THE LANCET

Supplementary appendix

This appendix formed part of the original submission. We post it as supplied by the authors.

Supplementary appendix for:

Independent SARS-CoV-2 staff testing protected academic and health-care and institutions in Northwest London

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Figure Legends

Figure 1: The CCTP mirrors the dynamics of the first year of the COVID-19 pandemic in London. (A) Prevalence of all SARS-CoV-2 infections in cases per 1000 resident, by London borough for the duration of the CCTP April 2020-May 2021, reported to the UK government testing service. Colour scale indicates increasing prevalence. FCI = Francis Crick Institute, RFH = Royal Free Hospital, CNWL = Camden and North West London NHS Trust, LNWUH = London North West University Hospitals, NMH = North Middlesex Hospital, RMH = Royal Marsden Hospital and UCLH – University College London Hospitals. **(B)** Numbers of daily tests April 2020-April 2022. Green bars show daily test count, yellow bars indicate positive tests. The period of the CCTP across NHS sites is indicated by the dark grey bar, continuation of asymptomatic testing at the FCI only indicated by light green bar. **(C)** Rolling 7-day incidence of SARS-CoV-2 infections across the all CTP sites April 2020-May 2021. Vertical lines indicate peak daily positive tests, smoothed line indicates 7 day rolling mean. **(D)** Pangolin lineage of all SARS-CoV-2 positive PCR tests, as a percentage of the total positive tests per calendar month. Colours indicate lineage, bars indicate months from April 2020-March 2022. **(E)** Phylogenetic tree showing variation in all SARS-CoV-2 lineages isolated from the FCI testing pipeline 2020-2022, coloured by pandemic Variant of Concern (VOC). **(F)** Detection lead time in days for three VOC Alpha (yellow), Delta (blue) and Omicron (green) on the CCTP before declaration of VOC status by the WHO.

Supplementary **Figure 1: Asymptomatic testing captures early infections and protects NHS green sites early in the pandemic. (A)** Top panel: Numbers of daily SARS-CoV-2 tests by site, representing the proportions contributing to the peak pandemic waves 2020-2021. Coloured lines indicate different sites. Bottom panel**:** Numbers of daily positive SARS-CoV-2 tests by site, representing the proportions contributing to the peak pandemic waves 2020-2021. Coloured bars indicate proportion of positives contributed to by each testing site. Data gap between 24-28th December 2021 due to maintenance and staff holidays, no test results reported on these days (shown as a grey bar). **(B)** Rolling 7day incidence of SARS-CoV-2

infections by Crick testing pipeline site April 2020-May 2021. RFH = Royal Free Hospital, CNWL = Camden and North West London NHS Trust, LNWUH = London North West University Hospitals, NMH = North Middlesex Hospital, RMH = Royal Marsden Hospital and UCLH – University College London Hospitals. **(C)** Incident rate ratio of positive tests comparing symptomatic and asymptomatic sites. Green site refers to NHS sites following NHSE IPC guidelines for safer surgery and cancer treatment. **(D)** Median Ct value for all tests across the CCTP between asymptomatic and symptomatic sites. **(E)** Cumulative incidence of infections with a Ct<15 between asymptomatic and symptomatic sites.

Supplementary **Figure 2**: **Enhanced COVID-19 workplace testing supports productivity in a large biomedical research institute. (A)** Positive SARS-CoV-2 tests at the FCI, as a proportion of all conducted tests, overlayed with building occupancy. Grey columns indicate daily tests (right axis), dark blue lines show the rolling 7-day incidence of positive tests (left axis). Horizontal red line indicates rolling 7-day average building occupancy April 2020-March 2022 (right axis). **(B)** Weekly building occupancy shown as a proportion of peak 2019 occupancy. Green bars indicate data across 2020, orange 2021 and blue 2022. Data gaps indicate national stay at home orders where the building was closed to non-essential workers and swipe card data not routinely collected. **(C)** Incidence of daily reported SARS-CoV-2 infections in the London borough of Camden (grey, left axis) matched to daily positive SARS-CoV-2 infections in employees of the Francis Crick Institute (blue, right axis) April 2020-March 2022.

Supplementary **Table 1: Effective population size and incidence rate ratios (IRR) for NHS Trust sites**

Site	Effective population size	IRR	95% CI
London	9,002,448	1	-
UCLH	10,933	7.4	(6.65-8.26)
RMH	4,080	12.9	(11.1-14.8)
LNWUH	8,774	2.1	(1.62-2.60)
CNWL	6,773	0.65	(0.46-1.10)
RFH	10,818	9.9	(8.98-10.89)

Methods

PCR testing and sequencing

Individual samples across the CCTP were assigned a barcode identifier associated with the sample donor and test site and processed as previously described[1]. Briefly, occupational health screening swabs were inactivated and stored in virus transport media (VTM), RNA extracted and tested using both the SARS-CoV-2 PCR kit (BGI), subsequently changing to the TaqPath COVID-19 CE-IVD RTPCR Kit (ThermoFisher) in December 2020[1]. Following a positive result, RNA was re-extracted from stored VTM sample and Illumina sequencing libraries prepared using the ARTIC amplicon protocol following the CoronaHIT method [https://doi.org/10.1186/s13073-021-00839-5]. Following Illumina sequencing, FASTQ files were processed using the ViralRecon nf-core pipeline [https://nf-co.re/viralrecon]. Consensus FASTA files were subsequently uploaded to COG-UK, where lineage was assigned using PANGOLIN (v3.1.9). Consensus FASTA files were aligned using MAFFT and a phylogenetic tree was constructed and resampled using bootstrapping (n=100) from multiple sequence alignments using IQ-Tree and visualised using the R package ape.[2]

Data handling & analysis

All barcodes from the CCTP were sub-divided into test sites prior to analysis. Cumulative Covid-19 case numbers as of June 30 2021 for each London borough as reported to Public Health England were retrieved from the 'Coronavirus (COVID-19) Cases and Vaccinations' dataset within the London Datastore. London Borough boundary data were obtained from data.gov.uk, contained in a data set extracted from the freely available Official Ordnance Survey boundary-line product (https://data.gov.uk/dataset/f4481b10-3618-4d87-ac84-22d8ee242878/london-boroughs). Maps were generated in R, using the rgdal and tidyverse packages.

Incident rate ratio estimates were calculated by dividing the number of positive PCR tests within the first four months of the pandemic by the effective population served by that trust. The effective population was defined from the employee count for each Trusts' annual report for 2020-2021: UCLH –10,933,(https://www.uclh.nhs.uk/about-us/what-we-do/our-performance/annual-report-annual-plan-and-quality-account), Royal Marsden Hospitals NHS Trust(RMH)–4,080 (https://www.royalmarsden.nhs.uk/about-royal-marsden/quality-and-safety/regulatory-information/annual-report), Royal Free Hospital NHS Trust (RFH)–10,818(https://www.royalfree.nhs.uk/about-us/corporate-information-and-accountability/annual-reports/), London North-West University Hospitals NHS Trust (LNWUH)–8,774 (https://www.lnwh.nhs.uk/annual-report-and-accounts/), Camden and North West London NHS Trust (CNWL) –6,773 (https://www.cnwl.nhs.uk/about/planning-performance-and-reports).

Ct data were summarised by both site testing strategy and variant. Continuous variables were summarised using medians, interquartile and range, and compared using Wilcoxon log rank test.

Data sharing

Sequencing data for all positive samples are publicly available through COG-UK resources. Data tables and code for figures can be found here: https://github.com/bailey-c/THELANCET-D-23-01260

Additional references

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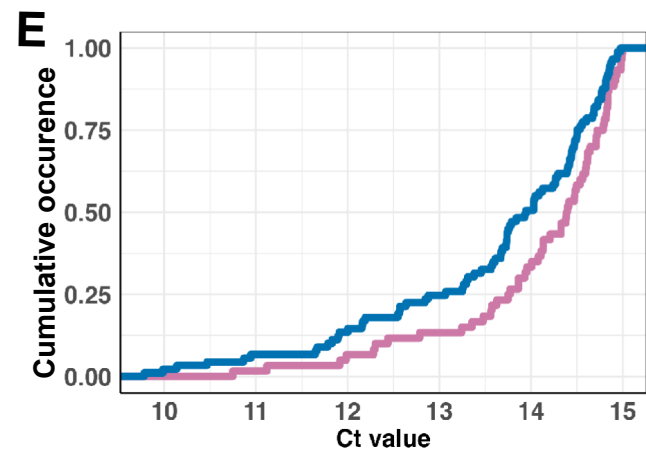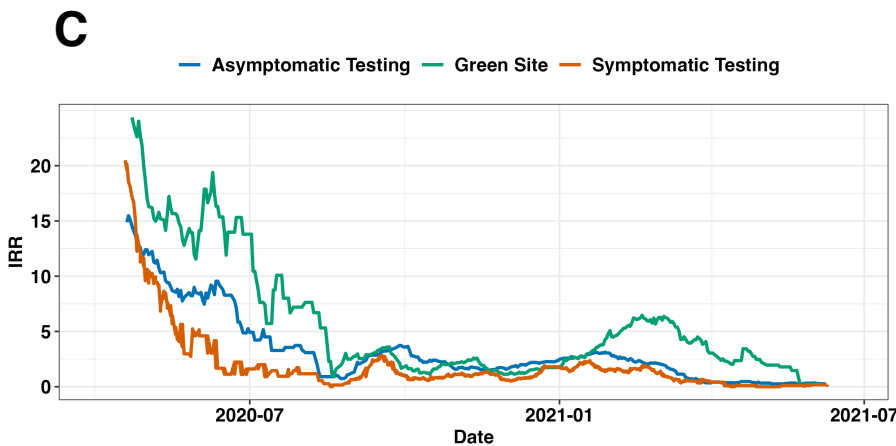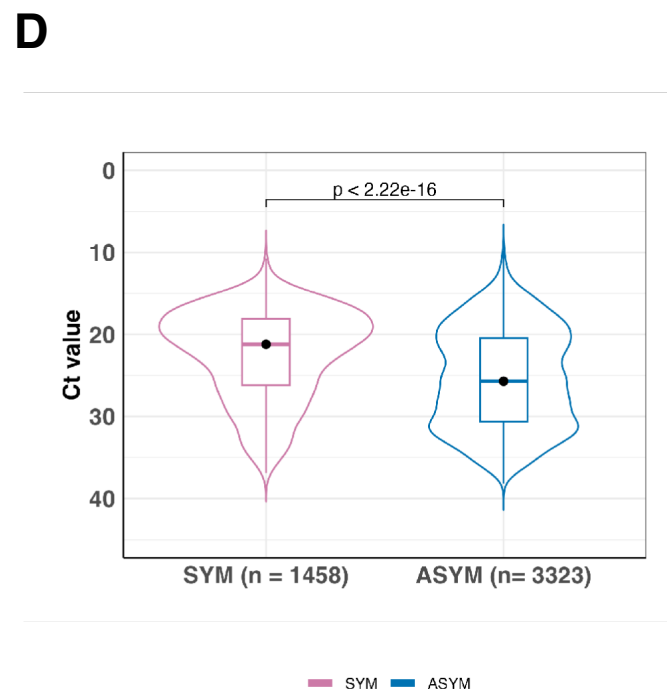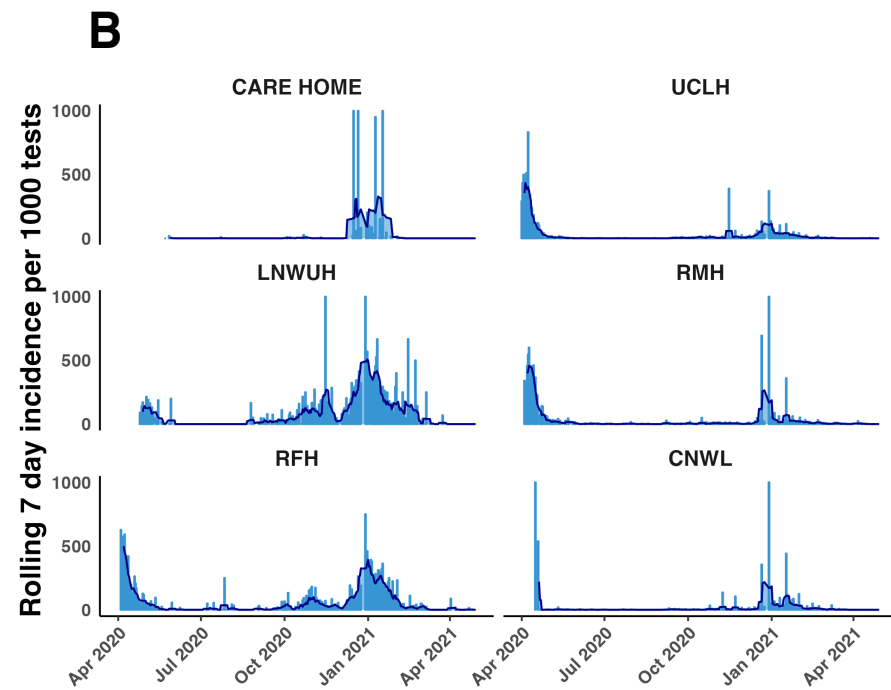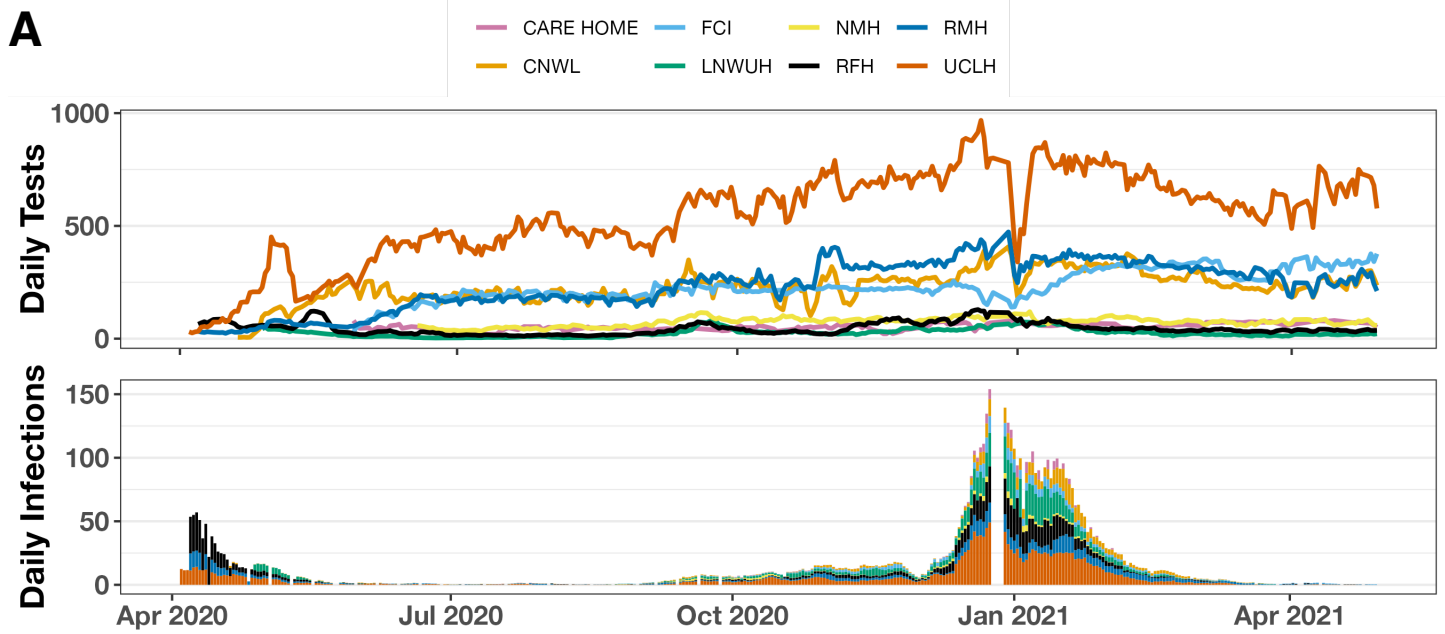
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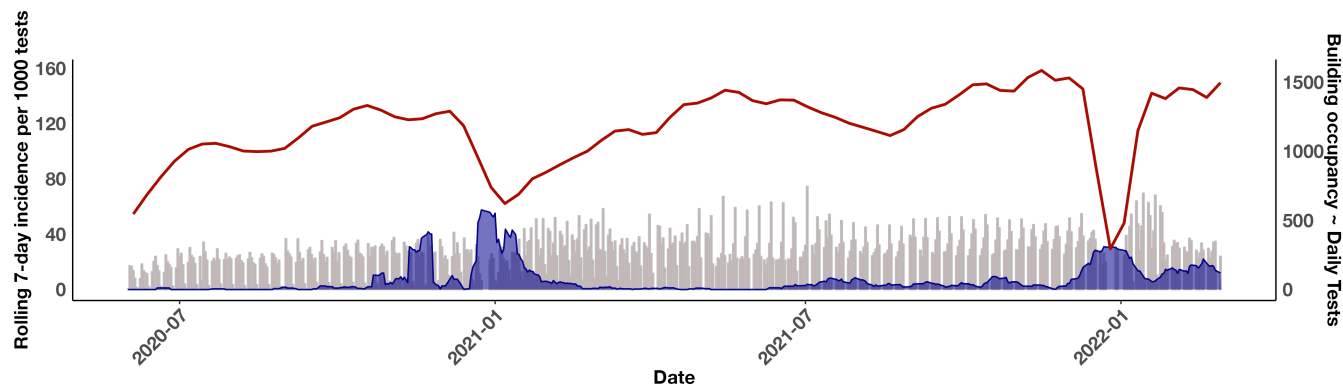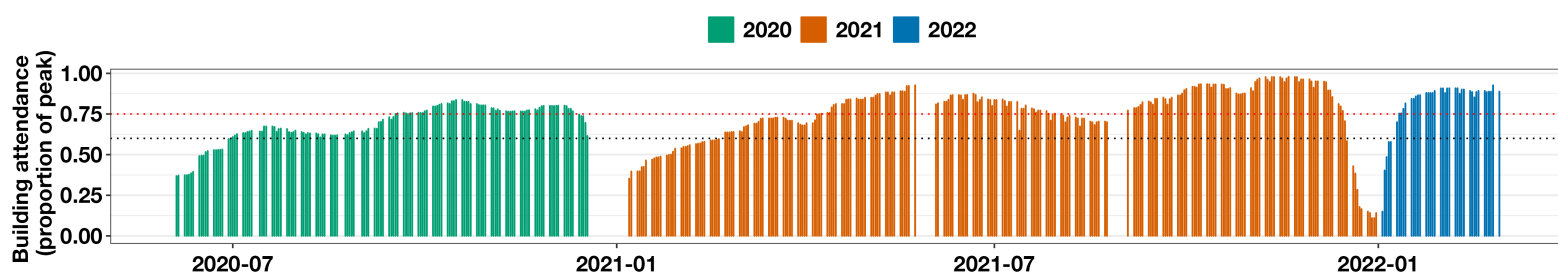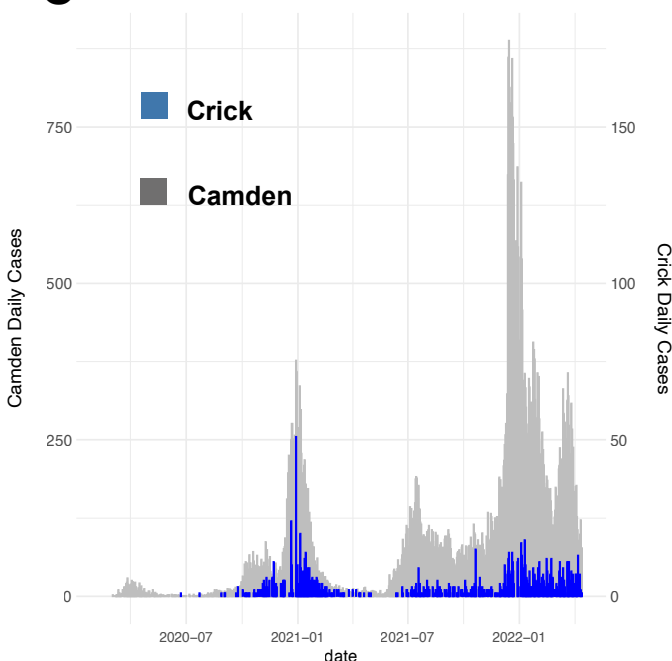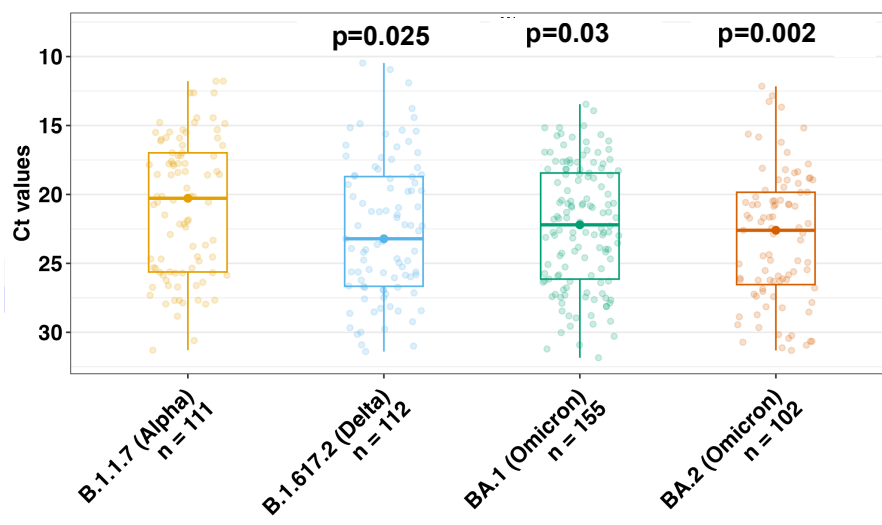
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Supplementary Figure 1: Asymptomatic testing captures a greater proportion of highly infectious staff than responsive symptomatic testing alone

(A-top panel) Numbers of daily SARS-CoV-2 tests by sites, indicated by coloured line. **(A-bottom panel)** Numbers of daily positive SARS-CoV-2 tests by site. Data gap 24-28th December 2021 due to CCTP maintenance. **(B)** Rolling 7day incidence of positive SARS-CoV-2 tests by site April 2020-May 2021. **(C)** Incident rate ratio of positive tests comparing symptomatic and asymptomatic sites. Green site refers to NHS sites following NHSE IPC guidelines for safer surgery and cancer treatment. **(D)** Median Ct value for all tests across the CCTP between asymptomatic and symptomatic-only sites. **(E)** Cumulative occurence of positive tests with a Ct<15 between asymptomatic and symptomatic sites.

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Supplementary Figure 2: Enhanced COVID-19 workplace testing supports in-person working in a large biomedical research institute

(A) Positive SARS-CoV-2 tests at the FCI, as a proportion of all conducted tests, overlayed with building occupancy. Grey columns indicate daily tests (right axis), dark blue lines show the rolling 7-day incidence of positive tests (left axis). Horizontal red line indicates rolling 7-day average building occupancy (right axis).
(B) Weekly building occupancy shown as a proportion of peak 2019 occupancy. Green bars indicate data across 2020, orange 2021 and blue 2022. Data gaps indicate national stay at home orders where the building was closed to non-essential workers and swipe card data not routinely collected. **(C)** Incidence of daily reported SARS-CoV-2 infections in the London borough of Camden (grey, left axis) matched to daily positive SARS-CoV-2 infections in employees of the Francis Crick Institute (blue, right axis) April 2020-March 2022.
(D) Distribution and median Ct value for all tests reported across FCI staff 2020-2022, stratified by VOC. Univariate comparisons between Delta, BA.1 and BA.2 with Alpha using Mann-Whitney test.

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