UK Health Security Agency

Joint Biosecurity Centre analytical policy report

Improving testing and self-isolation adherence in low-income groups: preliminary evaluation of the impact of the Test and Trace Support Payment (TTSP) scheme

16 June 2023

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Executive summary

Key points

In this report we present estimates for the impact of the NHS Test and Trace Support Payment (TTSP) scheme on testing uptake. We find testing uptake increased by 18% (95% confidence interval: 13% to 22%) amongst those who received a payment.

We present illustrative estimates of the potential impact of the scheme on hospitalisations and deaths throughout June-September 2021 for a reasonable range of epidemiological scenarios, using some straightforward calculations and a plausible assumption for the impact on the R number. We also present estimates for scenarios with alternative eligibility requirements for the support payments.

This analysis estimates only one direct impact of the payments. The true effect of the policy is highly uncertain, but the overall impacts of the policy may be expected to be larger than presented here when accounting for other effects of the policy that are not directly estimated.

Aim and scope

The analysis set out in this report estimates of the impact of the TTSP scheme on testing uptake using individual-level data. The estimate is made controlling for the effects of confounding using propensity score weighting, covariate adjustment, meta learners and double or debiased machine learning. Heterogeneity in treatment effects is estimated.

The true effect of the policy is highly uncertain. There was a relatively limited amount of available data at individual level meaning that there cannot be high confidence that all potential confounding factors were accounted for, which may introduce bias into the results. Further analysis should consider the potential for linking a broader set of individual-level data to ensure higher confidence in inference.

Data sources and contributors

The main data for this study are internal NHS Test and Trace (NHSTT) / Joint Biosecurity Centre (JBC) data, which are detailed below and in the methodology section. This paper also draws on survey data – the University College London (UCL) COVID-19 Social Study, and Office for National Security (ONS) reference data (population, income, indices of multiple deprivation). Summary evidence from UCL COVID-19 social survey highlighting the importance of income in self-isolation is presented in the Appendix.

This paper builds on previous analysis led by William Green and Robert Smith, who also contributed to the modelling and methodology for this project.

Lewis Ahlquist, Jamie Fraser, Pantelis Hadjipantelis and Tim Laurence contributed to the analysis.

Fergus Cumming reviewed and signed off the analysis.

Background

Evidence suggests that testing uptake is lower amongst individuals with lower incomes. This paper builds on this earlier analysis by presenting empirical estimates of the impact of the TTSP scheme on testing uptake amongst those who received the payments. Using some simple assumptions and calculations, we explore the potential impact of wider roll-out of the policy.

From September 2020 all eligible individuals in England told to self-isolate could receive a one-off payment of £500 via the TTSP scheme**.** Eligible individuals were employed or self-employed, unable to work from home, would lose income as a result of isolating and in receipt of certain means-tested benefits. The scheme was administered by local authorities, to whom individuals applied directly. The majority of funding was for the main scheme, with the eligibility requirements above. There was also a discretionary scheme, which gave local authorities discretion to set different eligibility requirements.

Methodology and results

Impact of the TTSP scheme payments on testing uptake

The impact of the TTSP scheme payments on testing uptake has been identified as outlined below. The starting point for this analysis was contacts of cases. Individuals entered the Contact Tracing Advisory Service (CTAS) databases as contacts of cases and were then required to self-isolate, some of whom successfully applied for a TTSP. These individuals were identified through an eligibility checker tool which local authorities used in order to confirm individuals' had a corresponding CTAS identification number. The treatment group consisted of contacts who successfully applied to and were awarded TTSP, and the control group consisted of contacts who were either rejected or did not apply to TTSP.

The resulting data set of unique individuals, when they enter CTAS, and whether they receive a payment, was linked to the NPEx (National Pathology Exchange) database of SARS-CoV-2 test results. Positive cases were excluded. It was assumed that the rate of testing uptake amongst those who previously tested positive was of less interest as they may have natural immunity. Further, a broader set of factors would need to be accounted for if likelihood of transmission were to be estimated rather than changes in an individual's test seeking behaviour. Every negative test for these individuals was identified, and aggregated, calculating the monthly rate

of tests taken after receipt of a TTSP payment (for the treatment group) and CTAS entry (for control). Data was from September 2020 to May 2021, to reflect the time the scheme was running. The average date of entry into CTAS for both treatment and control groups is mid-December 2020.

All tests that could be identified as individuals who were regularly repeat testing were removed. Predominantly these were individuals who lived or worked in nursing homes and so were likely testing asymptomatically, but this also applied to some other employees who were registered to other institutions such as schools. Therefore, a reasonable level of confidence can be had that the results are not unduly biased by, for example, the treatment group being comprised of individuals required to test by their employer. Non-working age individuals were also excluded, as they were not eligible to receive a payment.

Table 1 below sets out estimates for the impact of receiving the TTSP payments on testing uptake, which are described in more detail below. The mean values and the difference in means were identified — the naïve estimator — as a benchmark to which to compare other estimates. It was anticipated that the mean value was not the true reflection of the impact of the scheme, due to the presence of confounding factors; if there are individual characteristics which are correlated with the likelihood of receiving the TTSP award which also affect testing uptake, we may conflate the impact of these characteristics with the effect of the TTSP payments. The expectation was that low income was a factor that was particularly associated both with eligibility for the scheme and the likelihood of an individual coming forward for testing.

Table 1. Estimates of impact of TTSP payments on testing uptake

Measure	Test rate (tests per month)	% increase in test seeking
Treatment mean	0.103	
Control mean	0.091	
Difference in means	0.012	13%
IPTW (95% CI)	0.014 (0.006 to 0.021)	16% (7 to 27%)
Covariate Adjusted	0.014	16%
X-Learner	0.011	12%
Causal Forest DML (95% CI)	0.015 (0.011 to 0.018)	18% (13 to 22%)

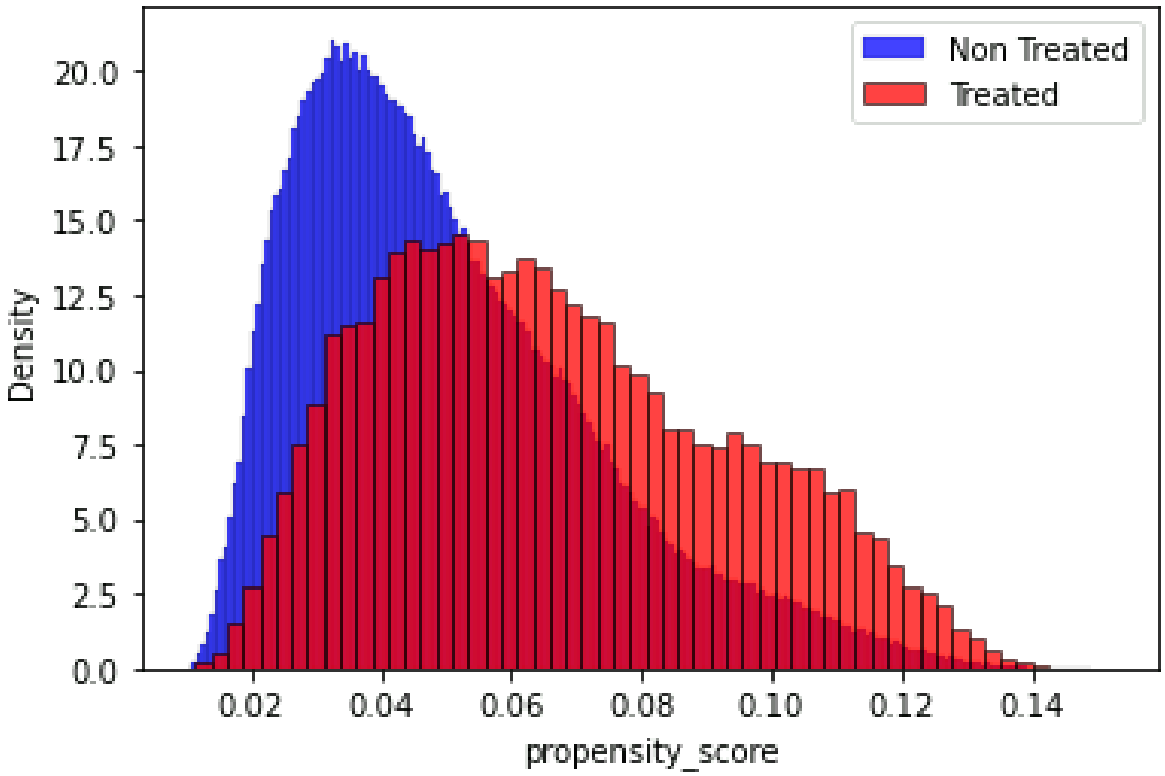
The data available at individual level which may help explain testing or compliance behaviour – hence which may be used to control for these confounding effects – is limited to age, sex, and ethnicity. So, in order to extend the data available, individuals were linked using their postcode to a wide range of data that was available at low-level geographies and which could serve as a proxy for individual characteristics. These included Indices of Multiple Deprivation (IMD), different income indices, the proportion of individuals of social class, the proportion of occupations of different types, and skill levels – all at Lower Layer Super Output Areas (LSOAs)

if available but in some cases Middle Layer Super Output Areas (MSOAs). Further work could explore linking administrative data sets to provide clearer and more robust inference.

To mitigate and assess the potential impacts of confounding, the methods outlined below were employed. We used the Inverse Probability of Treatment Weighting (IPTW) methodology to mitigate the potential treatment bias in our non-randomized study, where our treatment selection is based on pre-treatment characteristics that are also associated with the outcome. Here, we know that being selected for treatment (being a TTSP recipient) was based on pre-treatment characteristics (such as financial status) that were potentially associated with the outcome (testing uptake). To mitigate this potential bias, firstly the probability each individual in the sample applied for and received TTSP – the propensity score – was estimated. The original data was then reweighted using this score to create a pseudo-population.

Figures 1a to 1c below provide an overview of how these probabilities were associated with certain features. In this pseudo-population every individual appeared twice, both as a treated and as an untreated individual. As such, when the difference in means was estimated, the difference in the pseudo-population would reflect the difference in the original population (not just the sample).[1]

Figure 1a. Empirical distribution of propensity score for treatment and control groups



[1] Hernán MA, Robins JM. 'Causal Inference: What If.' Boca Raton: Chapman & Hall/CR (2020) chapter 2.4.

Figure 1b. Propensity score stratified by ethnicity

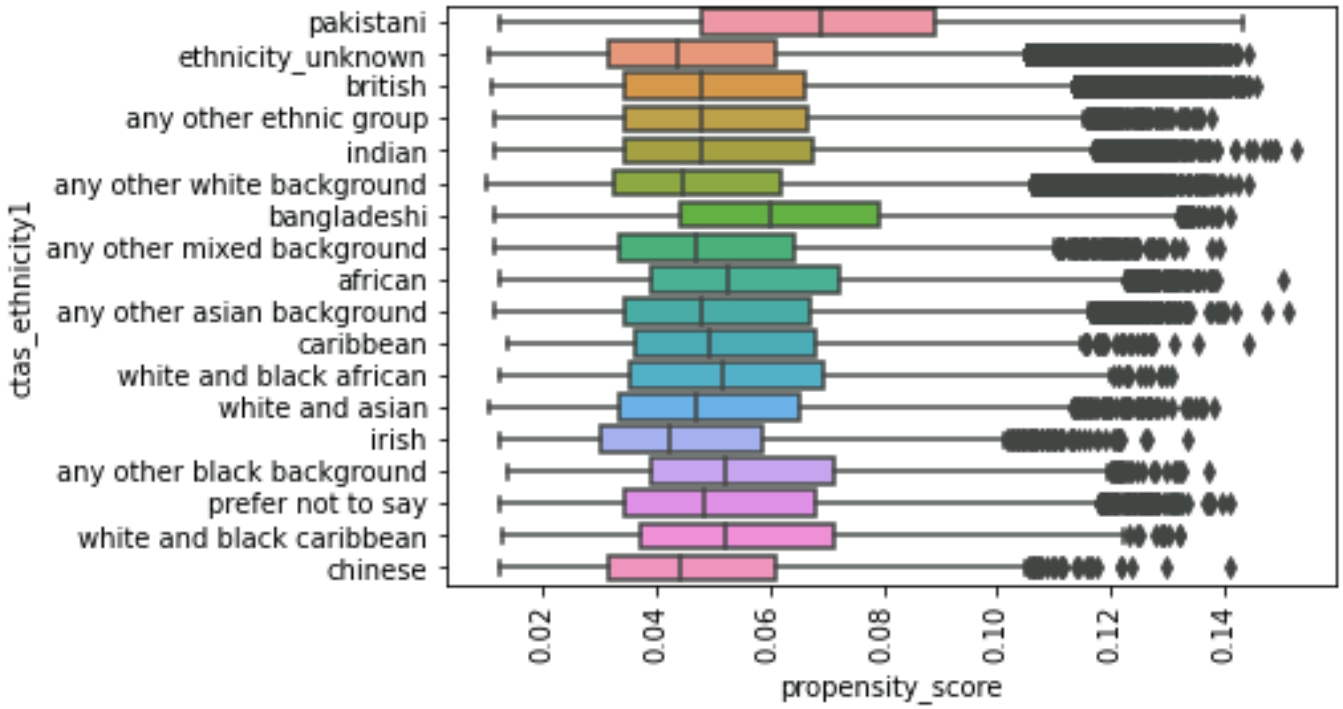
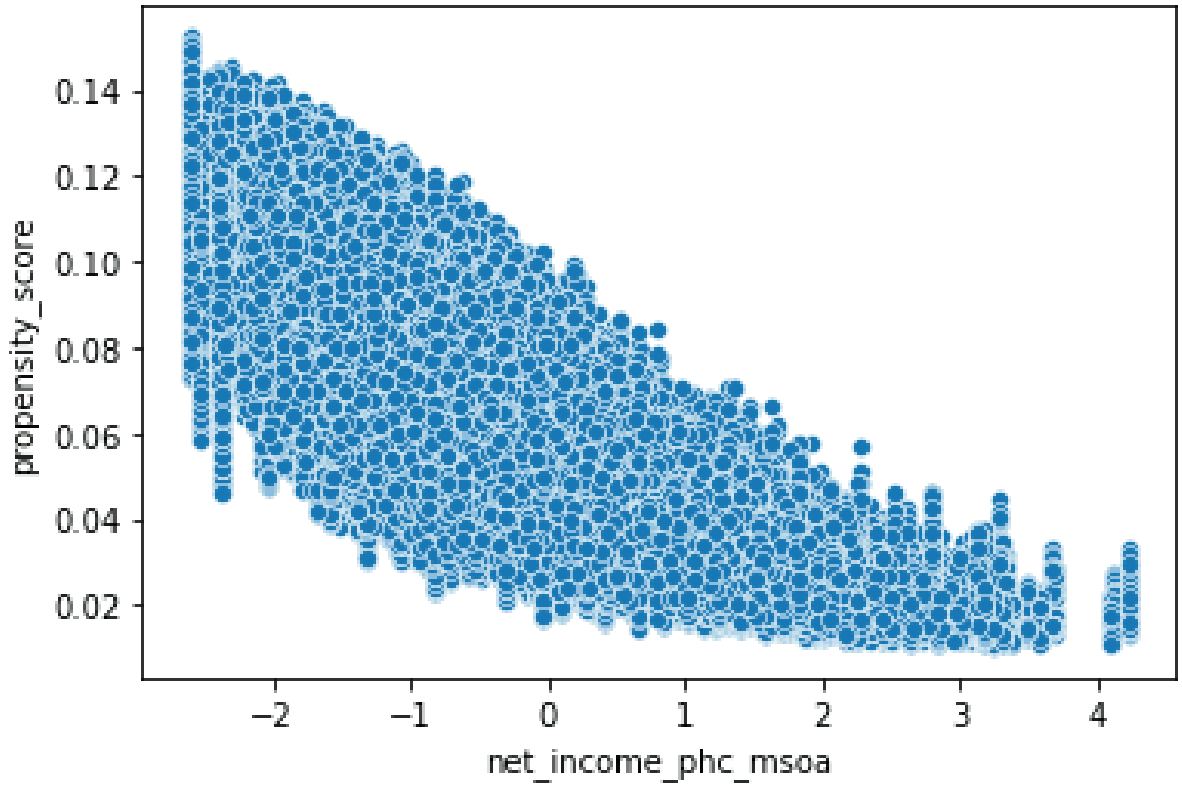


Figure 1c. Scatter plot of propensity score alongside net income before housing costs



Covariate adjusted estimates

Covariate adjusted estimates were generated by using ‘standard’ regression modelling adjusting for covariates including those that one would potentially use the estimation of propensity scores. The estimate presented is the coefficient associated with the treatment

assignment; it is effectively the mean difference after controlling for the differences in the outcome (here the probability of taking a test) due to observed covariates (such as ethnicity, income status and so forth).

Health benefits of extension scenarios

Using some simple calculations and assumptions, we estimated infections, deaths and hospital admissions between 1 July 2021 and 30 September 2021 under 3 different scenarios, shown in Table 2. The 3 scenarios are a base scenario (no TTSP intervention), scenario 1 (assuming TTSP intervention results in 0.2% reduction in Rt) and scenario 2 (extension the TTSP eligibility, assuming intervention results in a 1.1% reduction in Rt).

Table 2. Estimated infections, deaths and hospital admissions between 1 July 2021 and 30 September 2021

	Infections	Deaths	Hospital admissions
Base	12,030,700	30,200	100,300
Scenario 1	11,943,100	29,900	99,500
Scenario 2	11,633,600	28,800	96,700
Averted in scenario 1	87,600	300	800
Averted in scenario 2	397,100	1,400	3,600

HM Treasury's Green Book sets out a methodology for valuing health loss. Using that methodology each of these deaths averted is worth £1.9 million in 2021 prices, based on Department for Transport's Value of a Prevented Fatality (VPF). This means the deaths averted are valued at £2.7 billion. A more conservative approach to valuing the loss of life would be to recognise the fact many of the people who die from COVID-19 have a shorter life expectancy than that assumed by the VPF estimate. If these individuals only had a life expectancy of 5 years, the value of averting their life lost would be £0.4 billion. Neither of these estimates account for the considerable morbidity associated with COVID-19 cases, and the burden that placed on individuals, their families and healthcare providers. Moreover, these estimates do not account for the considerable impact COVID-19 had on the wider economy, due to restrictions and behaviour change with economic impacts.

Table 3. Illustrative parameters and assumptions used in calculation

Parameters	Value
Transmissibility of variant of concern (VoC) compared with B.1.1.7	1.45
Cross immunity (VoC to B.1.1.7)	80%
Vaccine effectiveness against infection	65%
Vaccine effectiveness against severe disease	88%

Parameters	Value
Vaccine effectiveness against onward transmission	45%
Seasonality (multiplicative, peak to trough – 1.1 at peak, 0.9 min)	20%
School closures (effect of school closure on R excluding immunity)	0.25pp
VoC start date	17 May 2021
VoC starting number	5,000 infections
Daily number of importations	10
Proportion that cause secondary infections	20%

Conclusions

The main finding of this analysis is that individuals who received TTSP payments sought, on average, 18% (95% CI: 13 to 22%) more tests than they otherwise would have. The estimate reflects the difference in subsequent testing uptake for individuals who received the payment compared to those who did not, controlling for confounding factors: age, ethnicity, sex; factors related to lower level geography of the surrounding area (indices of relative income, IMD, social class, the proportion of occupation types); and uptake of the scheme at local authority level. As outlined in the methods, we used a series of approaches, including propensity score weighting, and covariate adjustment, which produce consistent results. Key limitations to our analysis are set out below.

We estimated the potential impacts of further roll out of the TTSP scheme. The TTSP scheme was extended to the end of September 2021 with the same eligibility requirements. As a thought experiment, we assume that increasing in testing uptake could reasonably imply a similar increase in compliance with self-isolation. We present estimates for the impact of this higher compliance with isolation on the R number for the extension of the scheme on current terms, alongside the impact of the proposal to extend eligibility to the main scheme to those earning £26,000 or less – assuming a reduction in R of around 0.2 to 1%, respectively.

Our simple calculations show that the marginal difference in R resulting from this policy could reduce hospital admissions by 800, and deaths by 300, between 1 July and the end of September 2021. An extension of eligibility to £26,000, given these assumptions, would reduce hospital admissions by 3,600, and deaths by 1,400 over the same time period. Applying HM Treasury's methodology to valuing health would lead to an estimate of the monetary value of avoiding these deaths at between £0.1-0.6billion under current scheme eligibility, or £0.4-2.7billion with extended eligibility. This does not account for the monetary value of averted morbidity (when COVID-19 causes ill health but not death), or the wider economic benefits of reduced COVID-19.

Discussion

This analysis is focussed on only one direct effect of the scheme; there are likely to be a wider set of impacts. The starting point of our analysis is individuals who enter the contact tracing database as a contact. While this is an important group whose behaviour appears to be affected positively, we do not capture possible effects on individuals who have not entered contact tracing as a contact. It is possible that the availability of TTSP payments might also affect the willingness of individuals who are not a contact to come forward for tests. This effect could be large, and survey data supports this, but this effect is difficult to identify empirically, and further work will be needed to confirm this. Another effect that is not captured is that positive cases may be more likely to isolate if a payment is available, which may similarly be a significant effect. As such it would not be unreasonable to see the impact estimates presented here as a lower bound.

Beyond aggregate impacts, this evidence suggests that TTSP payments have been well-targeted at individuals in areas of higher deprivation, lower income, and particular ethnic groups, who are particularly affected by COVID-19 and may not be best targeted through alternative schemes, for example the furlough scheme.

Limitations

It is likely that we were not able to fully control for all confounding factors. While we have done so as best we can, given the available data, a richer individual-level data set would lead to higher confidence in the results.

Confidence

Confidence statement: data

Data used comes from NHSTT Data from EDGE, so is highly credible. Nevertheless, we downgrade our confidence since for the fields used in this analysis there are several with incomplete data, and as below we anticipate analysis could be improved with more complete data. Data confidence level: medium.

Confidence statement: analysis

We are confident in the analysis conducted. However, we downgrade our confidence to medium as we are only able to control for confounding to the extent we can given the available data. We would have high confidence in the robustness of analytical results if we were able to control for a broader set of individual characteristics that may affect compliance and test-seeking behaviour. Analysis confidence level: medium.

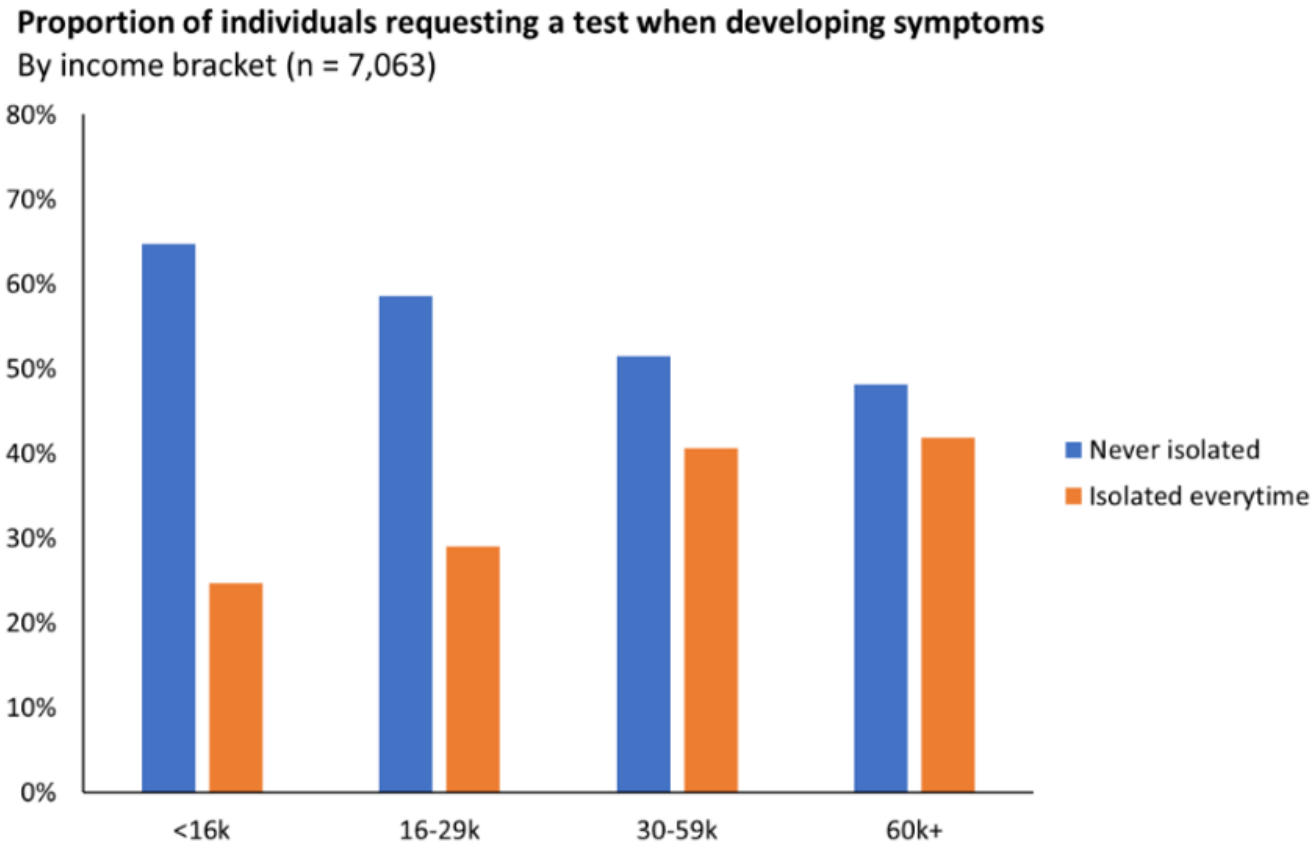
Appendix. Importance of income in self-isolation: evidence from the UCL COVID-19 Social Survey

A low proportion of people are seeking testing upon developing symptoms, with data suggesting testing uptake is lower among those with lower household incomes[2]. Some people face a clear financial disincentive to request a test since a positive result legally mandates 10 days of self-isolation, which will incur loss of income for certain types of workers (see point 8). Overall, in the UCL COVID-19 Social Survey, among respondents who had developed COVID-19 symptoms, 57% reported they had never requested an antigen test upon developing symptoms, compared to 33% who had requested an antigen test every time.[3, 4] Limited testing uptake can also be seen by comparing the ONS incidence estimates up to December 2020 with the daily pillar 1/2 case counts. This suggests at least 25% of symptomatic cases go untested, even if all individuals with symptoms immediately requested a PCR test.[5]

Breaking the data down by household income supports the hypothesis that financial considerations are a barrier to testing and self-isolation. Testing uptake increases with household income; infection prevalence increases with deprivation levels.[6] In total, 65% of those with household income less than £16,000 had never sought a test upon the development of COVID-like symptoms, compared to 48% of those with household income over £60,000. Similarly, only 25% of those with household income less than £16,000 had always requested a test upon development of COVID-like symptoms, compared to 42% of those with household income over £60,000[7] (Figure 1).

[2] For more on trade-offs in self-isolation enforcement and engagement see 'Engagement and adherence trade-offs for SARS-CoV-2 contact tracing'. The paper proposes that more restrictive self-isolation requirements are likely to decrease engagement.
[3] Respondents were asked: Since the start of first lockdown back in March, if you developed symptoms of COVID-19 (a cough, fever or loss of taste or smell) have you requested a test?
[4] The CORSAIR study found relatively similar results, with around 50% of respondents reporting an intention to request an antigen test if they were to develop COVID-19 symptoms.
[5] Based on comparison of incidence estimates in the ONS infection survey (discontinued on 4 December 2021) with daily case counts from the Government dashboard. REACT round 9 data show that roughly 60% of COVID cases display symptoms.
[6] REACT round 9 shows that prevalence was 0.85% for the most deprived areas and only 0.36% for the least deprived areas.
[7] Note: The report only provides the breakdown for those on less than £30,000 versus those on more than £30,000k. The more granular breakdown by income was received by personal communication with the study leads.

Figure 1. Test seeking behaviour by income bracket

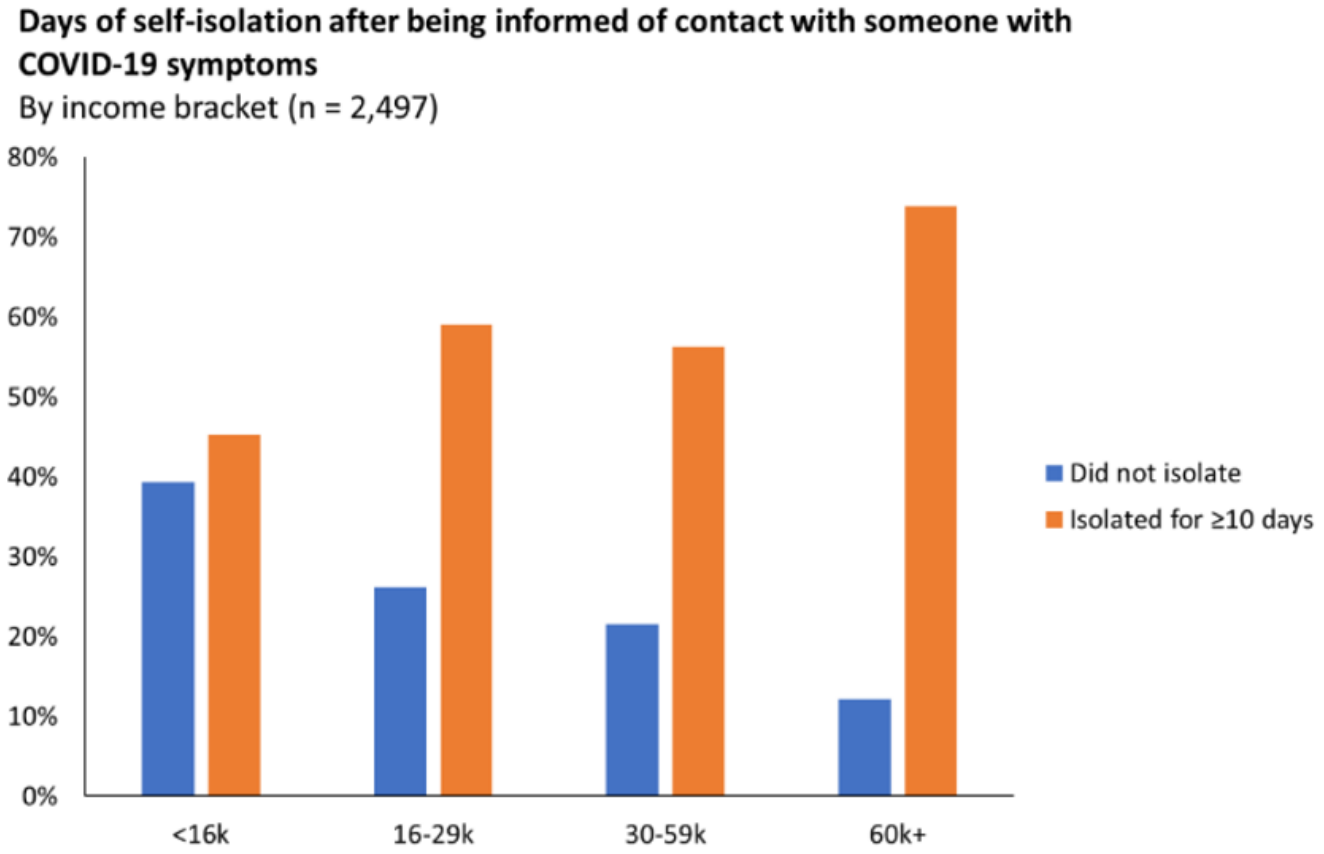


Contact-driven isolation also demonstrates a disparity based on income, with those on low income less likely to isolate for the required 10 days than those on higher income. Data shared by the UCL study suggests that 59% of those who were told they had come into contact with somebody else who had developed COVID-19 symptoms isolated for 10 or more days.[8, 9] Responses were highly income dependent, with 39% of those on incomes of below £16,000 not isolating at all, in comparison to 12% of those on £60,000 or more; and 45% of those on less than £16,000 isolating for at least 10 days, in comparison to 74% of those on more than £60,000 (Figure 2).

Factors other than headline salary may be driving this lower level of compliance in lower income groups. For instance, people on lower incomes may be more likely to undertake work on insecure terms (for example, they are self-employed or on zero hours contracts). Unfortunately, the UCL study was underpowered to disaggregate this effect by self-employed compared to employed individuals, so it was not possible to analyse this. The UCL study also shows that younger people are less likely to comply than older people, suggesting that non-compliance in low income groups may be driven by their age. Although this seems unlikely it was not possible to validate whether age is the causal factor with the data available.

[8] Respondents were asked: Since the start of first lockdown back in March, if you were told you had come into contact with somebody else who developed symptoms of COVID-19, how many days did you stay at home for?
[9] While this question does not directly ask about if the contact was by NHSTT, the phrasing is suggestive of contact by the tracing program. In any case, assuming that the question was interpreted equivalently between groups, the disparity still appears stark.

Figure 2. Isolation behaviour upon potential contact with COVID-19



This observation is also supported by the Scientific Advisory Group for Emergencies (SAGE). A recent SAGE paper suggests that "reimbursing people for all financial losses arising from self-isolation would remove a disincentive to self-isolation among people who are not in receipt of sick pay. Intentions to self-isolate in a general population sample in Israel increased from 57% to 94% when lost wages were to be compensated".[10]

[10] 'Reducing within- and between-household transmission in light of new variant SARS-CoV-2'

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UKHSA is an executive agency, sponsored by the Department of Health and Social Care.

Published: March 2024
Publishing reference: GOV-14905

UKHSA supports the Sustainable Development Goals