Supplements to: Impact of the COVID-19 pandemic on the circulation of other pathogens in England

Running title:

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Suppl. Methods

Infectious disease data sources

The infectious diseases that were studied in this report are presented together with their anticipated modes of transmission in Suppl. Table 1. 'Influenza-like illness' include diseases that were diagnosed as influenza based on the sudden onset of clinical symptoms including runny nose, fever, malaise, aches, cough, sneezing, and nausea, which was not always confirmed by a diagnostic test. Hence, some cases may have been caused by other respiratory viruses [Fitzner et al., 2018]. 'Skin and subcutaneous tissue infections' encompasses both uncomplicated and necrotising pathological conditions of the skin or subcutaneous fat, resulting in erythema, oedema, inflammation, and pain. This includes (but is not limited to) diseases such as cellulitis, impetigo, folliculitis, abscesses, carbuncles, and trauma-related infections [Esposito et al., 2017]. 'Infectious intestinal diseases' refers to infections of the stomach, small intestine, and/or bowel, with symptoms including diarrhoea, vomiting, and abdominal pain, typically reflecting diseases such as gastroenteritis, cholera, and typhoid fever [Donaldson et al., 2019].

Weekly case numbers were available for England for all diseases, except for methicillin resistant *Staphylococcus aureus* (MRSA), Lyme disease, and hepatitis E that were recorded quarterly. For diseases with seasonal transmission patterns (influenza-like illnesses, pneumococcal disease, strep throat, scarlet fever cryptosporidiosis, foodborne illness, norovirus, Lyme disease), the average season peaks were calculated based on the included pre-COVID-19 years.

Infectious disease case number dynamics during the COVID-19 pandemic were compared to those of COVID-19 and in the context of the prevention measures that were in place at the time. Rubella was excluded from the analysis due to low case numbers (<5) and diseases with cumulative quarterly cases due to lack of comparable data.

Links to each data source are provided in the respective figure legends. Measles, mumps and rubella (MMR), tuberculosis, scarlet fever, foodborne illness and whooping cough case numbers reported to the UK Health Security Agency (UKHSA) by medical practitioners were derived from the PHE Notifications of Infectious Diseases (NOIDs) database [https://www.gov.uk/government/collections/notifications-of-infectious-diseases-noids]. Lyme disease, hepatitis C, hepatitis E, cryptosporidiosis, shigellosis, strep throat, and pneumococcal disease case numbers were derived from NOIDs causative agent reports, which are based on notifications from laboratories in England [https://www.gov.uk/government/collections/notifications-of-infectious-diseases-noids].

MRSA data was derived from the joint UKHSA/ Office for National Statistics (ONS) MRSA bacteraemia monthly count reports [https://www.gov.uk/government/statistics/mrsa-bacteraemia-monthly-data-by-location-of-onset].

Laboratory confirmed norovirus cases were extracted from 2020 to 2022 national norovirus and rotavirus bulletins (from 2020 onwards) [https://www.gov.uk/government/statistical-data-sets/national-norovirus-and-rotavirus-bulletin-management-information--2] and weekly UKHSA reports (prior to 2020) [https://www.gov.uk/government/statistics/norovirus-and-rotavirus-summary-of-surveillance-2019-to-2020]. Data was extracted from the norovirus routine laboratory reports of positive norovirus samples from the Second Generation Surveillance System (SGSS).

Chickenpox, influenza-like-illness (ILI), herpes simplex virus (HSV), infectious intestinal disease, skin and subcutaneous tissue infection (SSTI), and urinary tract infection (UTI) data was derived from the Royal Collage of General Practitioners (RCGP) Research and Surveillance Centre (RSC) public health data [https://www.rcgp.org.uk/representing-you/research-at-rcgp/research-surveillance-centre/public-health-data]. COVID-19 data was derived from the Coronavirus (COVID-19) Infection Survey of the ONS [https://www.ons.gov.uk/peoplepopulationandcommunity/healthandsocialcare/conditionsanddiseases/datasets/coronaviruscovid19infectionsurveydata]. Information on circulating SARS-CoV-2 variants was derived from the variants of concern technical briefing 44 (22 July 2022) of UKHSA [https://www.gov.uk/government/publications/investigation-of-sars-cov-2-variants-technical-briefings].

Timeline of protection measures

An overview of the timing of prevention measures is provided in Suppl. Table 2. Dates and guidance are based on the British Foreign Policy Group (BFPG) COVID-19 Timeline by Evie Aspinall (https://bfpg.co.uk/2020/04/covid-19-timeline/). The accuracy of this information was confirmed using GOV.UK guidance, policy papers, and records including prime minister statements and daily press briefings on governmental responses to the COVID-19 pandemic (Prime Minister's statement on coronavirus (COVID-19): 23 March 2020 [Internet]. GOV.UK. [cited 2022 Aug 16]. Available from: https://www.gov.uk/government/speeches/pm-address-to-the-nation-on-coronavirus-23-march-2020; https://www.gov.uk/government/speeches/pm-statement-on-coronavirus-18-march-2020; https://www.gov.uk/government/news/prime-minister-announces-new-national-restrictions; https://lordslibrary.parliament.uk/covid-19-local-alert-levels-three-tier-system-for-england; https://www.gov.uk/government/publications/covid-19-response-autumn-and-winter-plan-2021; https://www.gov.uk/government/publications/covid-19-response-spring-2021; https://www.gov.uk/government/news/prime-minister-confirms-move-to-step-4).

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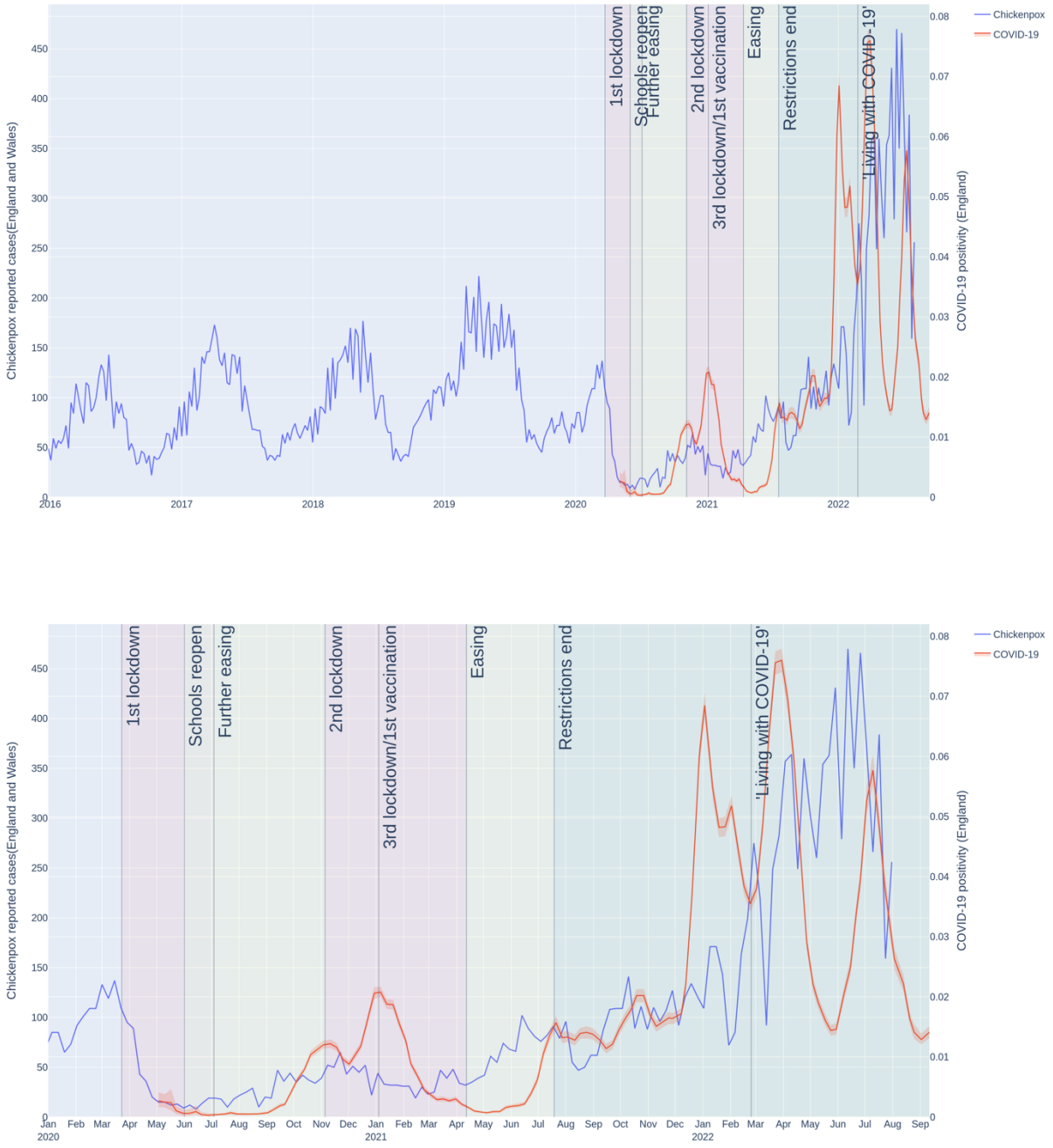
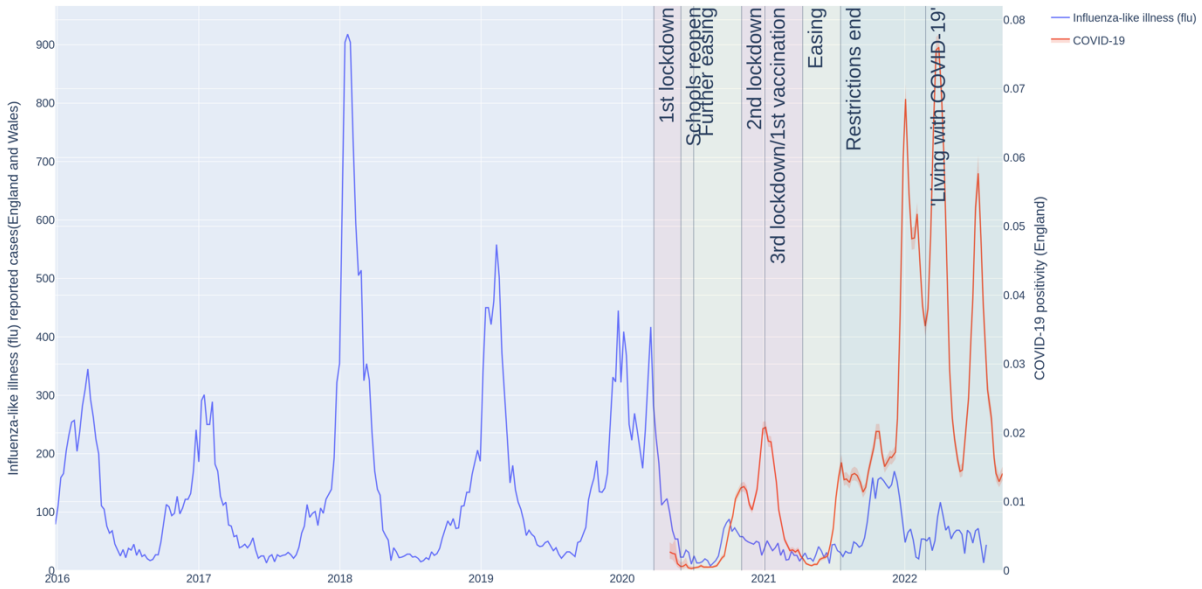
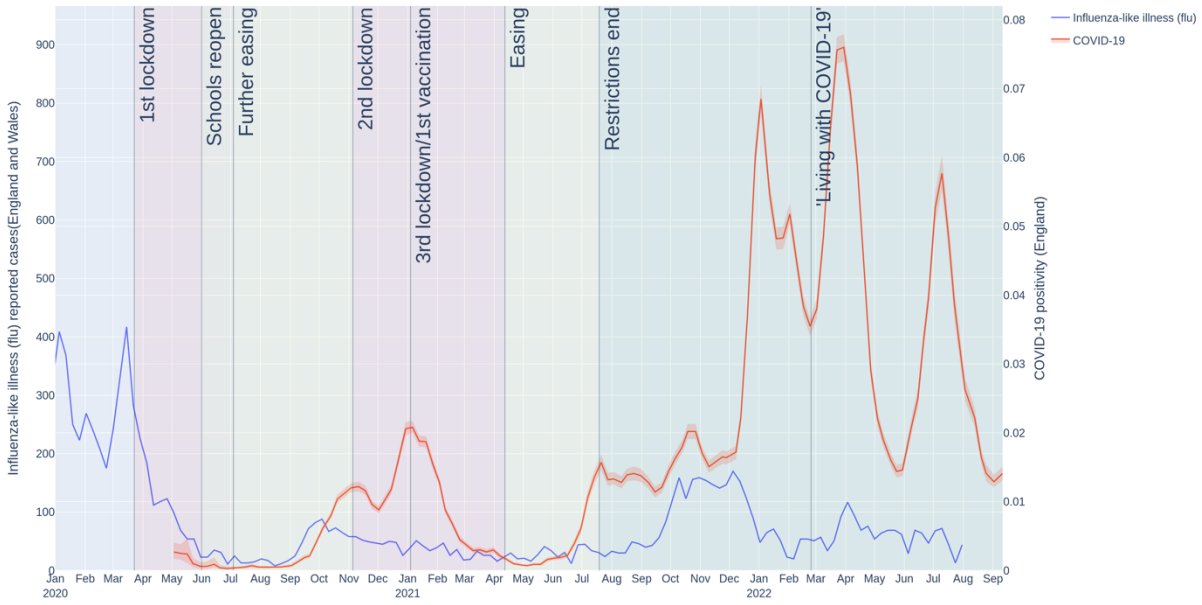
Suppl. Figure 1



Suppl. Figure 1. Chickenpox case numbers during the COVID-19 pandemic in England. Weekly case numbers (chickenpox: left y-axis, blue line, COVID-19: right y-axis, orange line) starting from 1st January 2017 (top graph) or 30th December 2019 (bottom graph).

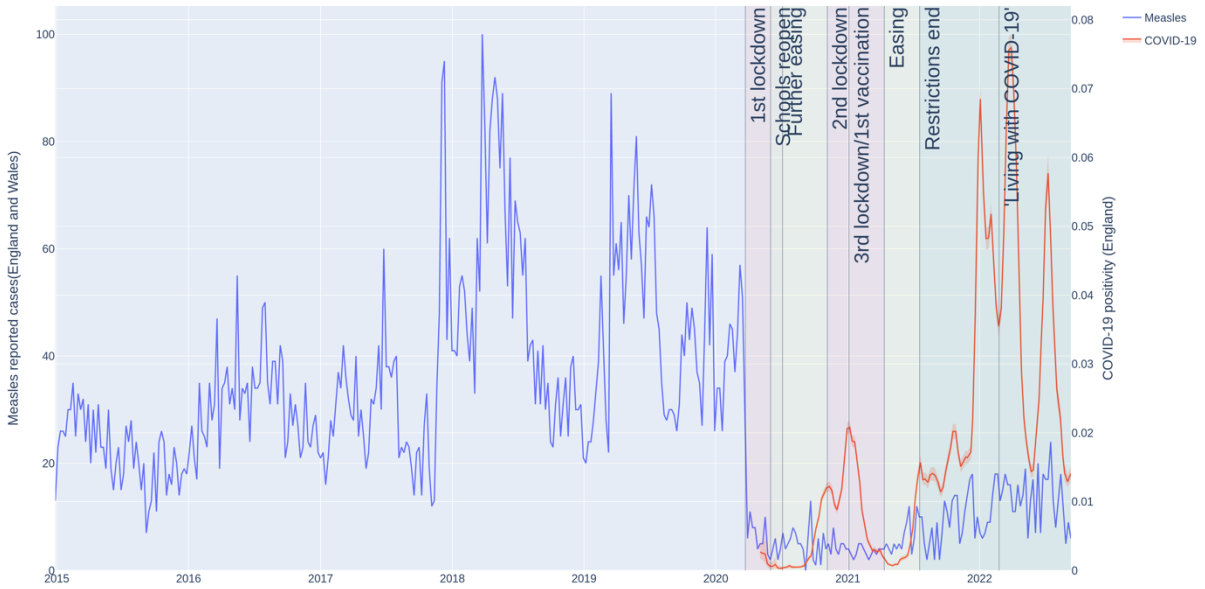
Suppl. Figure 2

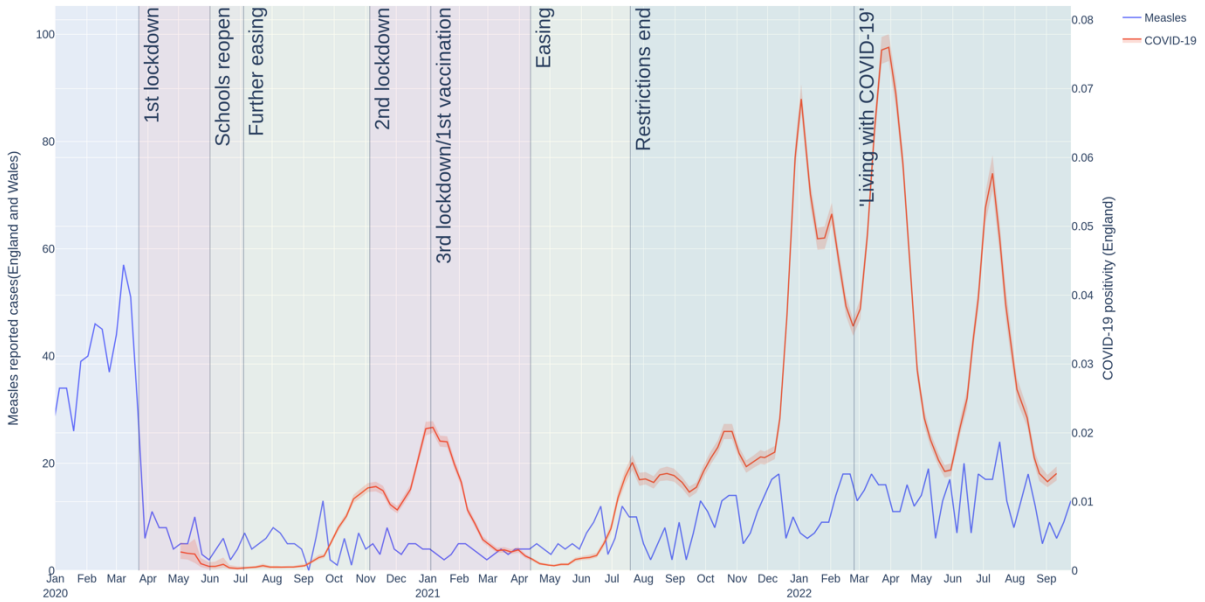




Suppl. Figure 2. Influenza-like illness case numbers during the COVID-19 pandemic in England. Weekly case numbers (influenza-like illnesses: left y-axis, blue line, COVID-19: right y-axis, orange line) starting from 1st January 2016 (top graph) or 30th December 2019 (bottom graph).

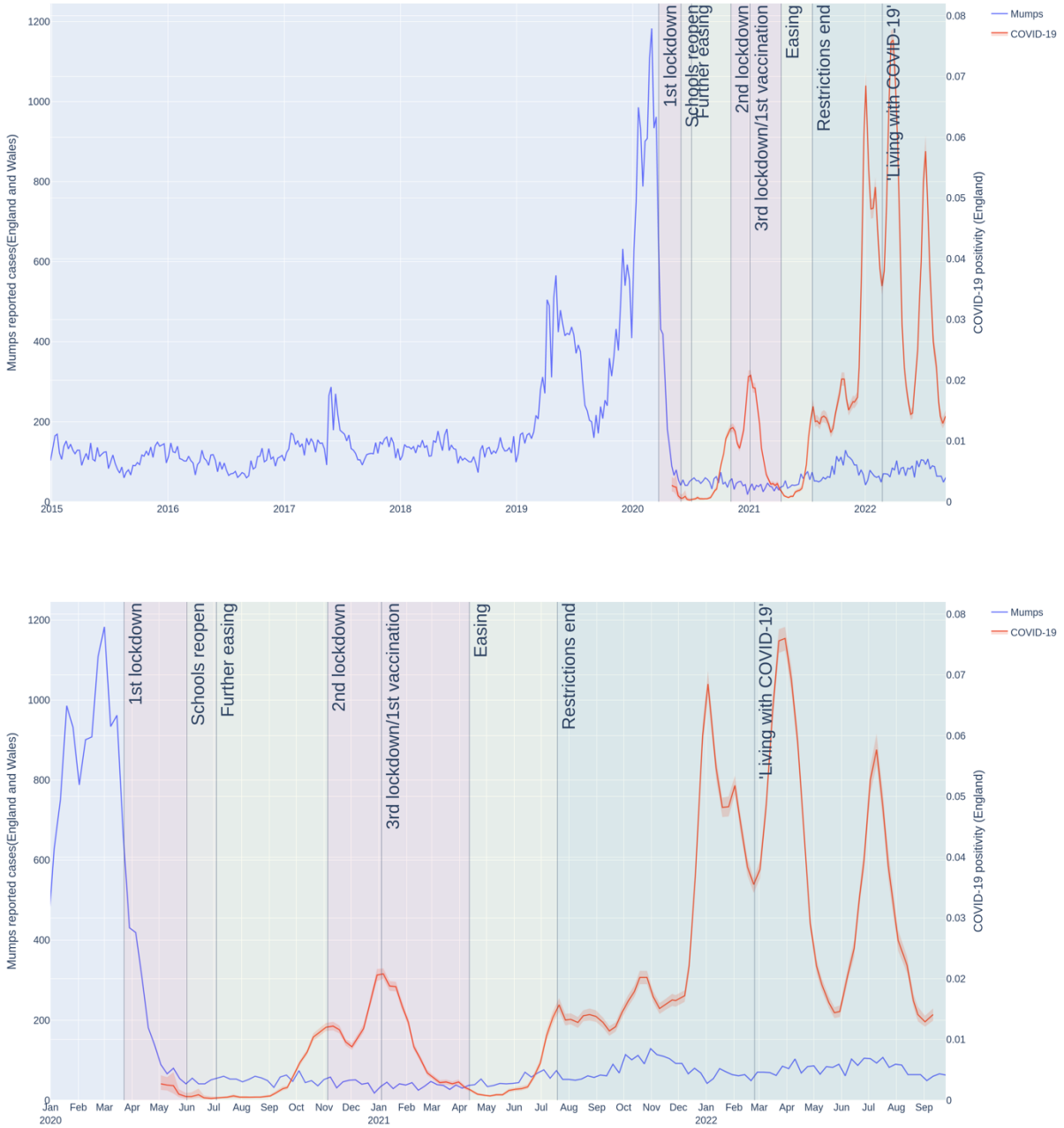
Suppl. Figure 3





Suppl. Figure 3. Measles case numbers during the COVID-19 pandemic in England. Weekly case numbers (measles: left y-axis, blue line, COVID-19: right y-axis, orange line) starting from 1st January 2015 (top graph) or 30th December 2019 (bottom graph).

Suppl. Figure 4

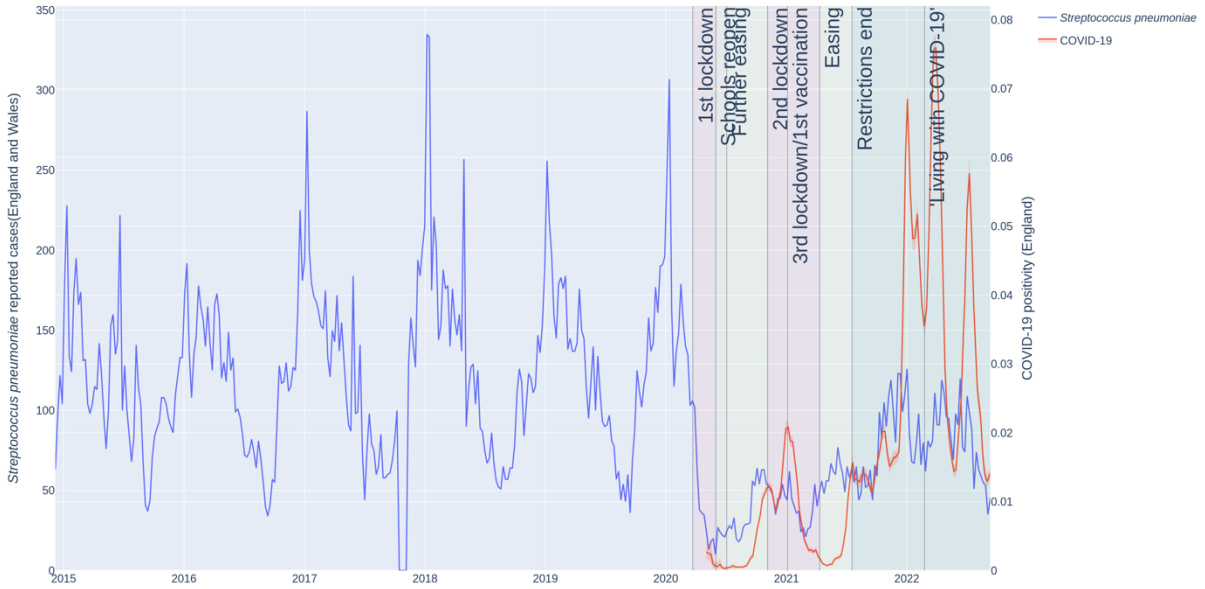


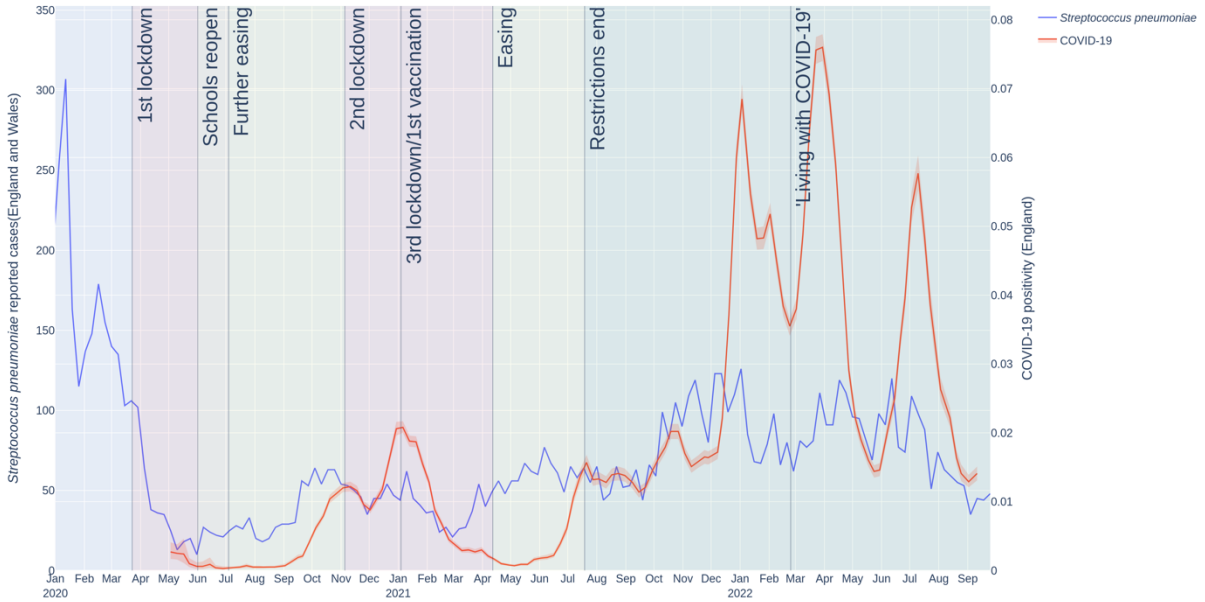
Suppl. Figure 4. Mumps case numbers during the COVID-19 pandemic in England. Weekly case numbers (mumps: left y-axis, blue line, COVID-19: right y-axis, orange line) starting from 1st January 2015 (top graph) or 30th December 2019 (bottom graph).

Suppl. Figure 5

Suppl. Figure 5. Rubella case numbers during the COVID-19 pandemic in England. Weekly case numbers (rubella: left y-axis, blue line, COVID-19: right y-axis, orange line) starting from 1st January 2015 (top graph) or 30th December 2019 (bottom graph).

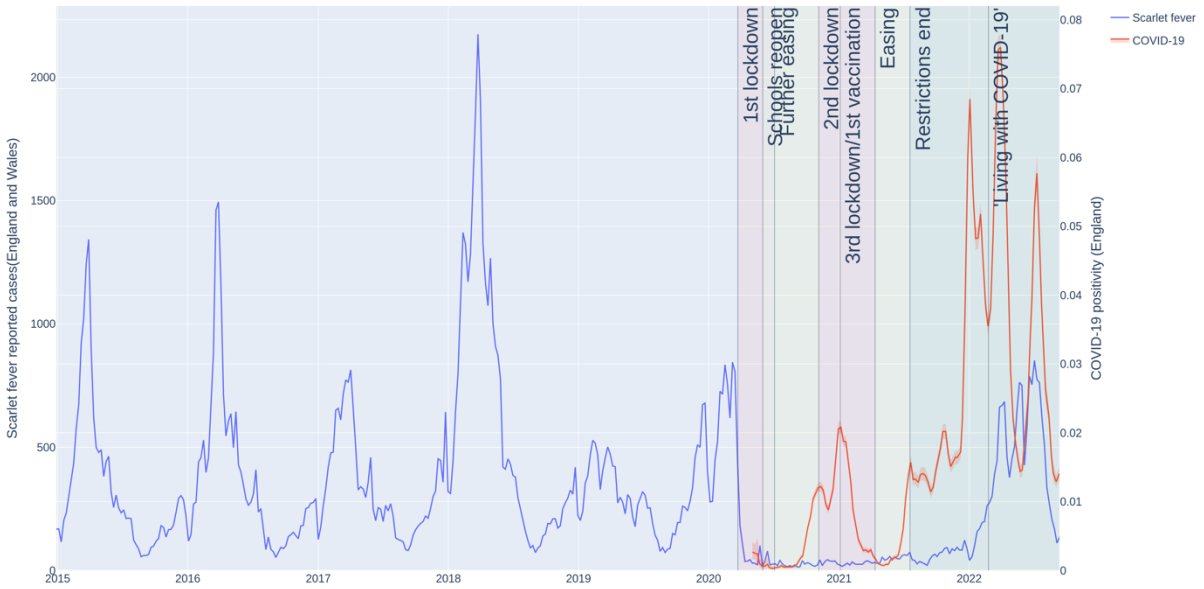
Suppl. Figure 6

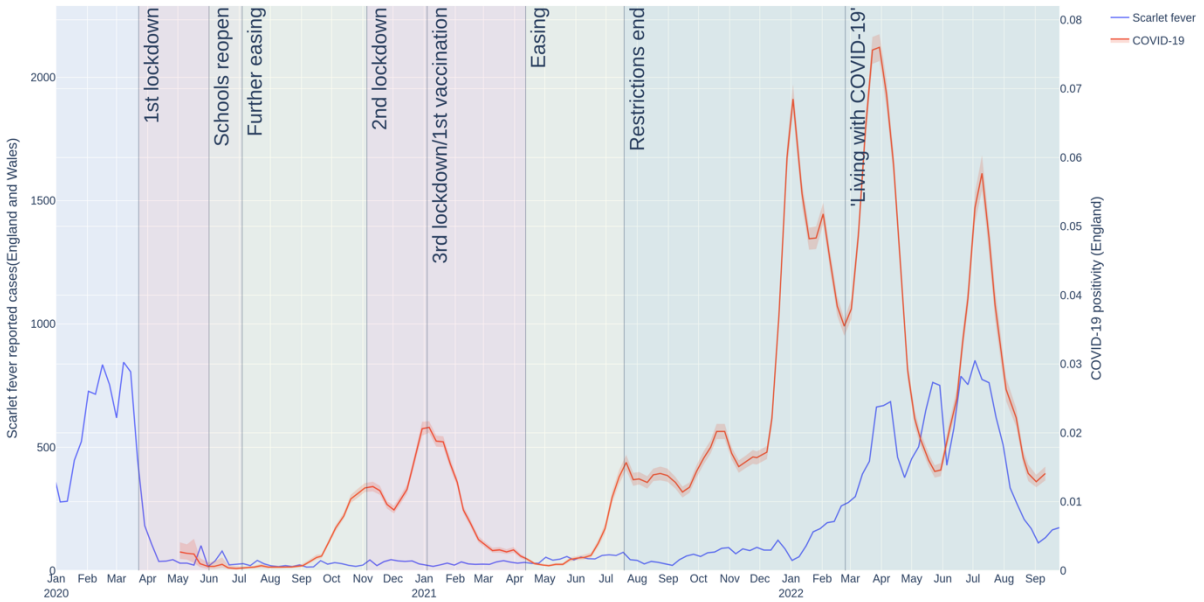




Suppl. Figure 6. Pneumococcal disease (*Streptococcus pneumoniae*) case numbers during the COVID-19 pandemic in England. Weekly case numbers (*Streptococcus pneumoniae*: left y-axis, blue line, COVID-19: right y-axis, orange line) starting from 1st January 2015 (top graph) or 30th December 2019 (bottom graph).

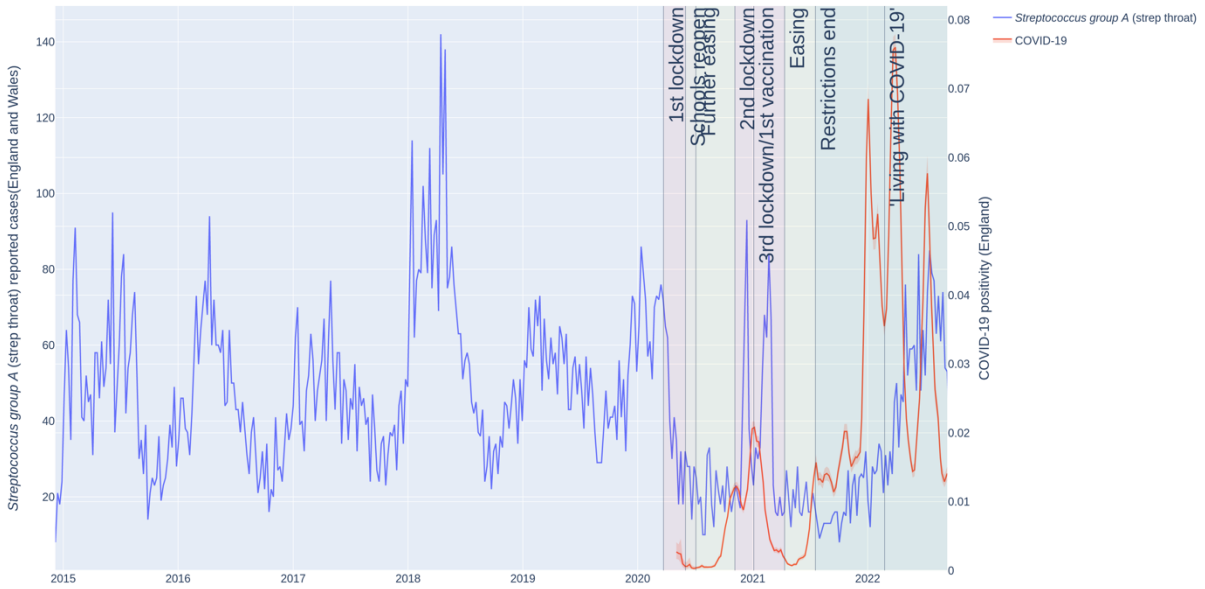
Suppl. Figure 7

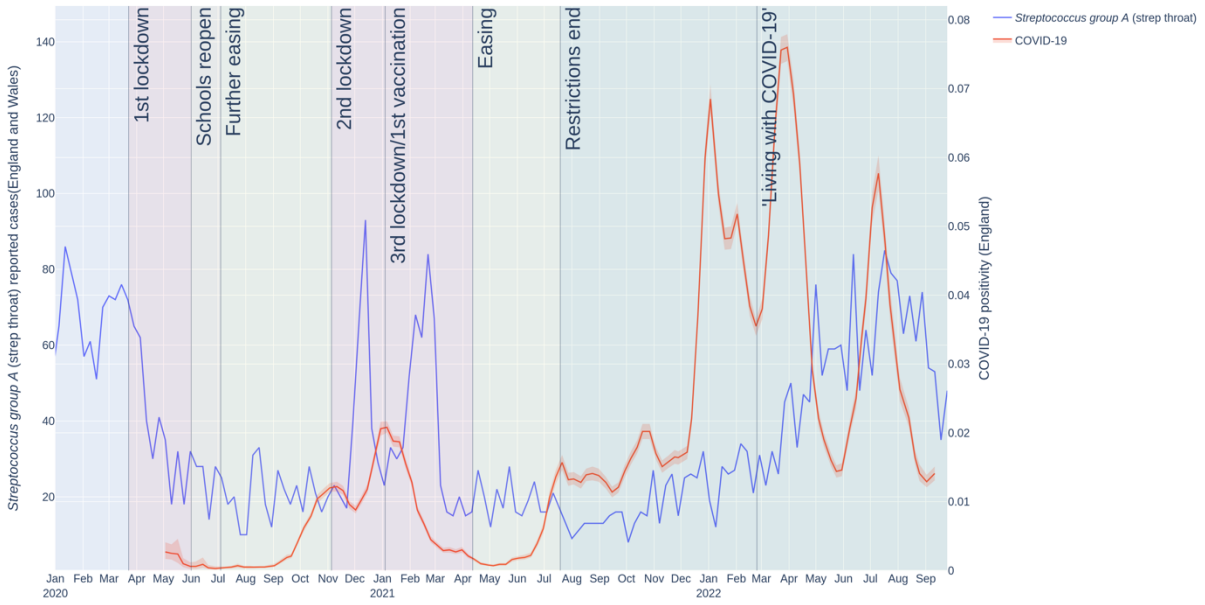




Suppl. Figure 7. Scarlet fever case numbers during the COVID-19 pandemic in England. Weekly case numbers (scarlet fever: left y-axis, blue line, COVID-19: right y-axis, orange line) starting from 1st January 2015 (top graph) or 30th December 2019 (bottom graph).

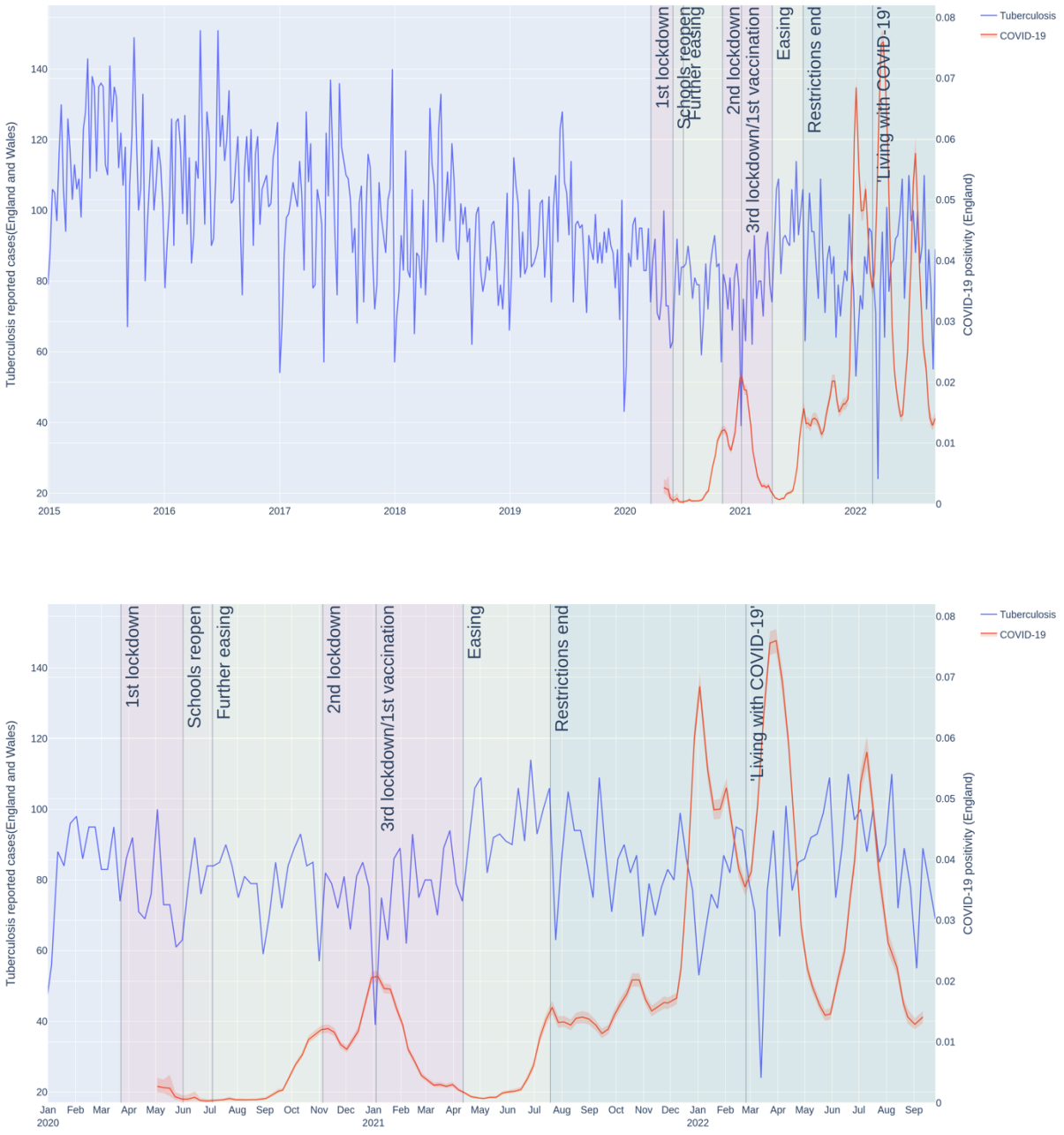
Suppl. Figure 8





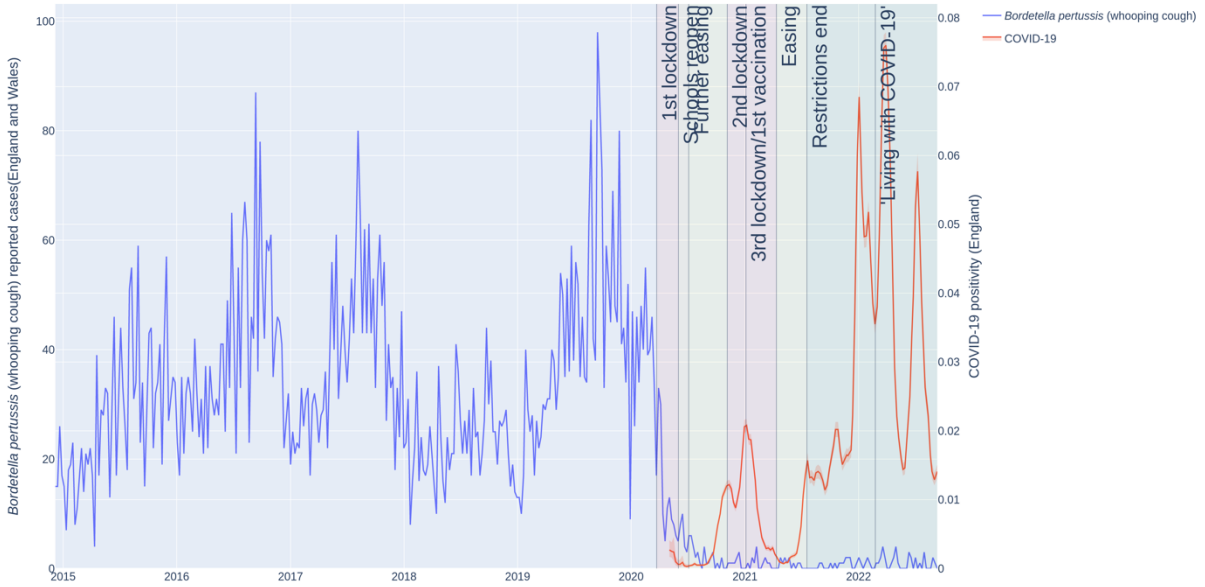
Suppl. Figure 8. Streptococcal pharyngitis (Streptococcus group A, strep throat) case numbers during the COVID-19 pandemic in England. Weekly case numbers (Streptococcus group A: left y-axis, blue line, COVID-19: right y-axis, orange line) starting from 1st January 2015 (top graph) or 30th December 2019 (bottom graph).

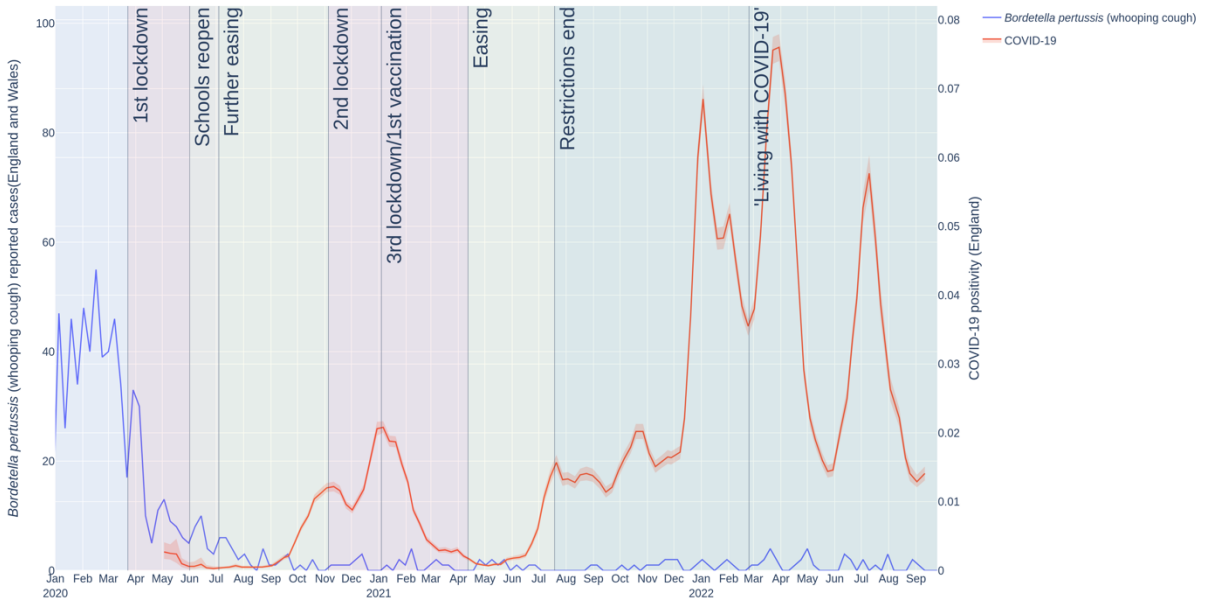
Suppl. Figure 9



Suppl. Figure 9. Tuberculosis case numbers during the COVID-19 pandemic in England. Weekly case numbers (tuberculosis: left y-axis, blue line, COVID-19: right y-axis, orange line) starting from 1st January 2015 (top graph) or 30th December 2019 (bottom graph).

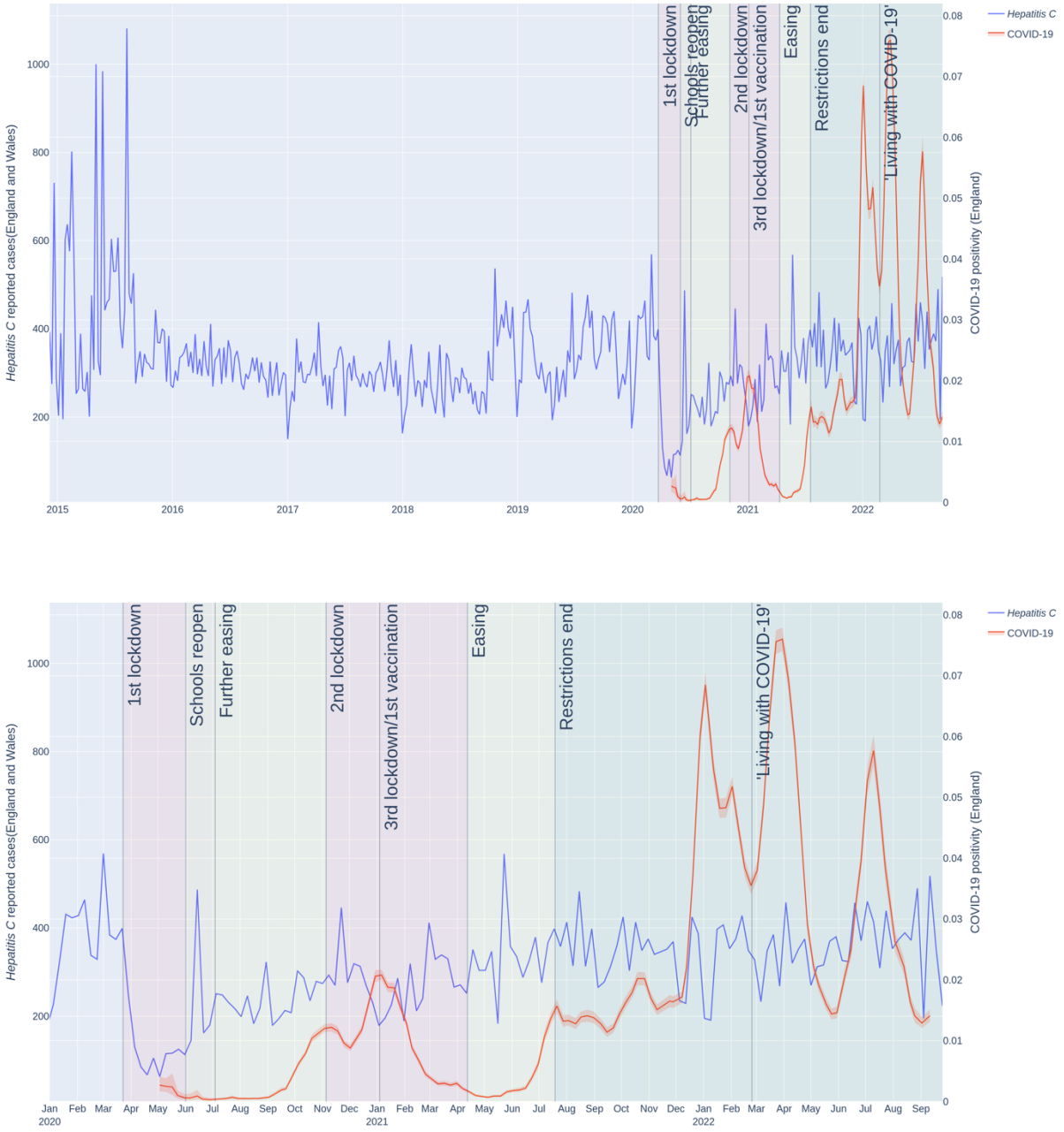
Suppl. Figure 10





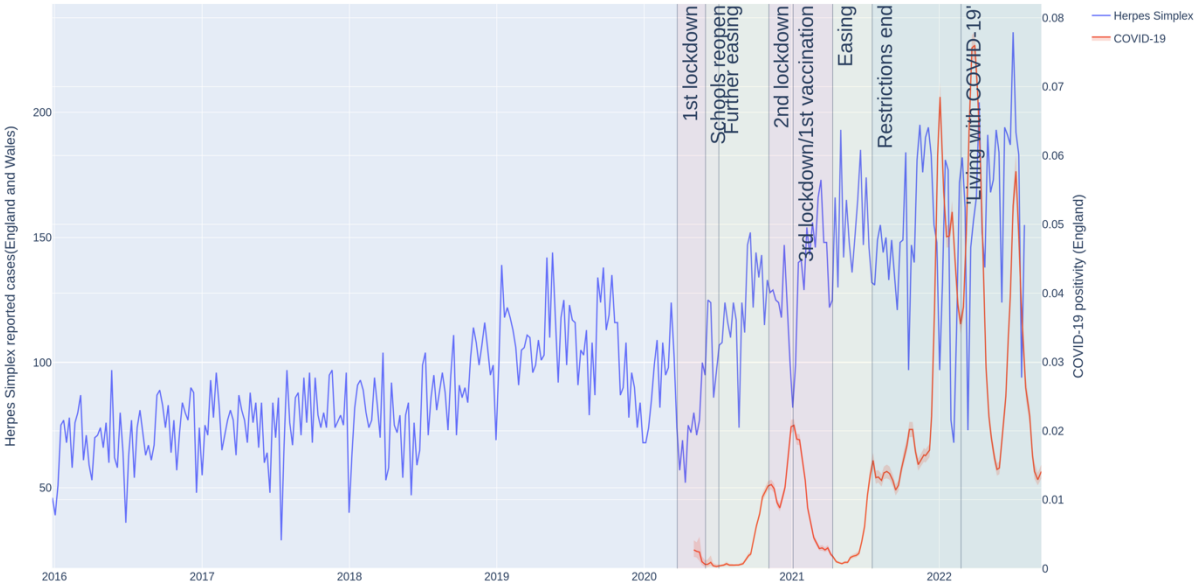
Suppl. Figure 10. Pertussis (*Bordetella pertussis*, whooping cough) case numbers during the COVID-19 pandemic in England. Weekly case numbers (pertussis: left y-axis, blue line, COVID-19: right y-axis, orange line) starting from 1st January 2015 (top graph) or 30th December 2019 (bottom graph).

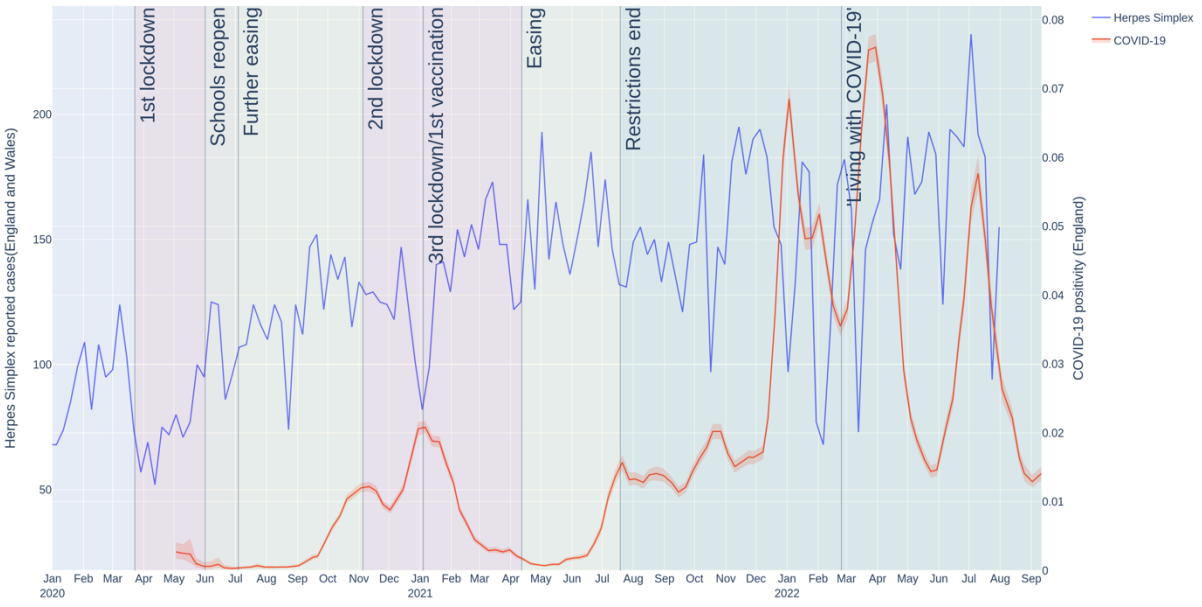
Suppl. Figure 11



Suppl. Figure 11. Hepatitis C case numbers during the COVID-19 pandemic in England. Weekly case numbers (hepatitis C: left y-axis, blue line, COVID-19: right y-axis, orange line) starting from 1st January 2015 (top graph) or 30th December 2019 (bottom graph).

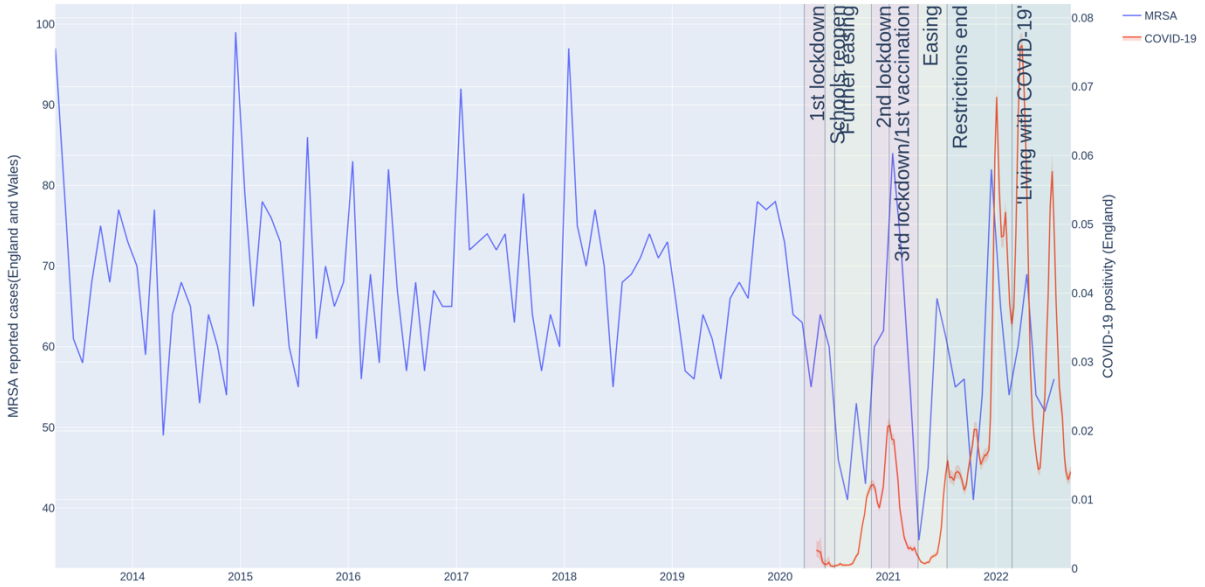
Suppl. Figure 12

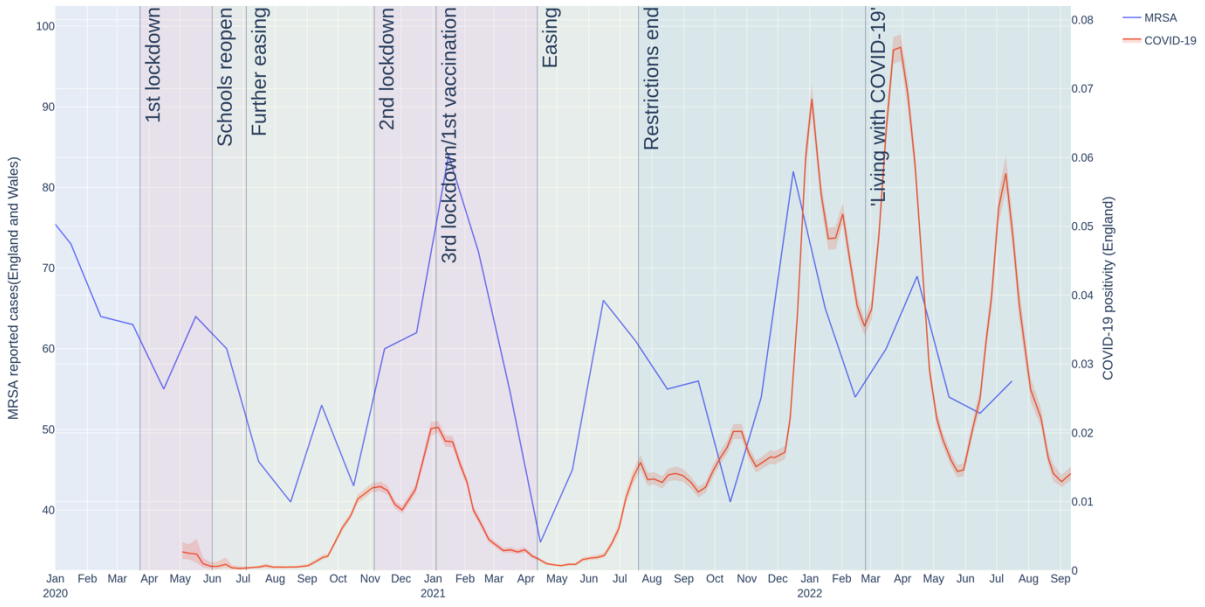




Suppl. Figure 12. Herpes simplex virus case numbers during the COVID-19 pandemic in England. Weekly case numbers (herpes simplex virus: left y-axis, blue line, COVID-19: right y-axis, orange line) starting from 1st January 2016 (top graph) or 30th December 2019 (bottom graph).

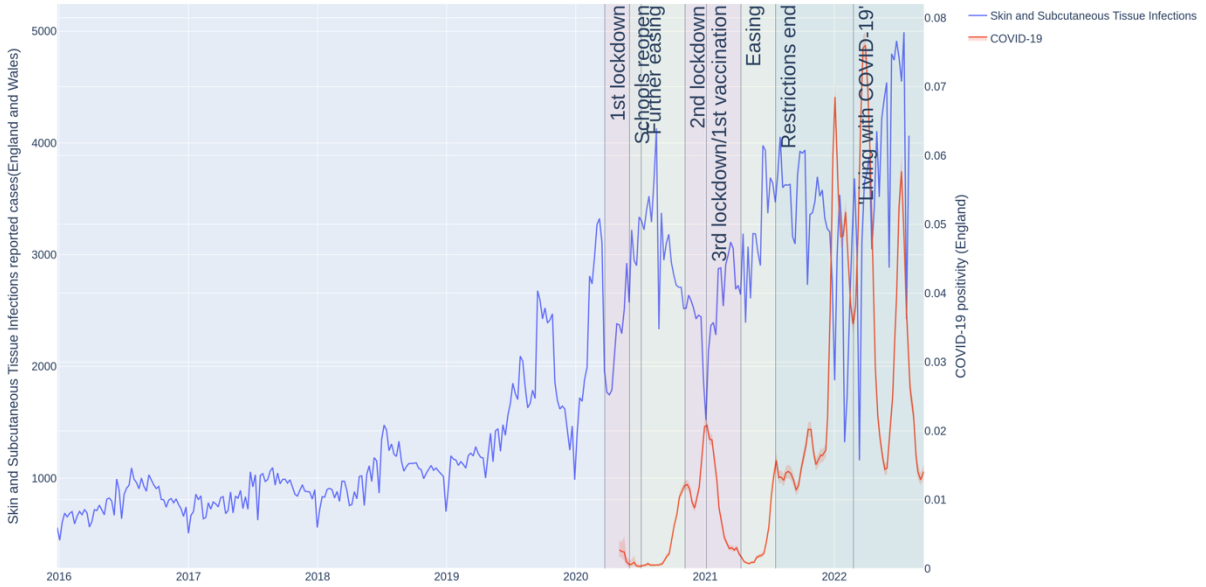
Suppl. Figure 13

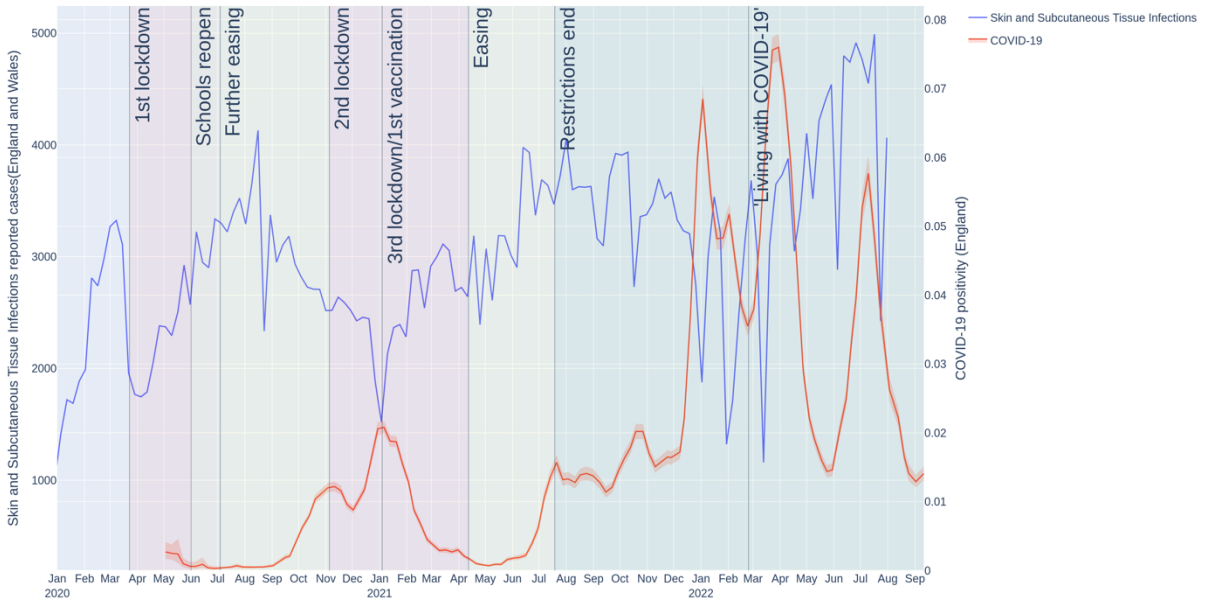




Suppl. Figure 13. Methicillin-resistant *Staphylococcus aureus* (MRSA) case numbers during the COVID-19 pandemic in England. Weekly case numbers (MRSA: left y-axis, blue line, COVID-19: right y-axis, orange line) starting from 1st January 2017 (top graph) or 30th December 2019 (bottom graph).

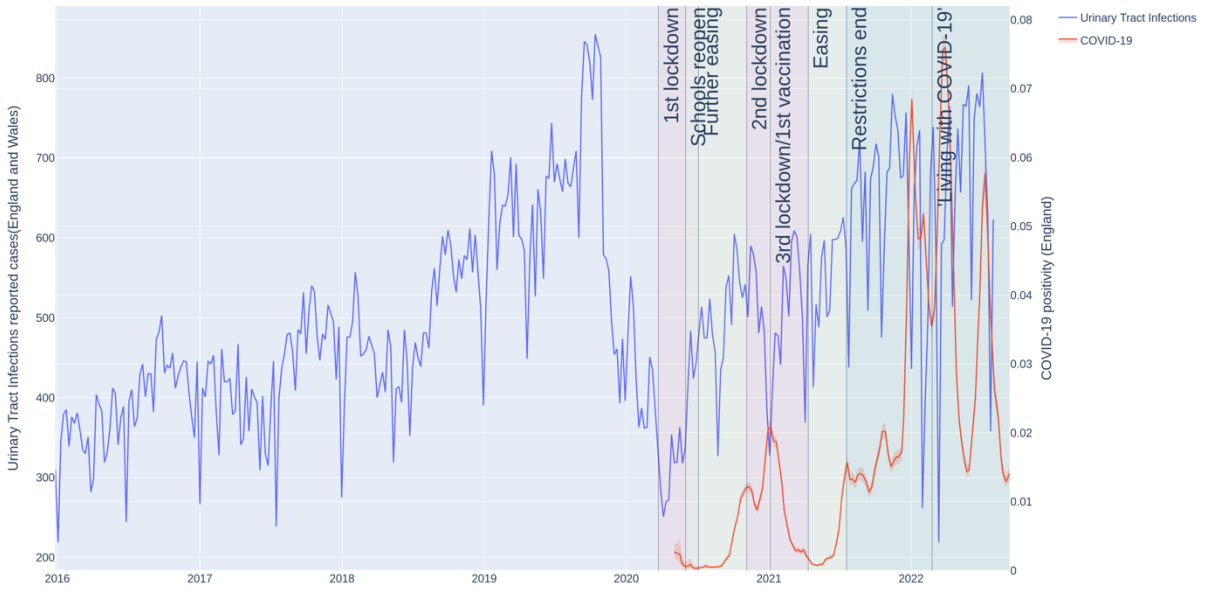
Suppl. Figure 14

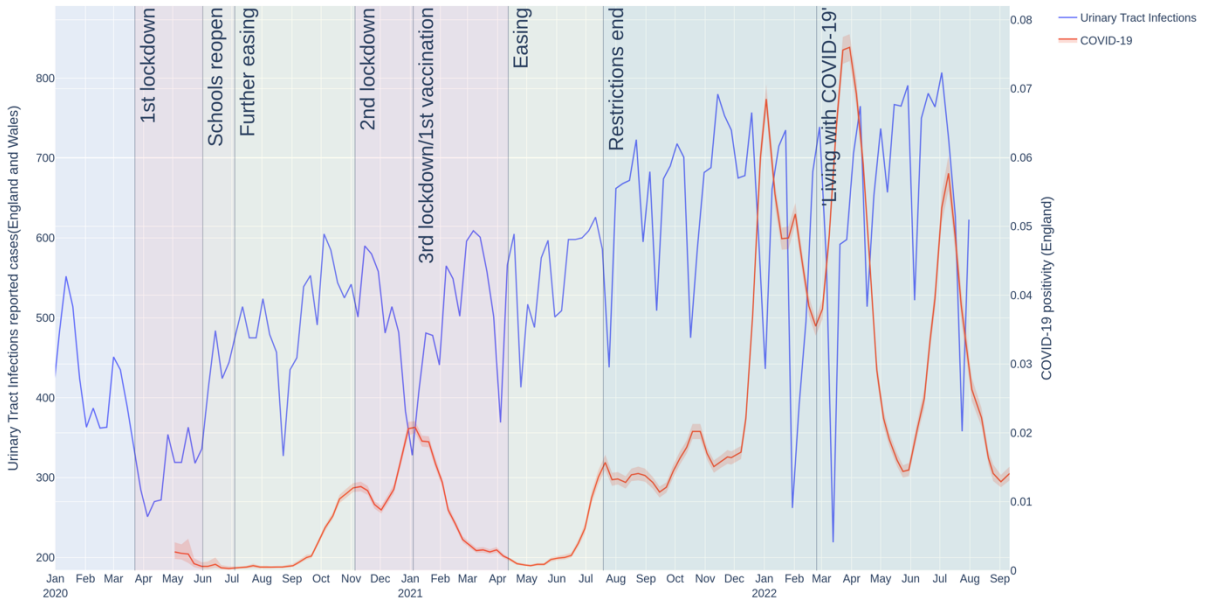




Suppl. Figure 14. Skin and Subcutaneous Tissue Infections case numbers during the COVID-19 pandemic in England. Weekly case numbers (Skin and Subcutaneous Tissue Infections: left y-axis, blue line, COVID-19: right y-axis, orange line) starting from 1st January 2016 (top graph) or 30th December 2019 (bottom graph).

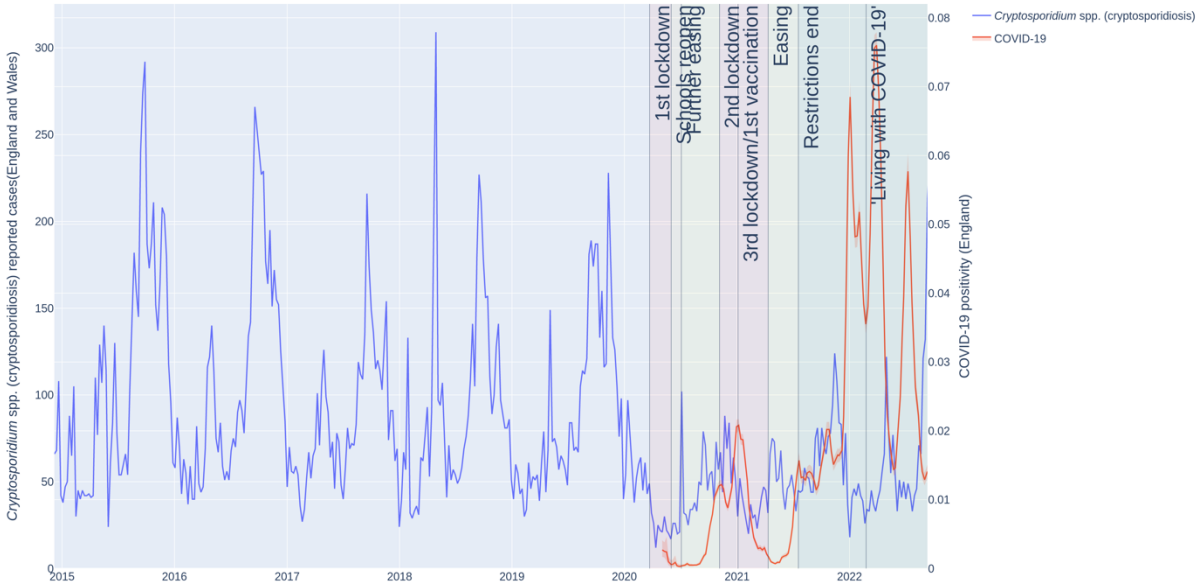
Suppl. Figure 15

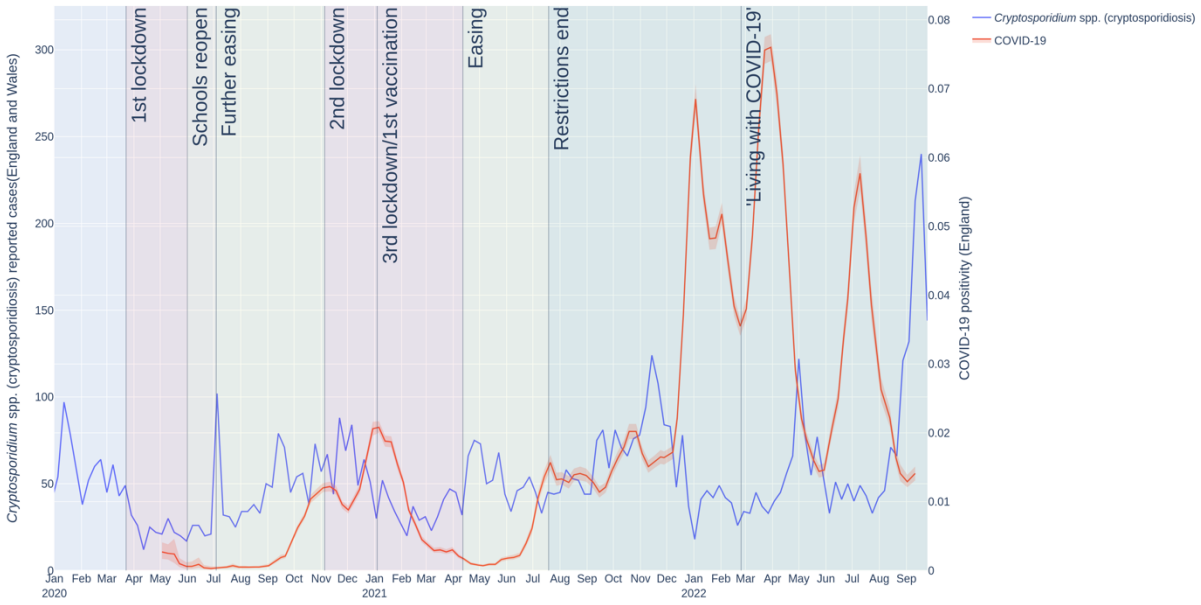




Suppl. Figure 15. Urinary tract infection case numbers during the COVID-19 pandemic in England. Weekly case numbers (Urinary tract infections: left y-axis, blue line, COVID-19: right y-axis, orange line) starting from 1st January 2016 (top graph) or 30th December 2019 (bottom graph).

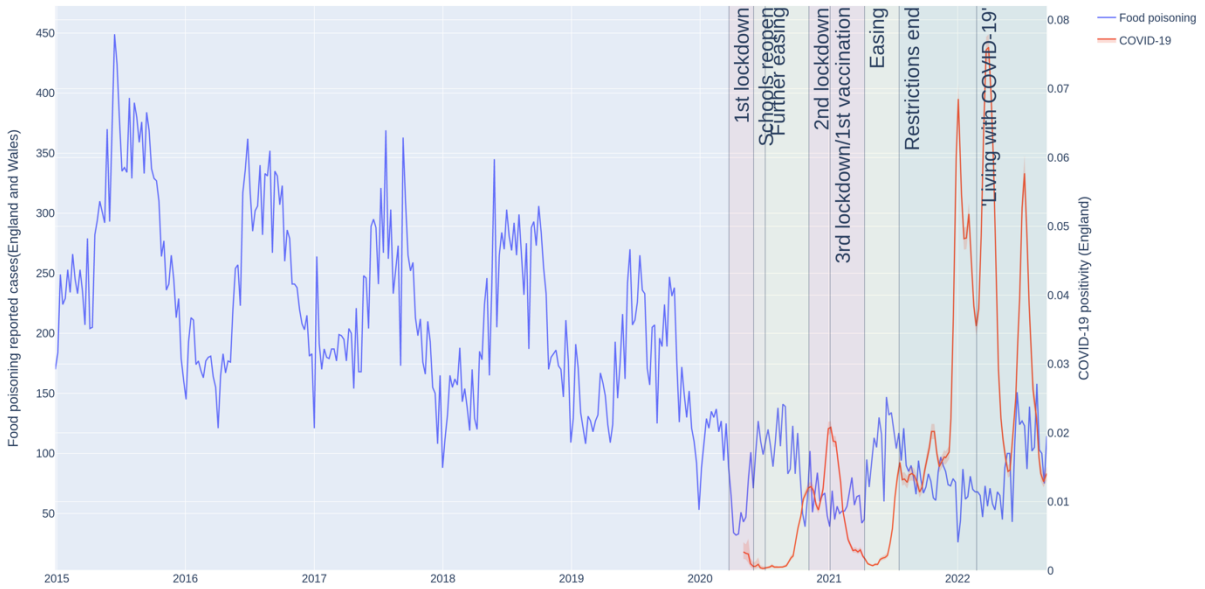
Suppl. Figure 16

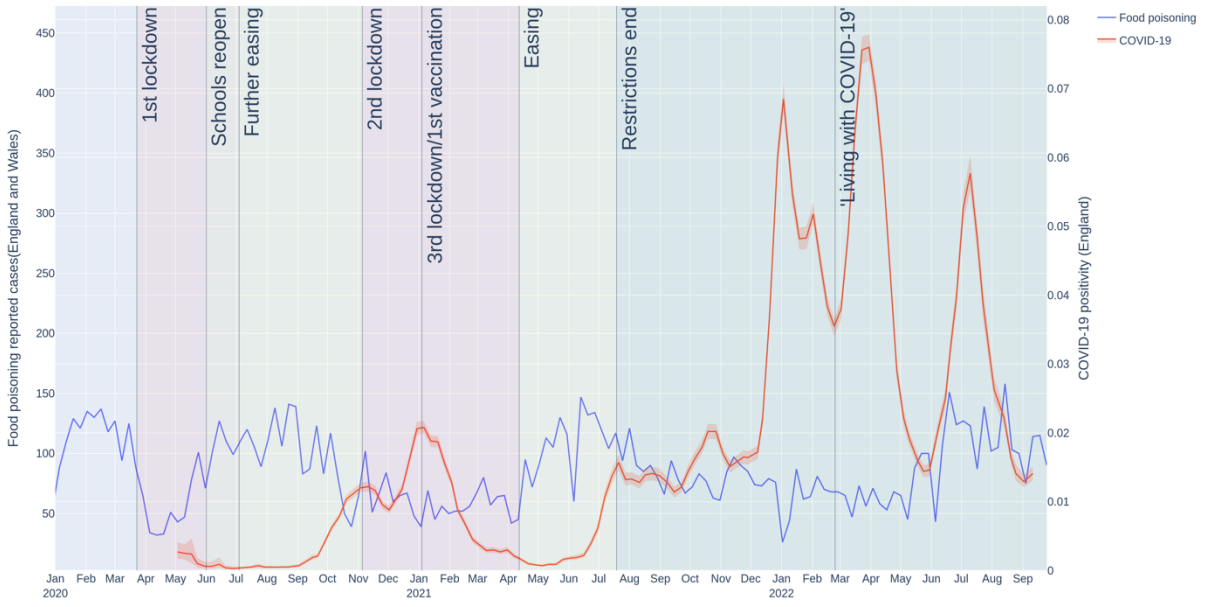




Suppl. Figure 16. Cryptosporidiosis (*Cryptosporidium ssp.*) case numbers during the COVID-19 pandemic in England. Weekly case numbers (*Cryptosporidium ssp.*: left y-axis, blue line, COVID-19: right y-axis, orange line) starting from 1st January 2015 (top graph) or 30th December 2019 (bottom graph).

Suppl. Figure 17



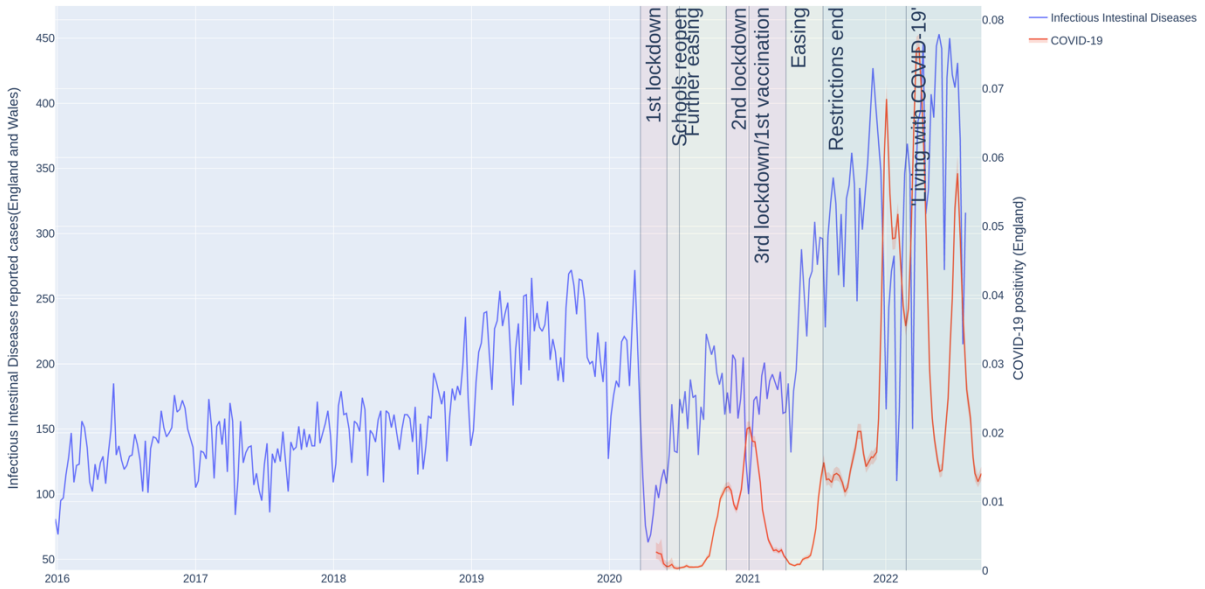


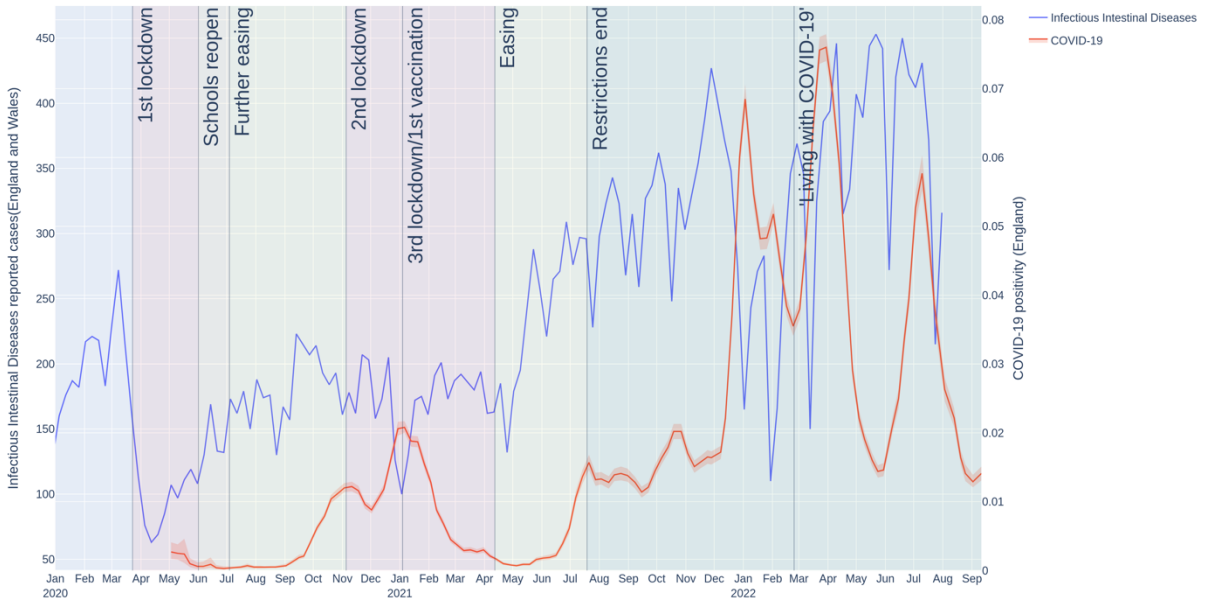
Suppl. Figure 17. Foodborne illness (Food poisoning) case numbers during the COVID-19 pandemic in England. Weekly case numbers (Food poisoning: left y-axis, blue line, COVID-19: right y-axis, orange line) starting from 1st January 2015 (top graph) or 30th December 2019 (bottom graph).

Suppl. Figure 18

Suppl. Figure 18. Hepatitis E case numbers during the COVID-19 pandemic in England. Weekly case numbers (hepatitis E: left y-axis, blue line, COVID-19: right y-axis, orange line) starting from 1st January 2015 (top graph) or 30th December 2019 (bottom graph).

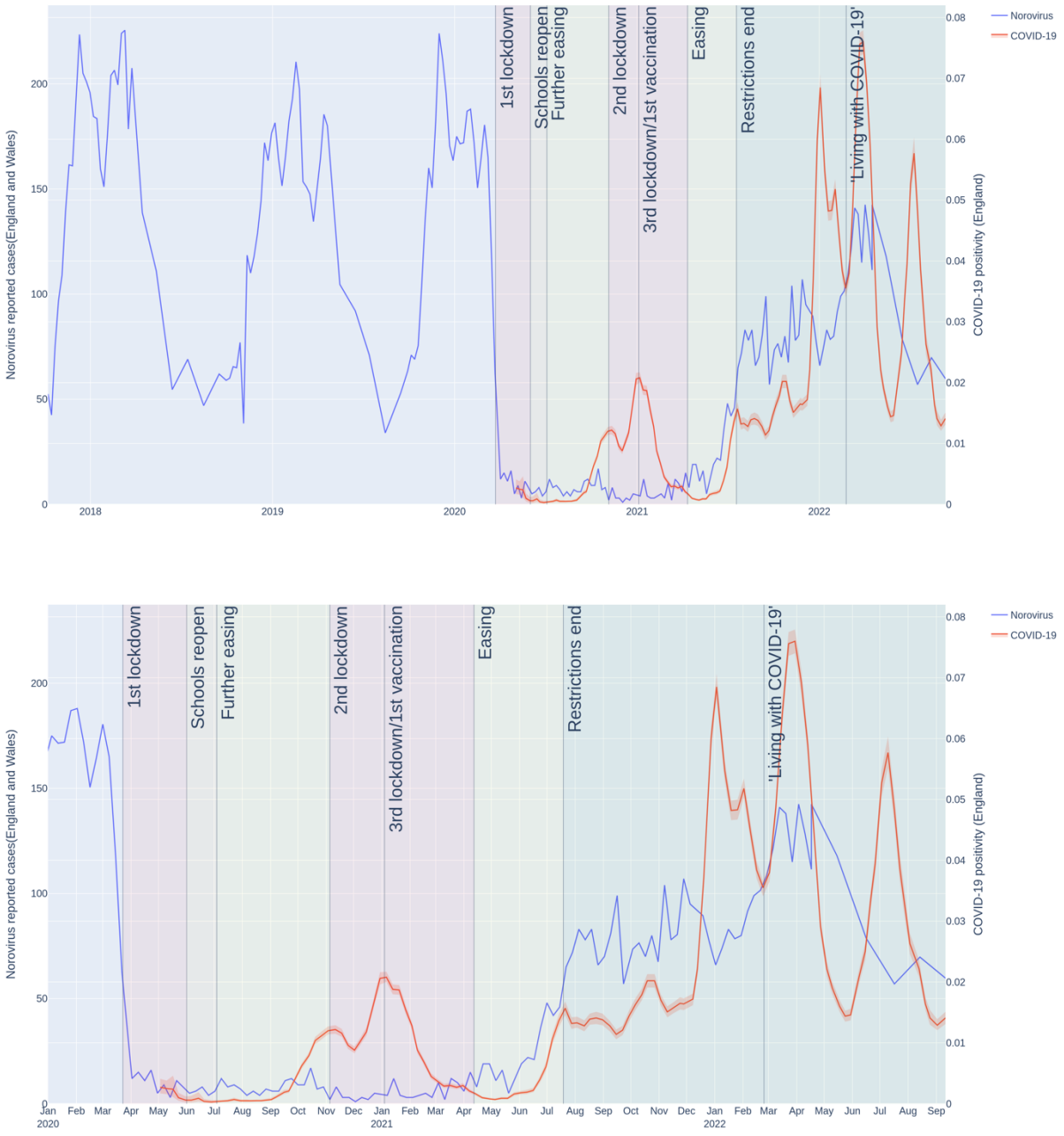
Suppl. Figure 19





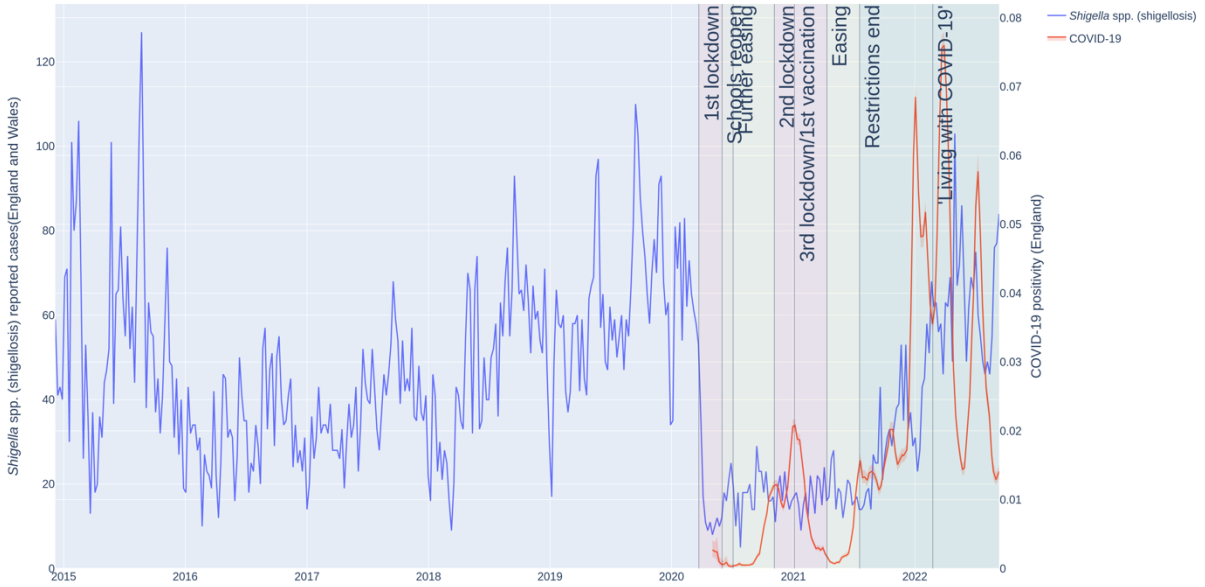
Suppl. Figure 19. Infectious intestinal disease case numbers during the COVID-19 pandemic in England. Weekly case numbers (Infectious intestinal disease: left y-axis, blue line, COVID-19: right y-axis, orange line) starting from 1st January 2016 (top graph) or 30th December 2019 (bottom graph).

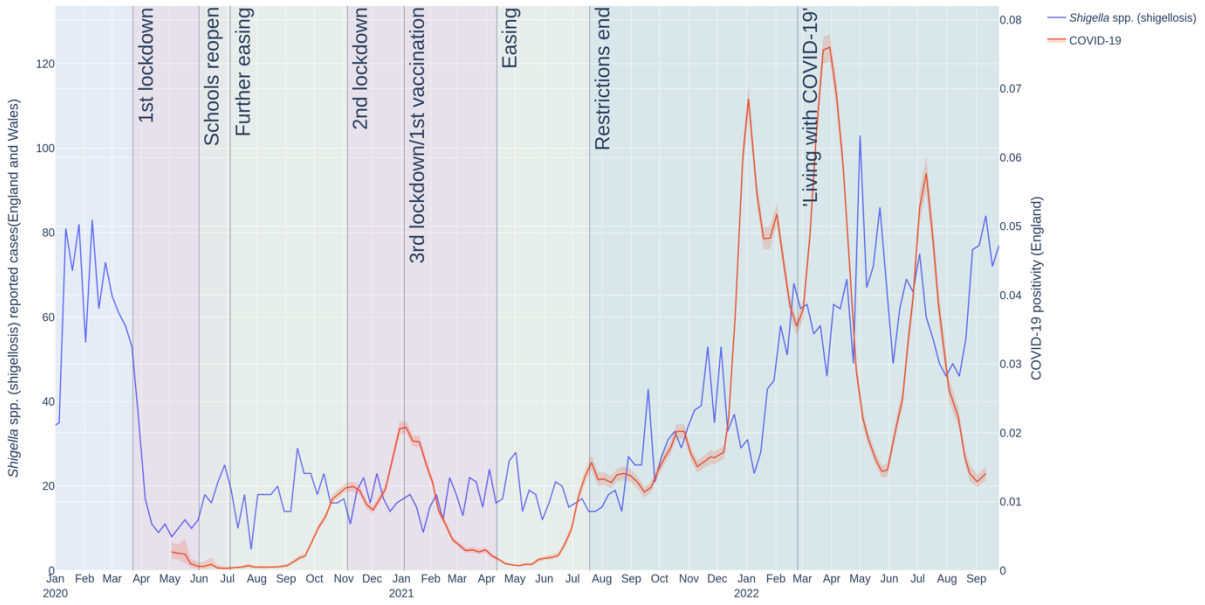
Suppl. Figure 20



Suppl. Figure 20. Norovirus case numbers during the COVID-19 pandemic in England. Weekly case numbers (norovirus: left y-axis, blue line, COVID-19: right y-axis, orange line) starting from 2018 (top graph) or 30th December 2019 (bottom graph).

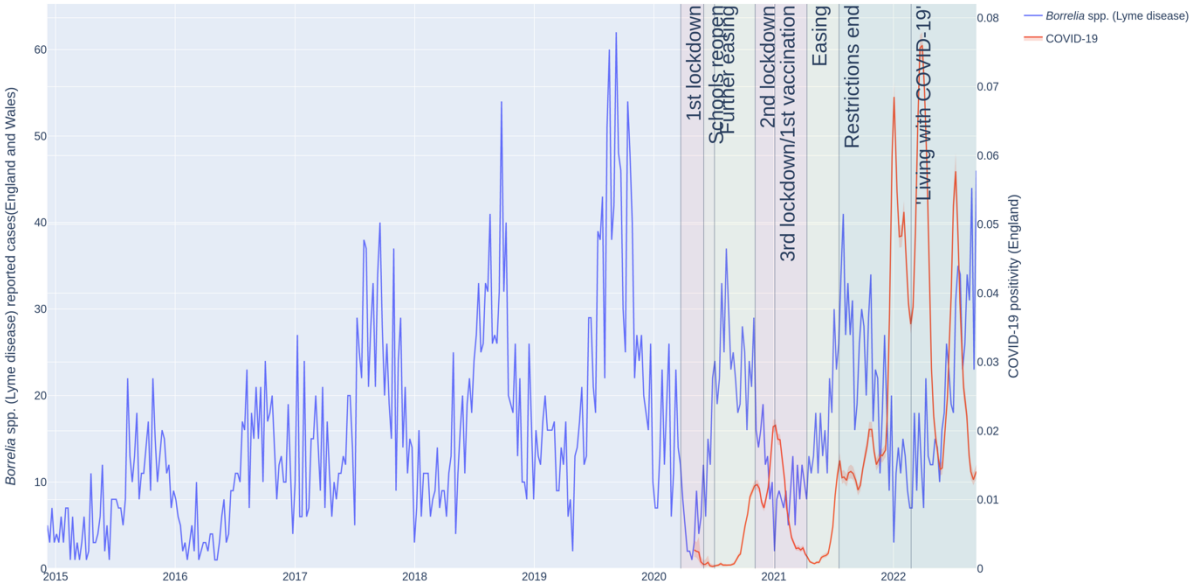
Suppl. Figure 21

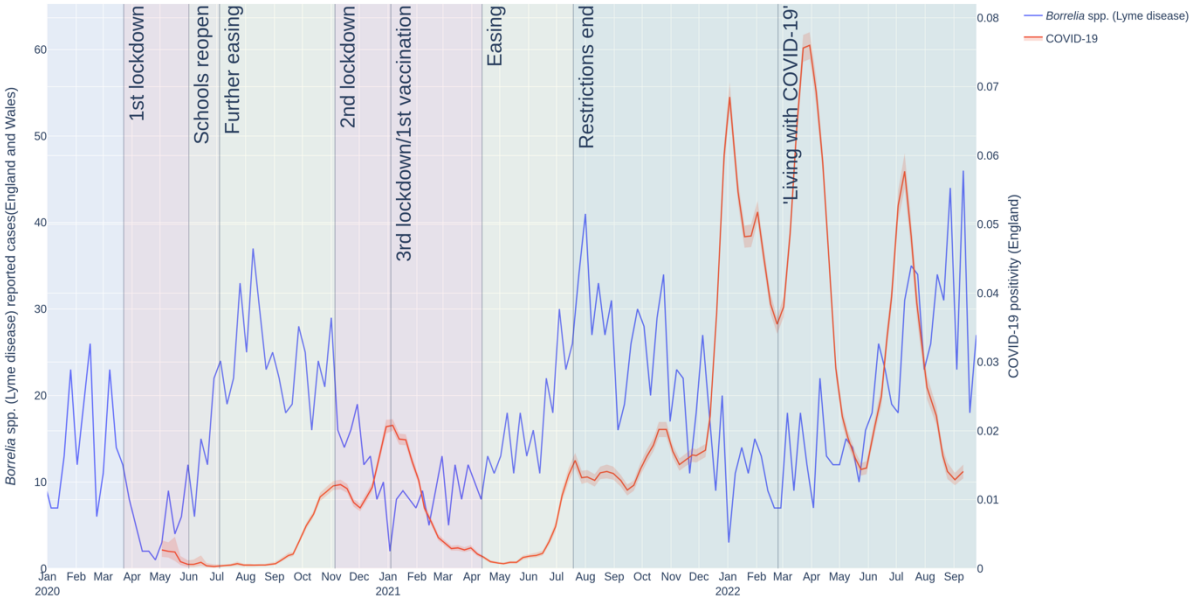




Suppl. Figure 21. Shigellosis (*Shigella ssp.*) case numbers during the COVID-19 pandemic in England. Weekly case numbers (*Shigella ssp.*: left y-axis, blue line, COVID-19: right y-axis, orange line) starting from 1st January 2015 (top graph) or 30th December 2019 (bottom graph).

Suppl. Figure 22





Suppl. Figure 22. Lyme disease (*Borrelia ssp.*) case numbers during the COVID-19 pandemic in England. Weekly case numbers (*Borrelia ssp.*: left y-axis, blue line, COVID-19: right y-axis, orange line) starting from 1st January 2015 (top graph) or 30th December 2019 (bottom graph).

Suppl. Table 1. Infectious diseases covered in this study and their anticipated modes of transmission.

Mode of transmission	Infectious diseases
Airborne/droplet	Chickenpox, influenza-like-illness, measles, mumps, rubella, pneumococcal disease, scarlet fever, strep throat, tuberculosis, whooping cough
Blood-borne	Hepatitis C
Direct contact	Herpes simplex virus, methicillin resistant Staphylococcus aureus, skin and subcutaneous tissue infections, urinary tract infections
Faecal-oral	Cryptosporidiosis, foodborne illness, hepatitis E, infectious intestinal diseases, norovirus, shigellosis
Vector	Lyme disease

Suppl. Table 2. Timing of COVID-19 protection measures in England.

Year	Date	Week/Quarter	Prevention Measure	Guidelines
2020	23rd March	13/1	First lockdown	- Confinement to household with exception for reasons deemed essential such as food or medicine. - 2-meter social distancing. - Mandatory wearing of face covering. - Closure of schools and non-essential businesses. - Ban of public gatherings. - Cease of foreign travel. - Rigorous hygiene measures including regular hand washing, use of hand sanitiser and frequent disinfection of surfaces.
	1st June	23/2	Schools reopen	Phased reopening of nurseries, primary and secondary schools.
	4th July	27/3	Further easing	Reopening of all non-essential business, such as restaurants, hairdressers, leisure facilities and tourist attractions.
	5th November	45/4	Second lockdown	Schools and universities remained open.
2021	4th/5th Jan	1/1	First vaccination/Third lockdown	Phased administration of the COVID-19 vaccine.
	12th April	15/2	Easing	Reopening of all non-essential business.
	19th July	29/3	Restrictions end	All restrictions lifted including removal of social distancing and reopening of existing closed sectors such as nightclubs.
2022	24th February	8/1	'Living with COVID-19' strategy	Legal requirement to self-isolate and wear face coverings removed.