University of Nottingham
UK | CHINA | MALAYSIA

COVID-19 testing policies in Universities

Kirsty Bolton, RAMP Continuity Network Asymptomatic Testing Meeting, 7th June 2022

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What makes universities different?

Demographics In 2020/21, across UK HE:

- 2.75 million students in the UK (2m undergraduate)
  - 592 190 > 30 y.o
  - 3090 over 70
- Academic staff: total staff 224 510
- Non-academic staff: 191 425

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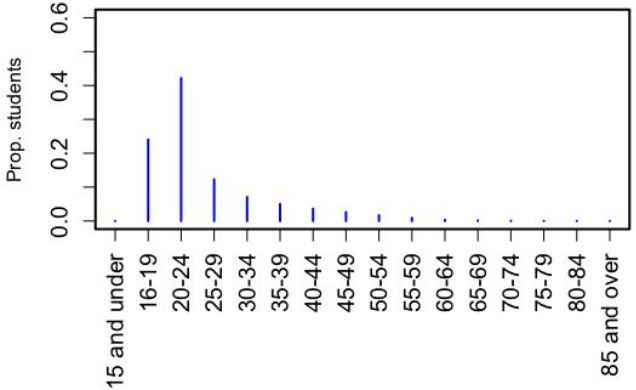
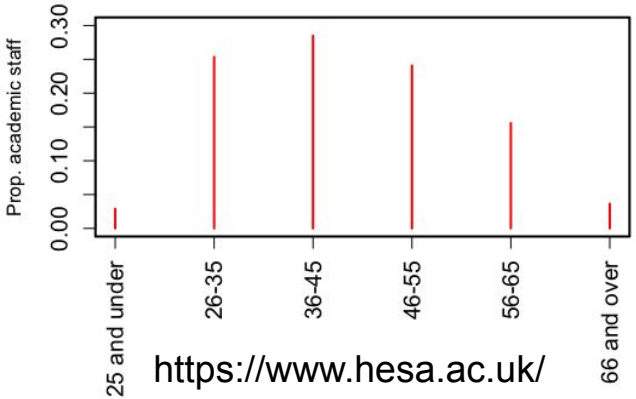


Living arrangements

- Halls of residence
- Congregate living

Large connected workplaces

- Spread across ~ 210 providers
- Variably connected to surrounding community



https://www.hesa.ac.uk/

What makes universities different?

Migration

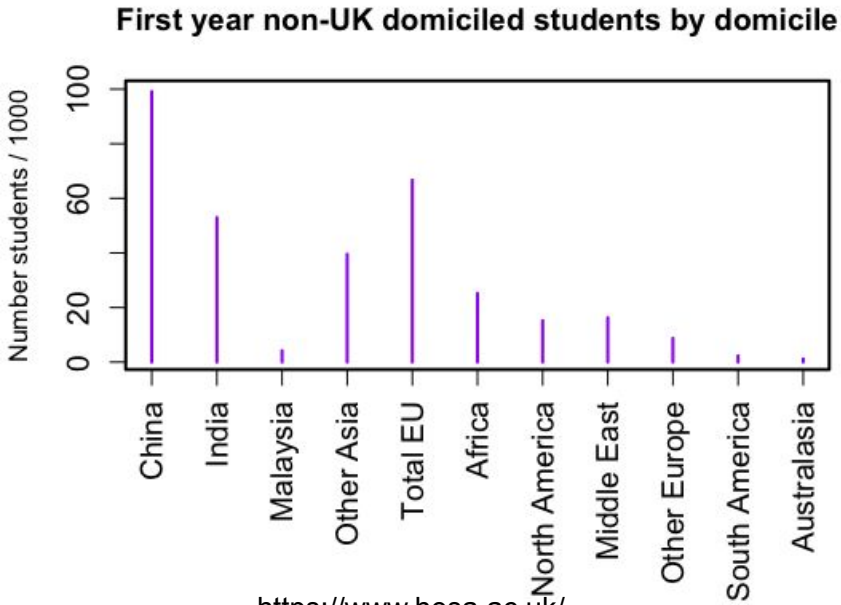
- Beginning of academic year
- Term times

Large events

- Exams
- Graduations

Behaviour

- Contact tracing difficult [1]
- Risk tolerance
- Vaccine hesitancy [2]



https://www.hesa.ac.uk/

Epidemiology

- Higher rates of asymptomatic / paucisymptomatic SARS-CoV-2 cases [3]
- Known for ‘freshers flu’ [4]

[1] Karosas & Lee, 2022, doi.org/10.1080/07448481.2022.2082845 [2] Knight *et al.* 2022, doi.org/10.1177/17579139221094750 [3] Oran & Topol, 2021, doi.org/10.7326/M20-6976 [4] Eames *et al*. 2021, doi.org/10.1101/2021.03.31.21251220

Many possible asymptomatic testing strategies

General

Regular voluntary testing

Test on arrival

Test to return

Test to access

Targetted

Surge testing

Contact testing

Sentinel surveillance

Population surveillance

And SARS-CoV-2 assays…

Assay	Collection	Viral gene target	Approx. limit of detection	University
RT-qPCR	Nasopharyngeal and/or oropharyngeal swab, saliva	N, E, S, ORF1a/b,...	~ 0.1 copies/mL [1]	Nottingham, Cambridge, Cardiff, Edinburgh,...
RT-LAMP	Nasopharyngeal and/or oropharyngeal swab, saliva	N, ORF8, …	~ 0.1 copies/mL [2]	Southampton, Leicester, …
LFD/RAT	Nasopharyngeal and/or oropharyngeal swab	N	~ 100s copies/mL [3]	All UK universities

[1] Tastanova *et al,* 2021, https://doi.org/10.1016/j.jmoldx.2021.04.009, [2] Mautner *et al.,* 2020, doi.org/10.1186/s12985-020-01435-6,
[3] Fung *et al.*, 2020, https://doi.org/10.1128/JCM.01535-20

Pooling strategies for expensive PCR tests…

Epidemiological considerations may maximise sensitivity / utility:

- No loss of sensitivity when pooling by household with pool size of 10 [1]
- Pooling by living circle may be more efficient due to clustering of follow up tests within pools [2]
- Random pooling may be logistically easier (e.g. 2-way matrix pooling [3])

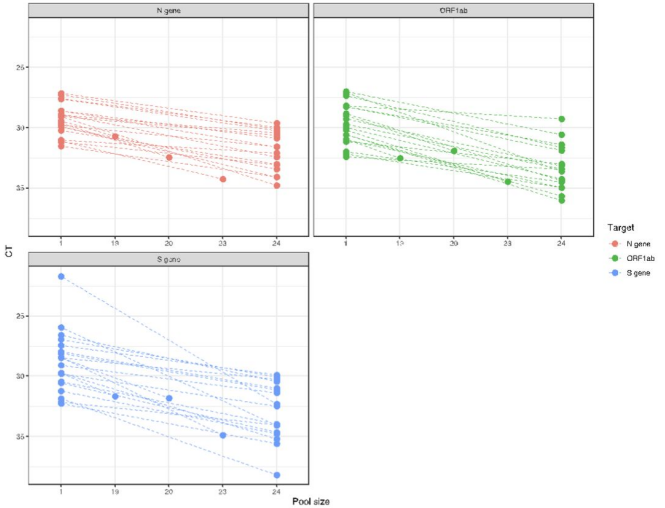


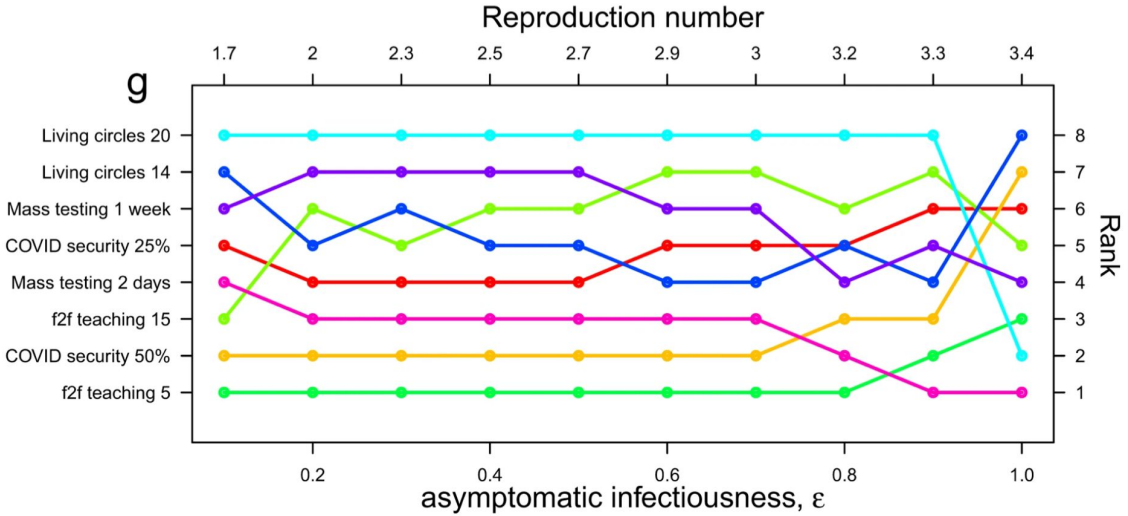
Figure 3. CT values comparisons between pooled and individual samples. Twenty randomly selected positive samples were analyzed for comparison of CT values when detected in a pool of 24 samples and when analyzed as a single sample. The dashed lines connect the dots that indicate the CT values of individual samples (higher) to the corresponding pools (lower).

Bi et al. 2021 [4]

[1] Warne *et al.* 2021, doi.org/10.21203/rs.3.rs-520626/v1, [2] Hemani *et al.,* 2021, doi.org/10.12688/wellcomeopenres.16639.1, [3] Ball & McNally 2020, doi: 10.1136/bmj.m4312, [4] Bi *et al.*, 2021, doi.org/10.1101/2021.02.09.21251464

Many uncertainties in modelled asymptomatic testing strategies

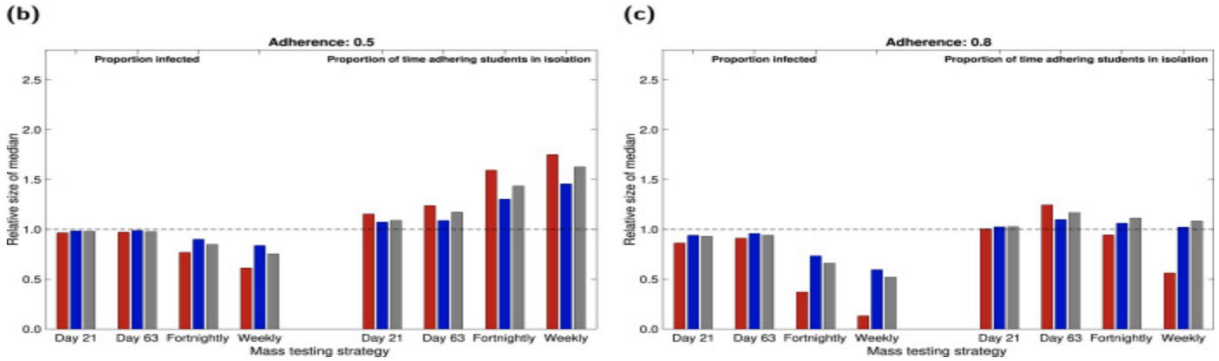
Viral dynamics/infectiousness of asymptomatic cases



Brooks-Pollock, E., *et al.Nat Commun* 12, 5017 (2021). https://doi.org/10.1038/s41467-021-25169-3

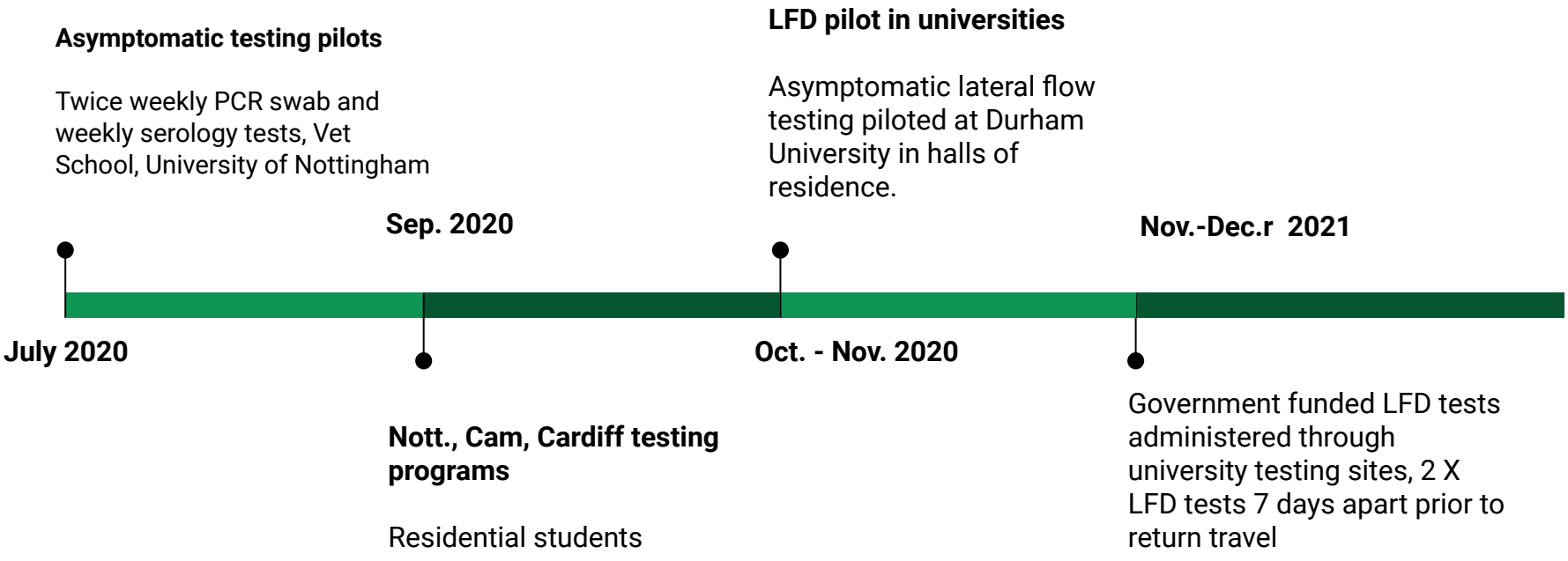
Many uncertainties in modelled asymptomatic testing strategies

Uptake of mass testing



Hill *et al., Epidemics,* 2021, https://doi.org/10.1016/j.epidem.2021.100476

Timeline of asymptomatic SARS-CoV-2 testing in UK universities



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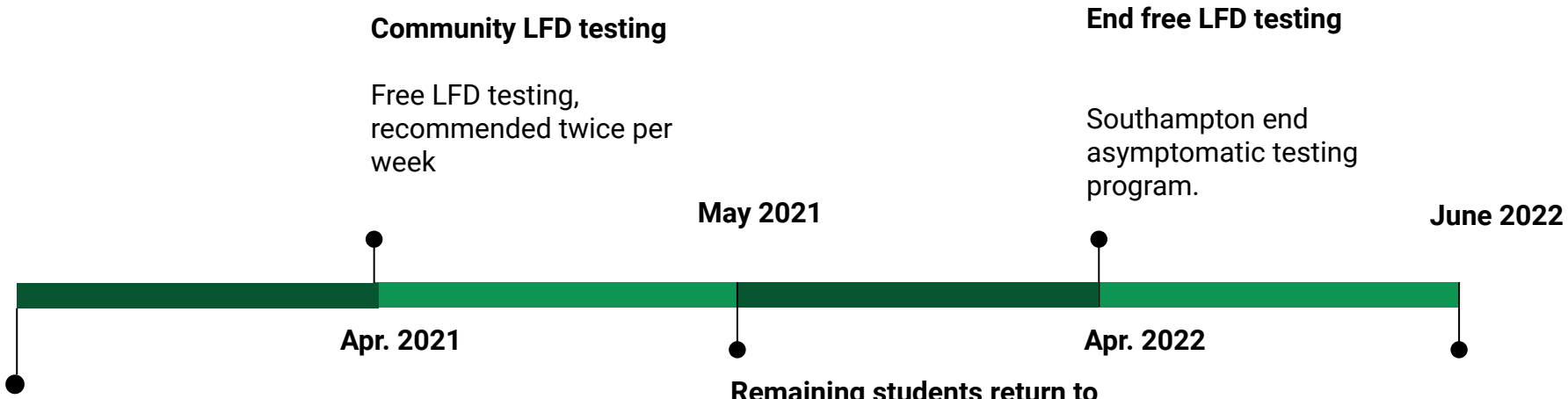


Period	Testing protocol	Participants	Uptake	Context	Ref
July-September 2020	Weekly PCR swab	Rural campus (Vet School) First year residential students	89.2% > 1 sample 70.8% all 10 samples *	Bubbles Low-prevalence	[1]
Autumn term 2020	PCR saliva	Halls of residence Large provincial university	Decreasing 58% to 5%	Local outbreaks	[2]
	Weekly PCR swab	Residential students, College based university	> 75 %	Some outbreaks	[3]

[1] Blake *et al.* 2020a, doi.org/10.3390/ijerph18010188, [2] Blake *et al.* 2020b, https://doi.org/10.3390/ijerph18084182, [3] Warne *et al.* 2021, doi.org/10.21203/rs.3.rs-520626/v1

Period	Testing protocol	Participants	Uptake	Context	Ref
Winter break testing (November-December 2021)	2 LFD	All students, Bristol University	10% had 2 required tests	Rising community prevalence	[1]
Testing participation pilot (May 2021)	Twice weekly PCR saliva Daily contact testing	Halls of residence, Large provincial university	88% > 1 test 46% all samples	Household rules relaxed in exchange for requirements to test	[2]

[1] French *et al.* 2022, doi.org/10.1016/j.puhe.2022.01.002, [2] Blake *et al.* 2021, doi.org/10.21203/rs.3.rs-1093335/v1

Uptake associated with mood, peer pressure, and more...

- Isolation requirements for peers/household members are perceived to have deterred uptake of asymptomatic testing (Blake *et al.* 2021b).

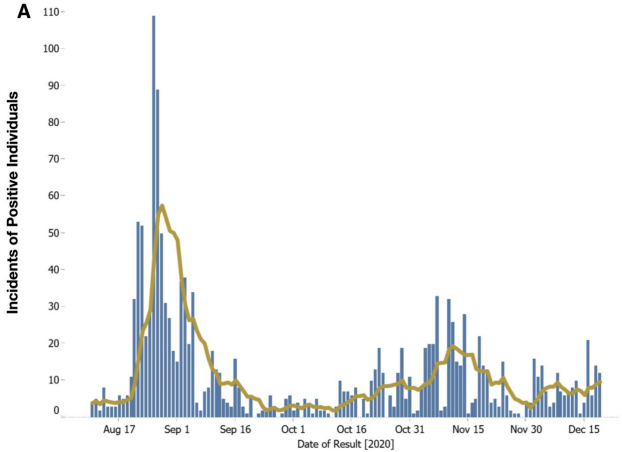
- Pressure from housemates not to get tested (Jones *et al.* 2021, doi:10.1136/bmjopen-2021-055644)

- Uptake correlated with lower anxiety, satisfaction with communication, worry about friends or family contracting COVID-19 (Blake et al. 2020a).

- Some significant differences in uptake by year of study, course, and ethnicity in Winter Break testing (French *et al.* 2021) and in residential setting (Warne *et al.* 2021).

Evaluation of testing strategies: outbreak control

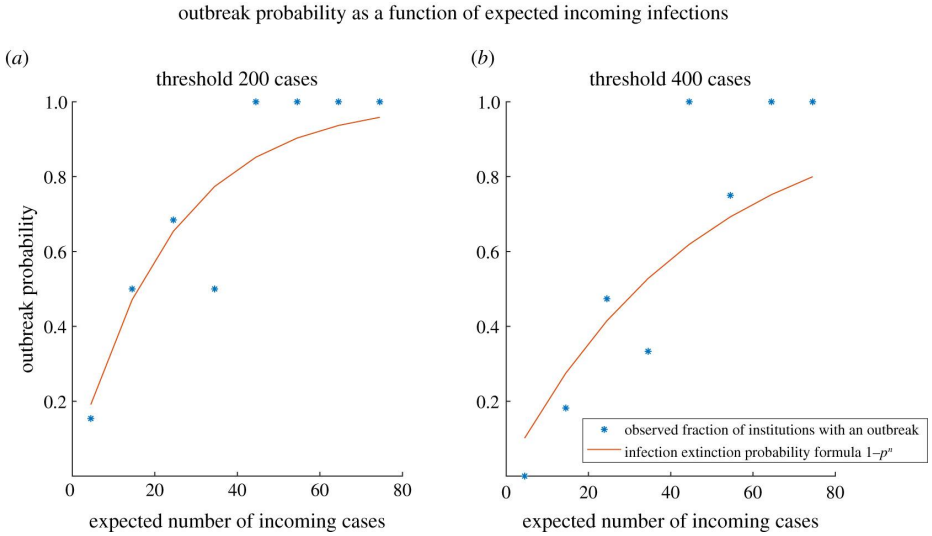
Increased testing associated with decline in cases



Greg et al., 2021, https:///doi.org/10.1097/EDE.0000000000001448

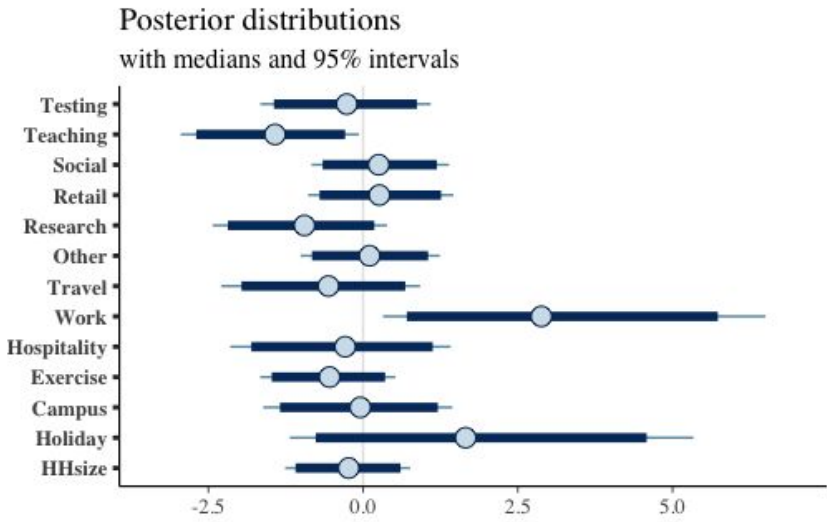
But outbreak control possible without mass testing. E.g. O'Donnell et al. 2021 https://doi.org/10.1101/2021.01.21.21249825, verified by asymptomatic surveillance

Outbreak probability well explained by expected importations (not availability of testing)



Enright et al., 2021; https://doi.org/10.1098/rsos.210310

How ‘COVID-secure’ were universities?

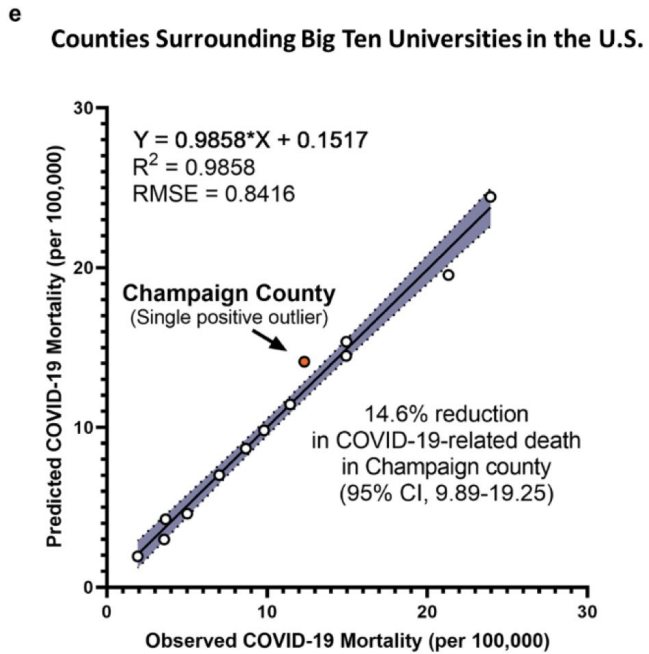


Settings and behaviours associated with a positive asymptomatic test result (October 2020 - March 2021)

Fairbanks, et al., submitted

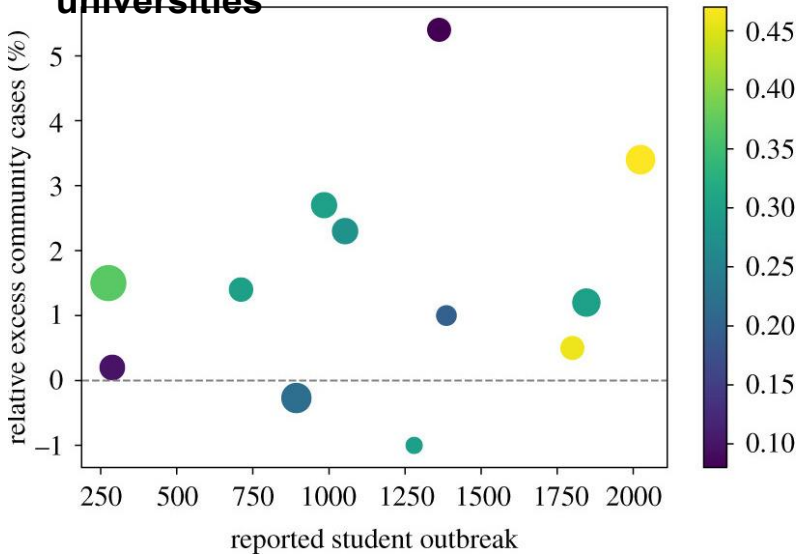
Evaluation of testing strategies: cumulative infections

Extensive testing reduces expected mortality in surrounding community



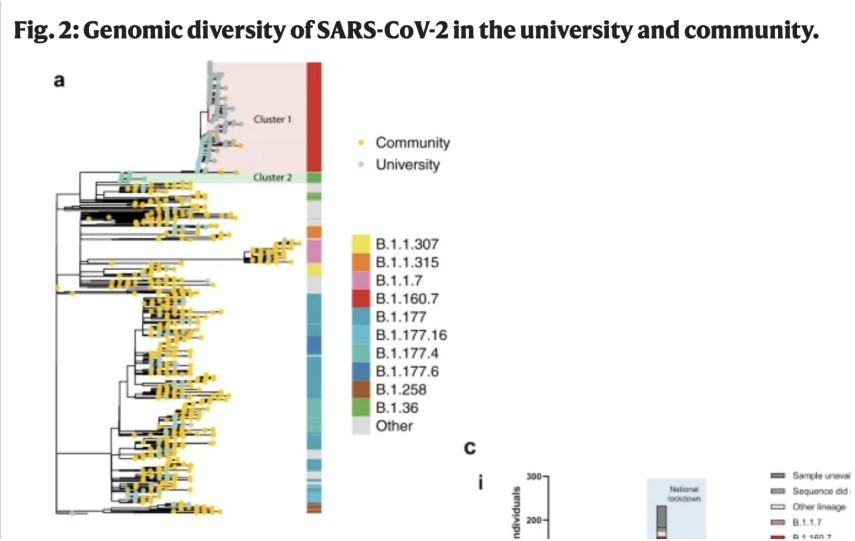
Ranoa et al. medarxiv,
https://doi.org/10.1101/2021.08.03.21261548

But no obvious pattern between size of student outbreak and community spillover in UK universities



Enright et al., 2021; https://doi.org/10.1098/rsos.210310

Evaluation of testing strategies: genomic epidemiology



University of Michigan, Autumn 2020

Rise in community cases in November following outbreak on campus at beginner of academic year not likely seeded by university cases.

Aggarwal et al., 20201,
https://doi.org/10.1038/s41467-021-27942-w

Valesano et al., 2021,
https://doi.org/10.1101/2021.07.19.21260726

Uncertainties in benefit of increased asymptomatic testing uptake

Epidemiological

Prevalence
Community seeding
Prior immunity
Vaccination [1]

Testing

Sensitivity profile
Turnaround time
Testing pattern / frequency

Virus/variant

Latent and generation intervals [2]
Heterogeneities in viral load [3]

Behaviour

Reporting proportion [4]
Engagement with contact tracing
Efficacy of isolation
What triggers voluntary decision to test?

[1] Nixon *et al.*, 2021, doi.org/10.1101/2021.11.22.21266565[2] Park *et al.* 2021, doi.org/10.1101/2021.05.03.21256545, [3] Bjorkman *et al.*, 2021, https://doi.org/10.1093/infdis/jiab386 [4] Children's Task and Finish Group, Feb 2021, https://www.gov.uk/government/publications/tfc-covid-19-in-higher-education-settings-10-february-2021

Summary

Behaviour possibly largest uncertainty in impact of testing as intervention (test capacity may not be the biggest limitation).

Communication, nature of access to tests and transparency of result important.

Efficacy of voluntary testing in absence of other interventions uncertain.

‘Optimal’ strategies for testing method, frequency, pooling may be frequently changing?

Universities useful test bed for epidemiological and behavioural research.