 0.997).

# Discusion

Sudden catastrophic events such as terror attacks may increase the numbers of patients developing intracranial LVO requiring stroke reperfusion therapies within the affected community. Further research is required to understand the mechanisms underlying this observation.

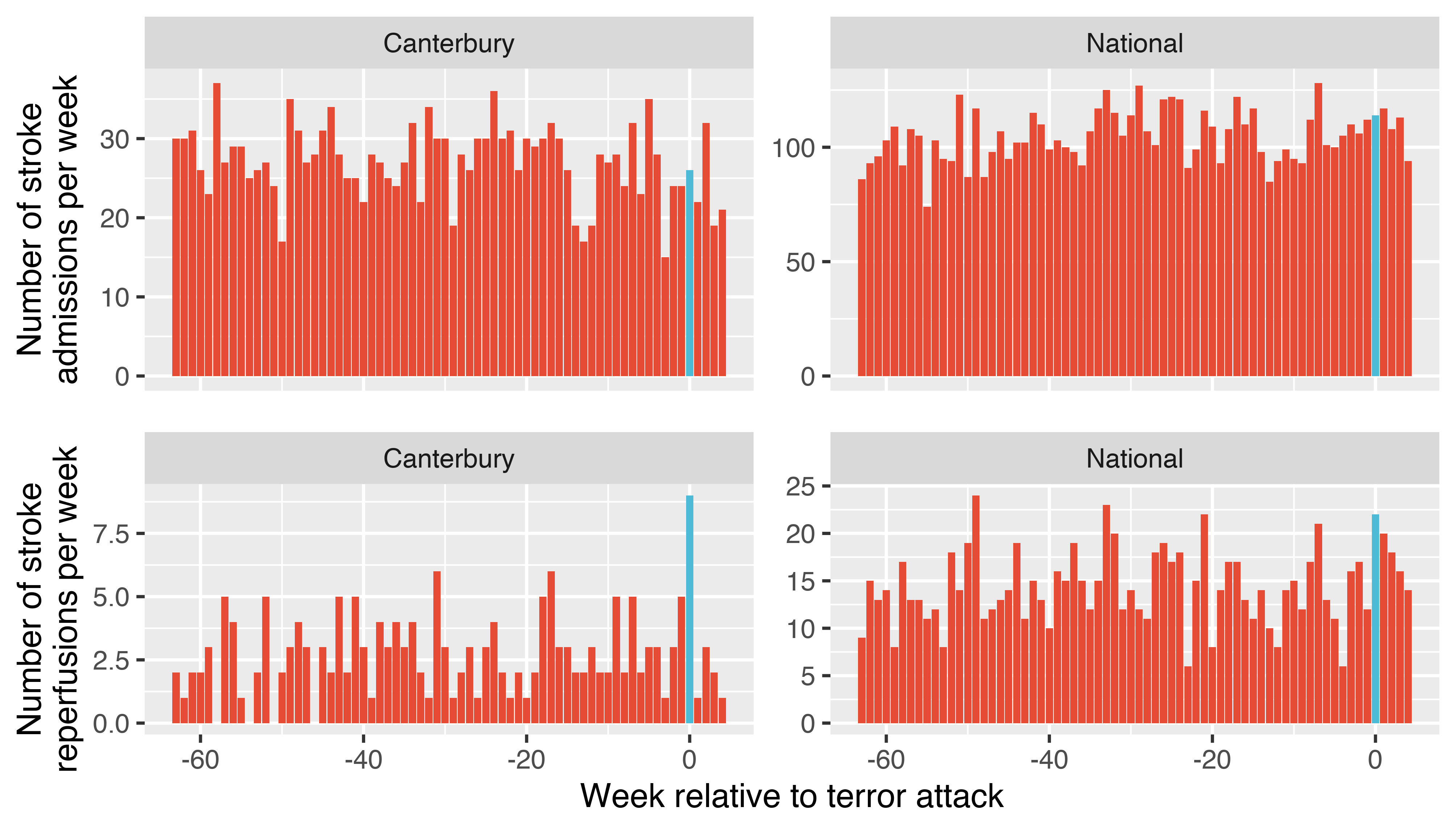


Figure 1: Number of stroke admissions (top row) and stroke reperfusions (bottom row) relative to the week of the stroke attack, for Canterbury and nationally (excluding Canterbury). Figure by Myall (2019), distributed at <https://doi.org/10.6084/xx> under an open CC-BY 4.0 license.

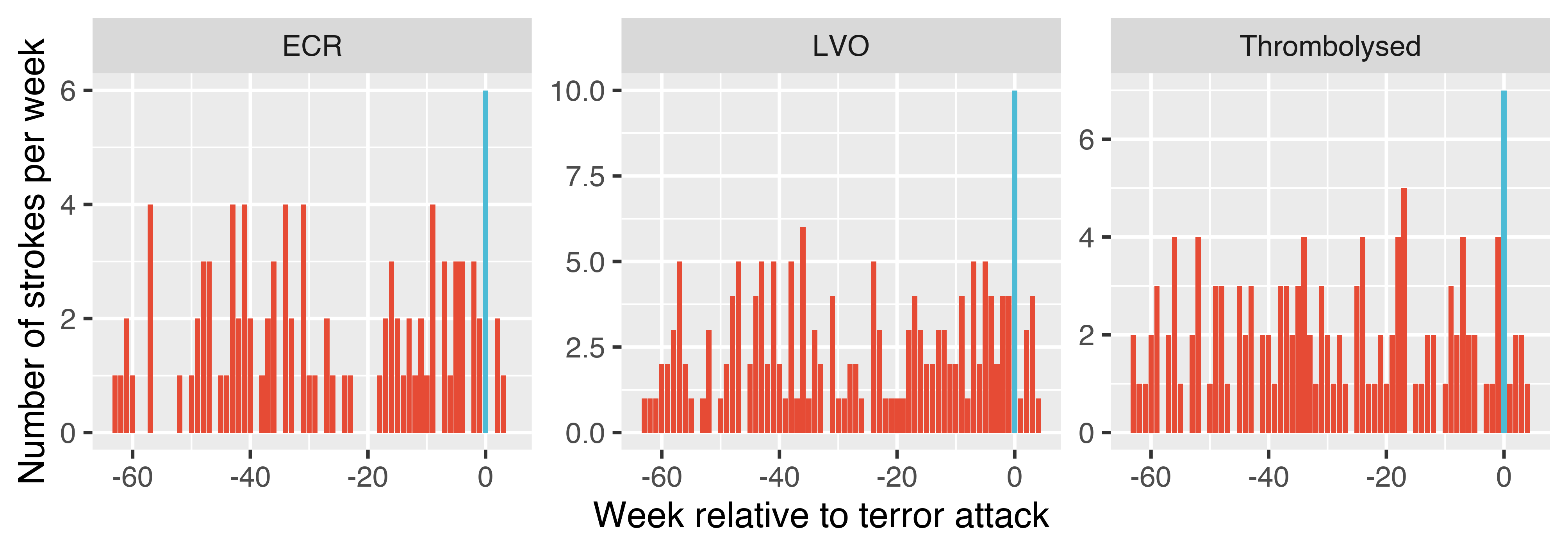


Figure 2: Number of strokes by type relative to the week of the stroke attack for Canterbury. Figure by Myall (2019), distributed at <https://doi.org/10.6084/xx> under an open CC-BY 4.0 license.

# References

1. R Development Core Team. *R: A language and environment for statistical computing*. R Foundation for Statistical Computing, Vienna, Austria, <http://www.R-project.org> (2019).

2. Bürkner P-C. Brms: An R package for Bayesian multilevel models using Stan. *J Stat Soft* 2017; 80: 1–28.