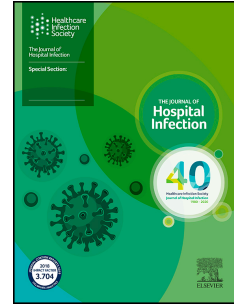


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Impact of COVID-19 on national surveillance of norovirus in England and potential risk of increased disease activity in 2021

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Title: Impact of COVID-19 on national surveillance of norovirus in England and potential risk of increased disease activity in 2021

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Running title: COVID-19 impact on norovirus in England

Key words: norovirus; SARS-CoV-2; COVID-19; surveillance; outbreak; epidemic

Text

We report a substantial and sustained reduction in norovirus outbreak and norovirus-positive laboratory reports to Public Health England (PHE) since SARS-CoV-2 (COVID-19) control measures were first introduced in 2020. This has raised concerns around the direct and indirect effects of the pandemic on routine surveillance functions, and the need to consider the potential risk of unusual disease activity and novel norovirus strain emergences when such interventions are relaxed.

The observed decrease in norovirus reporting ($\geq 84.6\%$, Figure 1) throughout 2020 across all four national surveillance systems used to monitor norovirus activity [1], and the marked decline in referral of norovirus-positive samples for genotyping and monitoring diversity of circulating norovirus strains [1, 2] have limited our ability to perform effective surveillance. These metrics were critical in detecting emerging epidemics during previous norovirus strain replacement events, such as temporally unusual levels of activity seen in the UK during the 2002 summer preceding the 2002/2003 pandemic event [3], or significant changes in the virus genome in the absence of an observed cumulative increase in confirmed norovirus laboratory reports, as was associated with emergence of the GII.4/Sydney strain in England in 2012 [2].

Globally, norovirus strain replacement events over the last 20 years have occurred every 3-4 years [4], with the last recorded in the UK in 2012 [2, 4]. Therefore, it is crucial that molecular surveillance is prioritised in 2021, specifically referral of norovirus-positive samples to the national reference laboratory for molecular characterisation to maximise the opportunity for timely detection of novel noroviruses which could lead to a strain replacement event. Consequently, PHE has updated referral guidance for PHE Regional Public Health and Collaborating Laboratories to include norovirus-positive samples from sporadic cases and outbreak-associated samples in both healthcare and community settings, aiming to highlight the importance of ongoing surveillance and improve the size and representativeness of molecular surveillance.

Changes in healthcare seeking behaviour, disruption to service provision and operational changes in local capacity to detect, test and report norovirus cases or outbreaks due to the COVID-19 pandemic has adversely impacted on norovirus surveillance. However, the reasons for the observed decrease in norovirus reporting are considered multifactorial and the non-pharmaceutical interventions (NPIs) introduced to reduce COVID-19 transmission in England have almost certainly resulted in a true decrease in norovirus transmission; raising the question of what may happen when measures are relaxed.

Similar reductions in norovirus reporting have been observed in other countries including Germany, USA and Australia [1, 5] following implementation of COVID-19 control measures [6]. Furthermore, unusual, delayed temporal peaks in disease activity following relaxation of NPIs have been reported for respiratory syncytial virus in the past [5, 7] and similar disease dynamics may be expected for norovirus whose transmission is facilitated by close social contact. Recent data from Australia support this, where relaxation of COVID-19 NPIs coincided with a sudden increase in gastroenteritis outbreaks in childcare settings reaching a peak in November 2020 [5].

Therefore, anticipating the imminent easing of COVID-19 control measures, we believe there is a real risk of a sudden and rapid increase in norovirus transmission which would result in temporally unusual activity due to:

- an increase in behaviours which facilitate transmission;
- an increased number of susceptible individuals in the population due to low norovirus activity throughout 2020;
- rapid emergence of a norovirus strain with epidemic potential;
- or most likely, a combination of these factors.

Increased or unusual norovirus activity has the potential to overwhelm NHS services [8, 9], especially following the prolonged period of pressure experienced during the COVID-19 pandemic and the substantial number of people awaiting postponed, non-urgent treatments [10]. The paucity of surveillance data on norovirus activity and circulating strains in England during the 2020/2021 winter season means key indicators of a potential strain replacement event are not being monitored as effectively as prior to the emergence of COVID-19 and could leave frontline services insufficiently prepared for any increased 'out-of-season' norovirus activity. Therefore, reporting of outbreaks and submission of norovirus-positive samples to the national reference laboratory is essential to maximise the opportunity to facilitate preparedness planning beyond that of the current COVID-19 pandemic.

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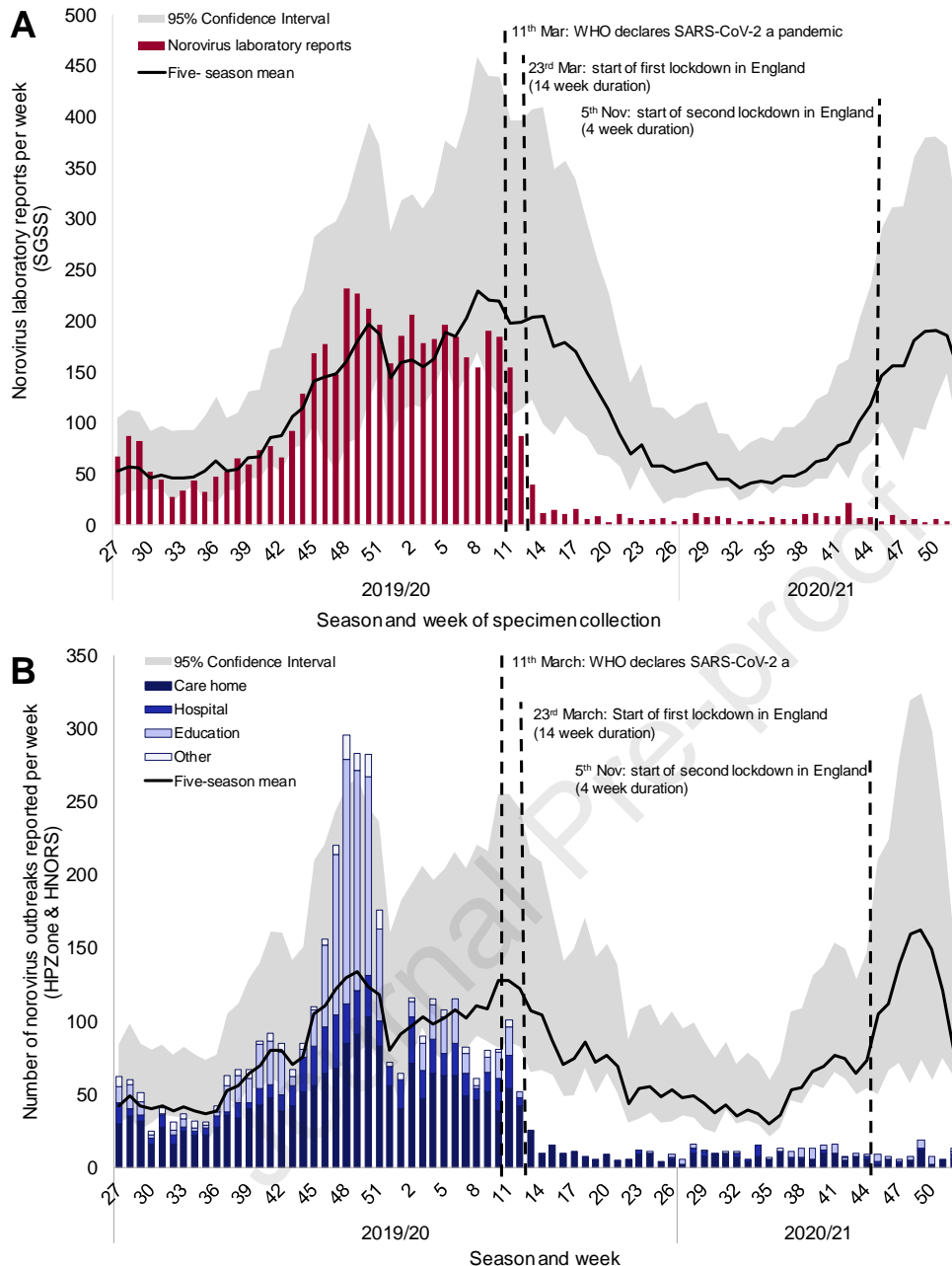


Figure title: *Figure 1.* Decline in norovirus laboratory reports in England (A) and suspected and confirmed norovirus outbreak reports in England by setting (B), 2019/2020 season and weeks 27 to 52 of 2020/2021 season compared to the five-season mean with 95% confidence intervals.

Figure footnotes: Data are reported by epidemiological seasons running from week 27 in the first year to week 26 in the second year, capturing the winter peak of activity in one reporting period. Five-season mean and 95% confidence intervals for 2019/20 and 2020/21 seasons are calculated from the 5- season periods of 2014/15 to 2018/19, and 2015/16 to 2019/20, respectively.

Since the first national lockdown in March 2020, multiple areas in England have been subject to variable levels of coronavirus restrictions at the regional level, with a national level 3-tiered restrictions approach first formally implemented in England in October 2020. These data are derived from three of PHE's national surveillance systems (described [here](#)).

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Authors' contributions: AD, FGS, DA, and LL conceived the study. FGS and AD wrote the first draft of the manuscript with feedback from all other authors including CC and SB. All authors contributed to the interpretation of the data and findings, contributed to the manuscript, and approved the work for publication.

