The impact of firebreaks in Wales and Northern Ireland on reproduction numbers

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Rationale

We aimed to explore ongoing intensive lockdowns (firebreaks) in Northern Ireland (from 16th October 2020) and Wales (24th October 2020), by analysing the reproduction number (R_t) before and after the intervention. In order to identify any effect from these interventions, we estimated R_t using a different forms with set breakpoints on the dates the interventions came into place, and compared to an area in England wihtout intervention as a control.

Methods

We estimated R_t separately from cases, hospitalisations and deaths (shown as a 7 day moving average in Fig 1A) over a ten week period using two different methods.

First we modelled R_t as piecewise constant with a single breakpoint at the start of respective intervention (figure 2B). Second, modeleld R_t using a weekly random walk with an additional breakpoint at the start of respective lockdowns. In the latter method, we left at least one week between the last random step and the firebreak breakpoint. No further breakpoints were included beyond the start of the firebreak.

We measured effect size as a multiplicative change in R_t.

We also estimated each region using a Gaussian process without breakpoints, to provide a comparison of change at daily intervals. In all estimates, we specified an R_t prior of mean 1.2 (SD 0.2).

Results

We saw some evidence of an impact of the firebreak when R_t was modelled using breakpoint. The firebreak appeared to have a strong effect on decreasing R_t when estimated from reported cases or hospital admissions in Northern Ireland, using either a single breakpoint or a weekly random walk with a breakpoint at the firebreak. However, the strength of this firebreak effect on R_t was less clear in Wales.

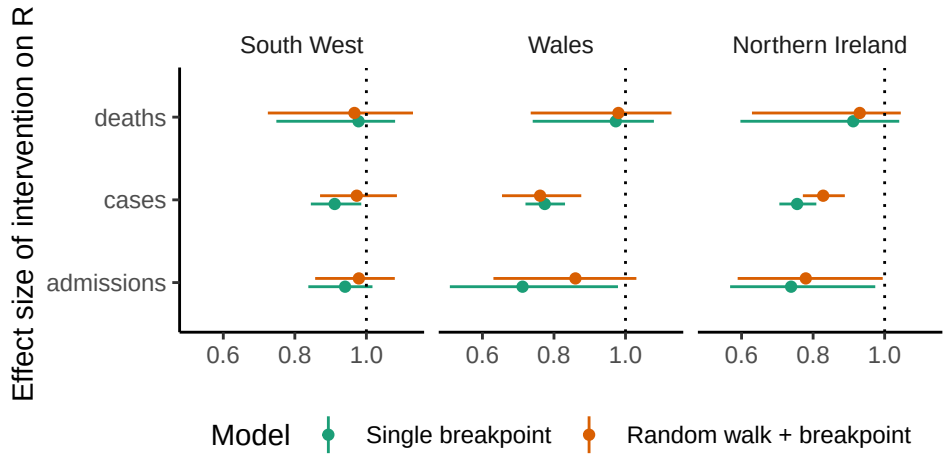

Figure 1. Effect size (multiplicative change) of breakpoint on R_t, on the start of the firebreak: 24th October for Wales and South West (no intervention), 16th October for N Ireland), median with 90% credible intervals.

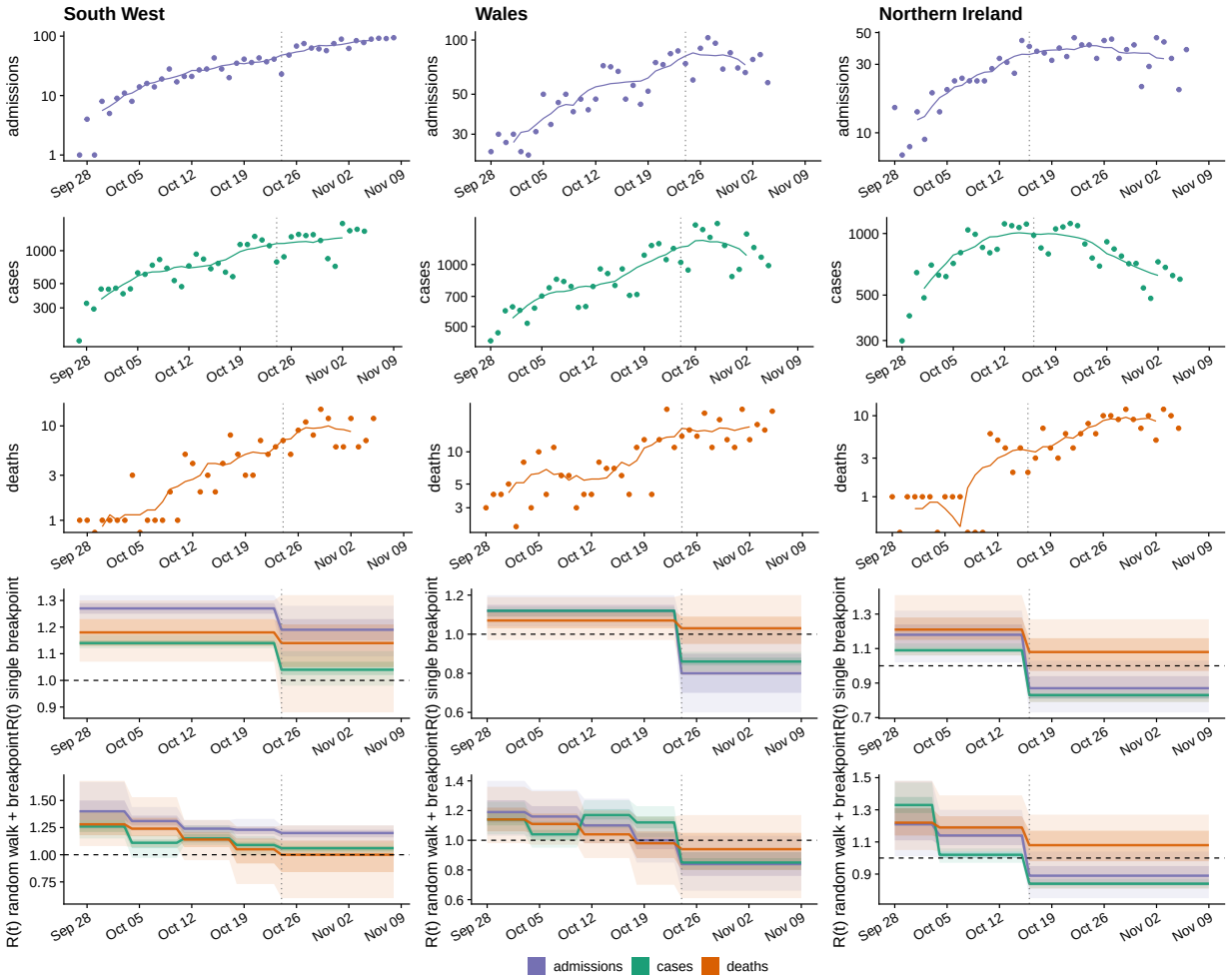

Figure 2. Top to bottom: Data for hospital admissions, cases, and deaths, in the South West, Wales, and Northern Ireland. R_t modelled using a single breakpoint: 24th October in the South West (no intervention); 24th October in Wales (firebreak); 16th October in Northern Ireland (firebreak). R_t including a random walk, with breakpoints each Sunday until the week before the firebreak, plus the single breakpoint as above.