Using R_t to explore firebreaks in Wales and Northern Ireland

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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), using the reproduction number over time (R_t). In contrast to using a smooth Gaussian Process method, we estimated R_t using breakpoints.

Methods

We used government data (shown as a 7 day moving average in Fig 1A), and used two methods to estimate R_t over a ten week period, and repeated each method for each of data reported as cases, hospital admissions, and deaths.

First we modelled a single breakpoint in R_t at the start of respective lockdowns (figure 2B). Second, we allowed for a weekly random walk in R_t by including a breakpoint on each Sunday, with an additional breakpoint at the start of respective lockdowns. In the latter method, we left at least one week between the last breakpoint and the firebreak breakpoint. No further breakpoints were included beyond the start of the firebreak.

We repeated this process for the South West region of England. This was included as a comparison given this region saw the lowest level of policy interventions. We included breakpoints as for Wales (i.e. 24th October).

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 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 across other regions (Wales and South West) and data sources (admissions and deaths), although we observed a general decline in R_t.

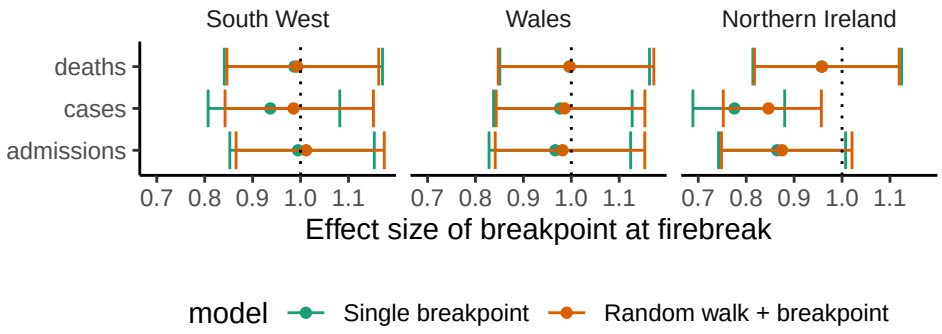

Figure 1. Effect size of breakpoint on R_t, on the date of the firebreak (24th October for Wales and South West, 16th October for N Ireland), median with 90% credible intervals.

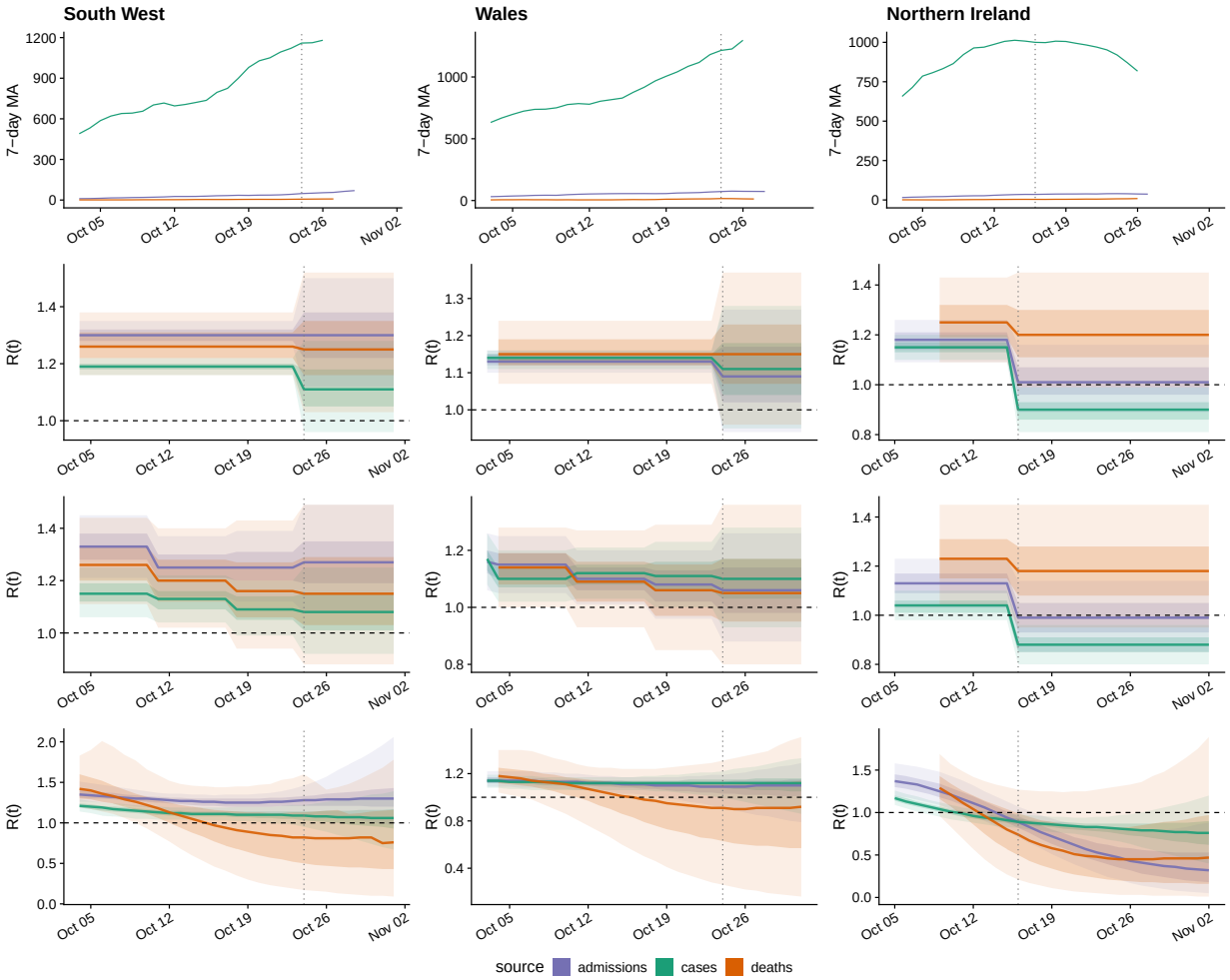

Figure 2. A: Data for cases, hospital admissions, and deaths, in the South West, Wales, and Northern Ireland. B: R_t modelled using a single breakpoint: 24th October in the South West (no intervention); 24th October in Wales (firebreak); 16th October in Northern Ireland (firebreak). C: R_t including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