Spatial considerations for reliable national surveillance for COVID-19

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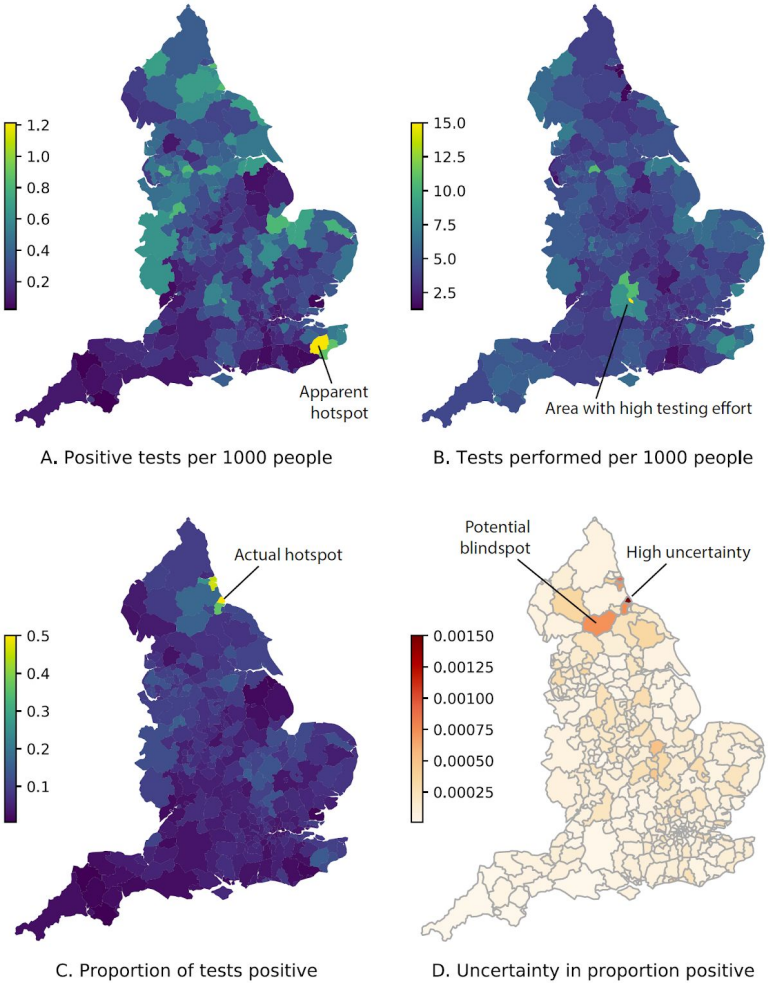
Aim: To highlight the importance of collecting and analysing **both** positive and negative test information at fine spatial scales for effective COVID-19 surveillance and biosecurity interventions.

Preamble: As the UK enters the next stage of the Covid-19 pandemic with further relaxation of current social distancing measures, accurate estimation of disease prevalence at a fine spatial scale is essential for informing and underpinning proactive disease management. Early detection and containment of local hotspots is key to preventing larger regional resurgence of the epidemic. This requires real-time finely-resolved spatial mapping of case incidence, accurately accounting for testing effort.

Findings: The figure shows data from the Public Health England Pillar 1 (patients and healthcare workers) testing programme for the first two weeks of May 2020. **Figure A** shows marked local variation in the number of positive tests per Lower Tier Local Authority Area. There is also considerable spatial variation in the number of tests performed; **Figure B**. To correctly identify regions of the country with unusually high numbers of cases, it is necessary to offset the absolute number of positive tests by the total testing effort to estimate the proportion of all tests performed which are positive; **Figure C**. This also allows uncertainty in the estimate to be determined (**Figure D**), enabling the significance of high prevalence areas to be judged correctly, and regions with insufficient testing to be identified, *i.e.* surveillance blindspots. Without negative test information, the actual hotspot around Tyneside and west County Durham (**Figure C**) would not be recognised.



A. Positive tests per 1000 people

B. Tests performed per 1000 people

C. Proportion of tests positive

D. Uncertainty in proportion positive

Conclusion: Positive *and* negative test data must be geolocated to the finest possible spatial scale for accurate ascertainment of local disease prevalence. Spatial analysis of COVID-19 case data is imperative for detecting hotspots of resurgent cases as social distancing restrictions are lifted. The clear localisation of case hotspots strengthens the argument for implementing localised restrictions as required, but hotspots should be identified statistically to avoid short-term false alarms due to random aberrations in an otherwise general downward trend in cases (*e.g.* Fronterre *et al*. https://www.medrxiv.org/content/10.1101/2020.05.15.20102715v1). Further accuracy in epidemic monitoring can be achieved by collecting and analyzing data at a finer spatial scale than LTLA, allowing local socio-demographic risk factors to be accounted for.