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Public understanding of COVID-19 antibody testing and test results: A qualitative study conducted in the U.K. early in the pandemic

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ARTICLE INFO

Keywords:

Public health
Pandemics
COVID-19
UK
Qualitative research methods
Antibody testing
Public views

ABSTRACT

Background: During the COVID-19 pandemic, antibody testing was proposed by several countries as a surveillance tool to monitor the spread of the virus and potentially to ease restrictions. In the UK, antibody testing originally formed the third pillar of the UK Government's COVID-19 testing programme and was thought to offer hope that those with a positive antibody test result could return to normal life. However, at that time scientists and the public had little understanding of the longevity of COVID-19 antibodies, and whether they provided immunity to reinfection or transmission of the virus.

Objective: This paper explores the UK public's understanding of COVID-19 testing, perceived test accuracy, the meaning of a positive test result, willingness to adhere to restrictive measures in response to an antibody test result and how they expect other people to respond.

Methods: On-line synchronous focus groups were conducted in April/May 2020 during the first wave of the pandemic and the most stringent period of the COVID-19 restrictive measures. Data were analysed thematically.

Results: There was confusion in responses as to whether those with a positive or negative test should return to work and which restrictive measures would apply to them or their household members. Participants raised concerns about the wider public response to positive antibody test results and the adverse behavioural effects. There were worries that antibody tests could create a divided society particularly if those with a positive test result were given greater freedoms or chose to disregard the restrictive measures.

Conclusion: Should these tests be offered more widely, information should be developed in consultation with the public to ensure clarity and address uncertainty about test results and subsequent behaviours.

1. Introduction

At the end of December 2019, the World Health Organization (WHO) was alerted to a cluster of unusual pneumonia cases in Wuhan, Hubei Province in China. In early January 2020 this was identified as a novel SARS-CoV-2, subsequently known as COVID-19. Within a short space of time the virus had spread across the world and the WHO declared COVID-19 to be a pandemic (WHO 2020).

In the first phase of the COVID-19 pandemic, antibody testing was proposed by several countries as a means of gathering data on the spread

of the virus and/or, to inform strategies to ease restrictive measures, and test and trace programmes (Baraniuk 2020) particularly to identify the source of clusters of infections (Normile 2020). In the UK, the Prime Minister said antibody testing was a potential 'game-changer' (BBC 2020). The presence of antibodies indicates an individual's immune system has responded to the virus. Antibody tests differ from antigen tests that determine whether someone is currently infected. In the case of this virus, at the time this study was conducted in April/May 2020, scientists and the public had little understanding of the longevity of antibodies, and whether they provided immunity to reinfection or

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<https://doi.org/10.1016/j.socscimed.2021.113778>

Received in revised form 26 January 2021; Accepted 12 February 2021

Available online 16 February 2021

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transmission. The current (January 2021) knowledge is that antibodies are maintained for at least eight months (Dan 2021) and for at least three months in those who had mild COVID-19 symptoms (Rodda 2020). There is evidence that people can be re-infected (Parry 2020; Hall 2021) and work continues to gain a greater understanding of antibodies and immunity. Interim findings from a large cohort study of COVID-19 antibody-positive and antibody-negative UK health workers found antibodies, produced in response to a previous infection, provided 83% protection against reinfection for five months (Hall 2021). Although the findings have been welcomed, the sample consists primarily of women under the age of 60 and it is too early to determine immunity against the new variants of the virus (Ledford 2021). The cohort study will follow participants for 12 months to provide further data on how long immunity lasts and the degree to which someone with immunity can transmit the virus to others (Hall 2021).

In the UK, antibody testing originally formed the third pillar of the UK Government's COVID-19 testing programme. They stated 'Antibody tests offer the hope that people who think they have had the disease will know they are immune and get back to life as normal.' (p. 4) (DHSC 2020). The idea of antibody testing was explored by UK policymakers as a possible part of the strategy towards lifting various restrictions imposed in the first months of the pandemic (DHSC 2020). This study arises as a consequence of research conducted to support that policy exploration.

Antibody testing has been debated in the scientific community (Armstrong 2020) and media. However, little is known about the UK public's understanding of COVID-19 antibody testing and at the time of collecting the data for this study, there was no published literature on the topic. A study of the impact of antibody test terminology on perceived risk and behaviour concerning COVID-19, had found that the use of the term 'immunity' led to twice as many respondents perceiving they were at no risk of contracting COVID-19 as those who perceived a risk (Waller 2020). They also found the terms 'passport', 'certificate' or 'test' did not affect perceived risk or anticipated behaviour. Perceived risk of contracting SARS-CoV-2, developing COVID-19, and/or passing the virus to others is predictive of adherence to recommended behavioural pandemic control measures such as personal and environmental hygiene, use of face masks, social distancing, and self-isolation (Xie 2020). According to Protection Motivation Theory (PMT) (Rogers 1983), the intended response to a potential health threat is based on a threat appraisal, considering the perceived severity and susceptibility, and on a coping appraisal, considering the response efficacy and response cost of various responses, and the self-efficacy for these response options. PMT is the most frequently used theory of behaviour change in the context of infectious disease outbreaks and emergency responses (Weston 2020). From a PMT perspective, a positive antibody test could reduce the perceived susceptibility (and/or severity) and thus, undermine the motivation to adhere to pandemic control measures. Indeed, there is some evidence that people who believe they have had COVID-19 are less likely to be adherent (Smith 2020).

The aim of our study, commissioned by the UK Department of Health and Social Care, was to explore using qualitative methods, public understanding of antibody testing more broadly beyond terminology.

The study was conducted in the early months of what became the first period of lockdown in the UK. Data were collected between 29 April and May 8, 2020, when very stringent control measures to prevent social contacts were in force. The day before the first focus group, the national news had reported that the total number of COVID-19 deaths in the UK was just under 22,000, with 586 deaths (ITN News April 28, 2020). There had been an increase of 3996 people who tested positive since the previous day (GOV.UK 2020). This was the period just before one of the UK government's first change of message. The alteration was from 'Stay at home, Save lives, Protect the NHS' to 'Stay alert, control the virus, save lives'. At the time of the investigation, almost all schools were closed, and only the children of key workers were allowed to attend the few that remained open. Wherever possible the public were asked to

work from home. The measures were, with the exception of key workers: to leave home only to shop for basic necessities, for a medical need or to help a vulnerable person, for one form of exercise each day; and, to keep a distance of 2 m from those not from the same household. Shops selling non-essential goods, restaurants and bars were closed. Numbers of mourners at funerals were restricted and social gatherings were banned. Those deemed clinically extremely vulnerable received a communication from the National Health Service to ask them to shield at home. This entailed avoiding all face-to-face contact and practicing social distancing with others in their household. The UK Government was working with partners to develop an antibody test with 98% accuracy for true positive and true negative cases.

2. Methods

2.1. Setting

The study involved members of the public from England, Scotland, and Wales.

2.2. Participants

A purposive sampling strategy was used to include participants from a range of socio-economic and ethnic groups and of regions. Members were recruited from a market research company's panel database. The company emailed panel members inviting those interested to complete a screening questionnaire. From those screened eligible, 60 members of the public were selected to ensure a mix of ages, homeownership, household type, ethnic group, employment status, socio-economic status, and region. Twelve were invited to each group to ensure a minimum of eight participants. Consent to participate and to use quotations from the discussions in reports and publications was obtained by the company.

3. Data collection procedures

3.1. Design

A qualitative design was chosen due to the exploratory nature of the research. Focus groups enabled the team to consider participants' shared, or differences in, understanding as well as disagreements. In focus groups, the discussion is between participants and insights are gained from this interaction (Kitzinger, 1994). A further rationale and benefit of this method was the speed with which we were able to conduct the fieldwork. Not only was the landscape of the pandemic changing rapidly, but also the research needed to contribute to policy discussions at the time. Due to the COVID-19 restrictions on social contact, online focus groups on Zoom were used (Archibald 2019). The format of data generated from online and in-person focus groups may differ, but content generated by both is notably similar (Woodyatt 2016). The use of the panel database enabled heterogeneous groups and the online format the inclusion of participants from more remote UK regions. Participants were not known to each other or to the researchers before the session.

3.2. Conduct of focus groups

An open line of questioning was employed. The topics for each group were iterative, informed by the input of a steering committee of national policy stakeholders and from successive focus groups' findings as they progressed. A member of the research team's Patient and Public Involvement Strategy Group commented on the topic guide (Table 1). All focus groups were facilitated by a lead moderator (JL) and a second moderator. Towards the end of each session the latter were asked if there were any points they would like to clarify or explore, to pick up any issues the lead moderator may have overlooked. Extraction of themes and concepts was conducted initially by the moderators and reported to

Table 1
Topics covered in each focus group.

	Group 1	Group 2	Group 3	Group 4	Group 5
Understanding of antibody testing	○	○		○	
Reaction to positive and negative test result – individual and general population	○	○	○	○	○
Change current behaviour?	○	○	○	○	○
Should tests lead to changes in current lockdown measures?	○	○	○		○ (positive test result only)
Impact of any changes on those negative (or not tested)	○	○		○	○
Views of positive test if lockdown measures changed	○	○			
Who should be tested?	○	○	○		
Accuracy of test (order changed)			○ (98% first)	○ (100% first)	
How should government use these tests	○	○	○	○	
What information is required with test			○	○	○
Sharing test result				○	○
Test combined with risk assessment				○	○

a steering committee and wider team to inform the areas of exploration in the subsequent focus groups. Thematic saturation was deemed to have been met when new groups contributed no additional information or insights on the topics of interest.

To gain insight into the public’s then understanding of COVID-19 antibody testing, the sessions began with an open question to generate the group discussion. The moderator intervened only to introduce a new topic or if the discussion was straying into other non-relevant areas. Before the groups discussed the meaning of a positive test, participants were informed about the then scientific consensus. This was that a positive test meant a *lower risk* of reinfection and transmission of the virus. Test accuracy was explored in the groups based on the UK Medicines and Healthcare Products Regulatory Agency (MHRA) guidance on antibody testing for patients, the public and professionals (GOV.UK 2020). In the MHRA’s Target Product Profile, the minimal requirements are that antibody self-tests have 98% clinical sensitivity (minimising false negatives) and 98% clinical specificity (minimising false positives) (GOV.UK 2020). For the first group 98% then 100% accuracy were discussed and for the second group this was reversed (100% then 98%) to determine whether the statement order had any impact.

3.3. Analysis

Group discussions were digitally recorded, transcribed, anonymised, and uploaded to NVivo 12 Pro (released March 2018) which was used for data management. A thematic analysis was undertaken (Braun and Clarke 2006) as described in Table 2. This was an inductive process, eliciting themes directly from the data. Other team members read through the transcripts independently to extract themes and concepts. These were compared with the rapid extraction conducted by the focus

Table 2
Steps in data analysis.

Step 1: Familiarisation with data – reading, re-reading and listening to recordings of interviews or focus groups.
Step 2: Generate initial codes – systematically record features of the data that are interesting across the data.
Step 3: Identify themes – coded extracts are sorted into overarching themes. Subthemes are developed where appropriate.
Step 4: Review of themes – at this stage, themes are combined, refined, redefined or separated. From this map or framework is devised.
Step 5: Defining and naming themes – another stage of refinement of the themes and sub-themes and the addition of concise working definitions of each theme.

group moderators and with the thematic framework.

The exploration was not explicitly theoretically driven and we were not seeking to test a particular theory. We were instead interested to see what ideas the focus groups generated. PMT (Rogers 1983) served as a framework for the subsequent interpretation of the data because it fitted well with the themes that had emerged. PMT identifies two parallel processes, threat appraisal, and coping appraisal. These determine an individual's intention to adopt, or not adopt, a protective behaviour. Threat appraisal is affected by how serious an individual believes the threat is to them and how vulnerable they are should the threat be realised, and the benefits of implementing a behaviour. Coping appraisal is determined by how effective an individual believes a behaviour will be in averting threat. The application of this framework helped to illuminate the participant responses to the uncertainties surrounding antibody testing.

3.4. Ethical considerations

The study received ethical approval from Newcastle University Research, Policy, Intelligence and Ethics Team, (Reference 2278/2020) on April 16, 2020.

4. Results

Five online focus groups were conducted between 29 April and May 8, 2020. Details of the 59 focus group participants are given in Tables 3–4. All quotations have been anonymised to protect the identity of the participants.

The overarching themes identified from the data were: the impact of scientific uncertainties about antibody testing; the pros and cons of antibody testing; and, response to and views of a positive and negative antibody test result. The sub-themes are discussed below within each theme.

5. Uncertainties about antibody testing

5.1. Accuracy of test results

The accuracy of identifying the presence or absence of virus antibodies with a test was explored. Statement order did not have any impact and most were satisfied with 98% predictive accuracy and said it provided 'good odds'. A few pointed out that tests are rarely 100% accurate. A small number in each of the two groups were concerned that the test was not 100% accurate.

'Yeah, 98% is good, but then if you're incorrectly detected – so, they say that you have got the antibody when you haven't and you then go out into the public and think 'Oh great, I've had it' or whatever, how many people are you then going to come into contact with before you then realise? You're being less safe because you've been told you've got antibodies.' **Joyce – Group 3, 30, FT, Lives with Partner, White.**

'Two people receiving the wrong result and being unaware of it is too much, in my opinion. Because then you can just go and infect so many people unknowingly because you had the confidence that 'oh, I'm fine'.

Table 3
Participant details of the focus groups.

Group	Sex		Age range	Home ownership		Household					Ethnic group				
	M	F		Rent	Own	Alone	Parents	Friends	Lives with Partner	Single parent	Lives with Partner and Children	White	Black	Asian	Other
G1	5	6	19–60	6	5	2	2	–	4	2	1	8	2	–	1
G2	6	6	22–65	4	8	1	–	1	4	–	6	9	1	2	–
G3	6	6	21–63	3	9	–	1	1	7	1	2	9	1	2	–
G4	6	6	22–65	6	8	3	3	1	3	2	–	9	2	–	1
G5	6	6	21–65	3	9	2	1	–	4	–	5	9	–	2	1

It takes just one person.' **Susan – Group 4,-26, FT, Lives with Parents, Mixed/Multiple ethnic group.**

In response to 98% accuracy and regardless of the test result, most said they would not drastically change their current behaviour and would continue to adhere to the restrictive measures which were then in force. This view was mostly attributable to a belief that these measures would be effective and to the uncertainties about antibody testing.

5.2. Scientific uncertainties of reinfection and transmission with a positive test

At the time of data collection, it was unknown whether someone who tested positive for antibodies could be re-infected or transmit the virus to others. In three of the five groups, these issues were raised spontaneously by participants early in the discussion, demonstrating an awareness of these problems which at the time had received some media coverage. A positive test was presented to the groups, as a person being at a lower risk of re-infection and transmission.

Uncertainty was a recurring theme. The absence of definitive scientific knowledge about the virus and evidence about the meaning of a positive test in the scientific community, were raised as concerns by a number of participants. One respondent pointed out that the test could be 'giving me a false sense of security that I'm not going to infect anybody else, when actually I could still be infectious' (**Jake - Group 1**). Some questioned the benefit of testing considering the uncertainties for the individual.

'I just don't think it's the right question, it's answering something that we don't yet understand. So, before we spend an awful lot of time and energy and resources and everything else on doing antibody testing, what is it actually telling you? And until we know that, then I can see little point in doing it. The World Health Organization came out just a couple of days ago saying, just because you've had it, it doesn't actually mean that you're immune or that you can't carry it. So until we've got a definitive answer to that, I can't see a whole lot of point doing it.' **Paul – Group 1, 60, R, Lives with Partner, White.**

'To have checked if you have got the antibodies against it is really good, but I'm just wondering if that's going to be enough just to protect you. Because we're not really sure whether that would work or not.' **Troy - Group 3, 52, FT, Lives with Partner/Children, Black.**

6. Pros and cons of antibody tests for COVID-19

6.1. Perceived benefits of antibody testing to the individual and scientific community

Antibody tests were considered by some group members to be of value to the individual and/or to the population and scientific community. Not all were interested in having an antibody test; for those who were, it was primarily to know if they had contracted the virus without suffering debilitating symptoms and the relief that they had not been hospitalised. The benefits for the wider population and scientific community, tests were thought by some participants to be that they were a useful surveillance tool and they provided valuable information on

Table 4
Employment status and socio-economic group.

	Employment status						Socio-economic Group					Residence				
	Full-Time	Part-Time	Self-Employed	Stay at home parent	Unemployed	Retired	Student	A	B	C1	C2	D	E	Urban	Suburban	Rural
G1	4	3	2	–	–	2	–	3	2	3	2	1	–	6	4	1
G2	6	–	2	1	1	2	–	2	5	2	2	1	–	4	6	2
G3	5	2	1	1	1	2	–	3	2	3	3	–	1	2	8	2
G4	3	2	2	–	1	2	2	1	4	4	1	–	2	5	5	1
G5	7	1	1	–	–	2	1	4	5	–	3	–	–	4	6	2

Note. Key to socio-economic groups: A-High managerial, administrative or professional; B-Intermediate managerial, administrative or professional; C1-Supervisory, clerical and junior managerial, administrative or professional; C2-Skilled manual workers; D-Semi and unskilled manual workers; E-State pensioners, casual or lowest grade workers, unemployed with state benefits only. Source: NRS 2008.

numbers infected per region or by communities, and on the longevity of antibodies. Increased understanding of COVID-19 was considered helpful in the development of a vaccine and to enable planning for lifting the restrictive measures.

‘Just from a personal point, I would like the antibody test, I’d like my family to have the antibody test. But I think it will also give more background information to scientists and the medical profession, there might be some data comes out of it that would be helpful. So I’m in favour of it.’ **June - Group 3, 66, R, Lives with Partner, White.**

‘But if there’s another wave of this, at least we have a history to go by, we can say ‘OK, this is what happens’ in the future, and we won’t have to be faffing around, trying to work out what to do. We will know what to do and it’s just about planning for the future really.’ **Cheryl – Group 4, 40, SE, Lives with Parents, Black.**

Although the majority said antibody testing would be beneficial, there were a few dissenting voices. The feasibility of testing on a large scale and frequency of testing were questioned. It was considered by some to be a waste of resources that could be of greater use elsewhere, for example in the development of a vaccine.

6.2. Potential societal divisions due to antibody testing

Apart from the uncertainties for those with a positive test, another disadvantage of antibody testing was considered by some to be the potential to create divisions in society at large. This was between both the tested and untested, and between those with a positive and negative test result. Most of the group discussion was related to the potential to impose distancing on individuals based on a negative test result. The tests, it was thought, could be divisive, particularly if those tested, or tested positive, had greater freedoms.

‘If you have half of society who’ve had the antibody test and half who haven’t, is the other half of society treated differently? Can they go into shops? Can they not go into shops? And that’s a really big fundamental shift in how, I think, our societies work, ...and now we’re turning around and potentially saying ‘well, society can do some things if you’ve had some tests or not’.’ **Jake – Group 1, 43, SE, Partner and children, White.**

If those who tested negative were expected to continue to follow restrictive measures they would most likely consider this to be unfair, and it was suggested there may be a ‘bit of a clash’ (**Nigel Group 4**). One participant said they would feel ‘cross’ if others who had had the virus were given greater freedom, when they themselves had taken measures to avoid being infected (**Jake Group 1**). Another raised concerns about the psychological impact on those testing negative. A few said the situation would have to be carefully managed to ensure that those whose freedom continued to be restricted were not treated unfairly.

‘I think it would affect people’s mental health ... Because if they’re stuck in for months and months and they think that other people are out, it could cause a problem.’ **Eileen - Group 2, 65, R, Lives with Partner, White.**

‘It could create quite a divided society. (if) There are a group of

people that get it first and everyone else has to stay in until they get that test. Whereas currently, a lot of us – unless you’re vulnerable – can still go to the shops, you can take measures, but there will still be a risk if you’ve had the test. I just think they’d have to do it carefully, because say you’re on social media watching a group of people out socialising and because you haven’t had this test, you’re still not able to do that.’ **Maddie – Group 3, 21, FT, Lives with Parents, White.**

The potential implications for work and employment were raised in discussion and whether those with a negative test may be at a disadvantage if they were not allowed in the workplace. One said there could be a situation ‘with people being almost forced back to work’ (**Thomas Group 5**) if they have a positive test. Another raised the point that if a company had to make redundancies, those with a negative test – assuming there are issues with them returning to the workplace – could be at a greater risk.

‘I think people might worry about their jobs if they tested negative, whether they would be at a disadvantage to colleagues who had tested positive, therefore are going to be needing to take time off work sick or self-isolate, etc, etc. I think it could affect people’s jobs adversely.’ **Anita - Group 2, 49, SE, Lives with Partner, White.**

7. Views of a positive and negative antibody test result

7.1. Individual response to a positive antibody test result

Most group members perceived that a positive test result would provide a measure of reassurance and peace of mind. There were comments about the comfort of having had a ‘mild form’ of the virus and getting ‘away with it quite lightly’ (**Jeff Group 5**). Those who were working outside the home said knowing they had had, or not had, the virus would alleviate the anxiety about infecting others in their households. In terms of risk perception, some participants talked about the reduced risk to others, rather than to themselves. A concern with infecting others and that a positive test would alleviate future anxiety and worry was primarily the view of female participants.

‘I would be pleased too that I’d had it, so then I don’t have to worry now about infecting others or whatever, so I think it would bring a lot of relief to my – the stressful life at the moment. Because I don’t know whether I’ve had it in the past.’ **Rasia - Group 2, 56, U, Lives with Partner/children, Asian.**

‘I don’t think I’d feel as guilty – because I go shopping once a week, but I do feel quite guilty for going shopping in case I am carrying it and I’m spreading it. So I think if I knew that I wasn’t able to spread it, I wouldn’t carry that guilt with me.’ **Fiona - Group 4, 37, Lives with Children, White.**

Although the majority said they would welcome a positive test result, this was based on the assumption that the infection had short-term consequences. It did raise concerns for a few participants that they may have infected family members and anyone else with whom they may have come into contact, and the timescales of testing.

‘Obviously, if I’ve tested for it ... I’d be happy in that aspect, knowing

that I've kind of come through it. But then I'd be concerned about when I had it and who I've come into contact with, whether it be, obviously, my son or my elderly parents, ... So who have I passed it to without knowing?' **Mike – Group 2, 34, FT, Lives with Partner/children, White.**

Participants were asked if they would change their behaviour in relation to the current measures (social distancing, restrictions on leaving home, hand hygiene) based on a positive test result. Only a minority discussed changing their behaviours and gave reasons. The first reason was to have direct contact with family members.

'But the first thing for me – and it's kind of a selfish thing – I've got a number of conditions that put me at fairly high risk from it, so selfishly, I would love to know if I've already had it. And then, if indeed I have already had it, it'll make it easier to probably interact with my kids and granddaughter.' **Paul – Group 1, 60, R, Lives with Partner, White.**

'I'm quite low risk and don't have any health conditions, so I'm not really too bothered to have a test, in a way. I think the only difference it would make for me is that I'd be able to go and see my grandma and feel a bit better about knowing that I'm not going to infect her.' **Kath – Group 1, 35, FT, Lives with Partner, White.**

The second reason was to relax measures for those shielding. One participant who had been shielding was more tentative about the idea of making any changes and questioned whether she would be able to leave her home if she had a positive test. The other said she probably would change her behaviour in light of a positive test.

'I'd be able to go out then, wouldn't I? As it is, I don't go out, my daughter does our shopping for us. We have a little walk, we've got quite a large garden we can walk around.' **Sharon - Group 4, 57, PT, Lives with Partner, White.**

'Can I just say, for me, now I'm thinking about it, it would probably make a big difference, because I'm in the shielding group and if I know I've had it and I haven't been too badly affected, etc, then I would just go to social distancing rather than full shielding. Because I haven't been out of the house for weeks.' **Anita - Group 2, 49, SE, Lives with Partner, White.**

The third reason was to return to the workplace. One participant who wanted to return to work was staying at home as she had a cough and – confusing the antibody with the antigen test – said a positive test would help to distinguish between a normal cold and the COVID virus. She argued that a test would enable people to remain in the workplace. Another who was unable to work from home claimed they had experienced financial difficulties and had had no support from elsewhere. They said they would be pleased with a positive test result and would return to work but also raised the issue of uncertainty of reinfection and transmission.

'Yeah, I'd be quite happy and, one, I'd have had it mildly and two, I'd probably go back to work, but we don't know whether we can catch it twice or not [...] I'm a taxi driver, so I'm going to have a one and a half metre-gap if you have them in the back, and you can wear masks, but what else can you do? You've still got to take people. ... my only hope is, if I was tested that I'd had it and I'd had it in a mild form, I'd be very lucky and I'd hope that would make me more immune in the future and I'd go back to work.' **Clive - Group 2, 56, SE, Lives with Partner, White.**

Despite this desire to change their current behaviour they also expressed concerns about the fact that accuracy will not be 100% and, or, the uncertainties regarding a positive test.

The majority said they would continue to follow the restrictive measures for a number of reasons. First, because of the uncertainties about testing and uncertainties about the virus. Second, some talked about the threat of the virus, a fear of contracting it or passing it to loved ones. A number had underlying health conditions or lived with others considered at high risk. Third, although acknowledging the adverse effects of restrictive measures on mental health, domestic violence and the economy, the view was to 'ride out the storm' and wait to see what happens.

'I'd probably stay to what I'm doing at the moment anyway, because I'm being quite cautious, not really going out, and just kind of getting on with everything at home. I have asthma, so I'm quite worried about getting it. If I had it already, then you can still get it, I'd still be quite concerned about that.' **Melissa - Group 5, 21, S, Lives with parents, White.**

'I have an elderly mother at home who's got quite a few underlying conditions and I'm just really terrified of leaving the house, because ... I might bring it back and give it to her. So I just wouldn't be happy socialising or being out there at all, because I'm scared for her.' **Jamilla – Group 3, 57, FT, Lives with Children, Asian.**

'I feel like the way we're going right now, we've been like six weeks in isolation and all these lockdown procedures. Why would you sabotage that now if what we're doing seems to be working, to then go and change it and then have a second peak and everything's for nothing? So I feel like it's actually dangerous.' **Gail - Group 1, 26, FT, Lives with Children, White.**

The majority of the participants had been able to work from home at least in the short term. With this in mind, most were not comfortable to return to the workplace whatever their test result. The view expressed in the first quotation below was representative of most participants.

'I'd want to be sure first that if I've had it, that I can no longer get it. And the people around me, before I take any risk, because that's my worry at the moment, that people who may have had it, can you get it again or if I haven't had it – stuff like that. So I'm quite worried about it coming back again if you've had it.' **Yvonne – Group 4, 49, FT, Lives with Children, Black.**

'No, I would not go back to work, I would stay home, it's too much of a risk to put yourself out there again. You can easily, easily get it. There's no information that says you can't get again. And I've read many stories about certain footballers who have contracted it more than once – I don't know how true it is, but for myself, hearing that is not really good. So I'll just keep myself to myself and stay home.' **Martin -Group 1–28, FT, Lives with Partner, Black.**

7.2. Individual response to a negative antibody test result

Only a few participants were vocal about how they would respond to a negative test result. There was less discussion about responding to a negative than to a positive result. One participant said a negative result would only confirm what he already believed and because of the restrictive measures there was currently little value in being tested.

'We're not going to be going to pubs in the next six months, ... So there's no urgency for me to know whether I've had it or not. And I'm 90% sure – well, probably more that I haven't had it, so just getting a test that says I haven't had it is like 'oh great, what's that then?'' **Freddie - Group 4, 22, Student, Lives with Friends, White.**

One participant commented that it would be proof that the measures they had taken were successful. Another said it would be a disappointment as he wanted to contract the virus and 'get it out of the way (rather than worry about it for the next however, 9–12 months'.

'If I tested negative, I'd be a bit gutted, obviously, because I'd hope I've had it already and not had any symptoms.' **Thomas – Group 5, 27, FT. Lives with Partner, White.**

In terms of changes to their behaviour based on a negative test result, one participant reported they would venture outside of their home more, knowing they were not a threat to others. Another participant mulled over the idea of relaxing their adherence to the restrictive measures, knowing they were negative, but raised concerns about the risk of becoming infected and passing the virus to family members.

'If I had a test at 98% saying that I had not got it, I'd feel safe going out and I would tell people I passed at 98%, then they could make their own decisions up.' **Andy – Group 3, 60, SE, Lives with Partner and Children.**

'For me, even if I was negative, like I obviously want to go out and see my friends, but at the back of my head, I'm always like if I brought

something back to my family home – because I'm back at my parents' at the moment – that would be where the risk is as well.' **Esther – Group 2, 27, FT, Lives with Friends, White.**

The remainder said they would continue to adhere to the restrictive measures. Some added they would be more careful, by going outdoors less and finding alternative means to shop for essentials themselves. In contrast to the risk perception of a positive antibody test – being less of a risk to *others* – with a negative test most considered the risk was to themselves.

'At the moment I go shopping once a week, but I also take my children for a walk every day, and I suppose if I'd got a negative antibody test back, then I would think twice about doing that.' **Fiona – Group 4–37, Lives with Children, White.**

'Even if you ... didn't have it, then you could catch it anyway, so you still have to social distancing and stay home and be safe.' **Patrick – Group 5, 58, FT, Live with partner, White.**

7.3. Perceptions of wider population response to antibody test results

How the wider population might respond to a positive antibody test result was an emotive issue for some respondents. Although participants reported high personal motivation to adhere to restrictive measures regardless of antibody test results, there were major concerns that other people would not behave similarly. That others might return to pre-COVID-19 way of life and not adhere to the measures were mentioned in this regard. This was a particular problem in light of the uncertainties about reinfection and transmission of the virus in those with a positive antibody test result.

'The thing that concerns me is, as people have the test, are they going to sort of let their guard down and think 'well, I'm OK. I don't need to be doing this now'. ... so they're less at risk, are they then going to just go out and ignore the guidelines?' **Ruth – Group 1–58, R, Lives with Partner, White.**

'Especially people my age, I know for a fact will kind of see it as somewhat of a free pass to go immediately back to normality and forget everything that they've been following on social distancing, to be perfectly honestly with you.' **Richard – Group 3, 24, U, Lives with Friends, White.**

The view that other people would return to 'old ways' based on the antibody test appeared to be driven by witnessing others, albeit a minority, not adhering to the restrictive measures. One person commented that when given advice, 'some people, they'll only hear out of that what they want to hear and that's a problem' (**Amy Group 5**) and may ignore the uncertainties about a positive antibody test. Non-adherence to the measures was a key concern for most. Concerning a population response to a positive test, one person said, 'I would feel even more nervous than I do now, because of lots of lunatics not complying' (**Paul Group 1**). The implications were said to be undoing the good achieved through the measures and 'being back where we started' and the occurrence of a second wave.

'I've seen ignorant people out in the street that simply aren't following the basic rules, so I couldn't imagine, if they had a test, what they would be doing. The negative does outweigh the positive really, because we've sacrificed nearly seven weeks in isolation and to risk getting Britain moving again based on tests, it puts what everyone's been doing at the minute at risk and I just don't think it's worth doing that. We're doing OK at the minute, why risk that and ruin that and end up back at square one again? I just don't think it's worth it.' **Lisa Group 1–30, FT, Lives Alone, Black.**

A few held the view that not everyone would stop adhering to the measures. One participant said behaviour will be moderated by fear of contracting the virus and by the uncertainty about what a positive antibody test means. Another said the response will depend on the individual's circumstances rather than a lack of regard for the measures.

'Why would they be any different to the spread of opinion here? I think people aren't really sure whether that ... you've got antibodies is

protective and means that you won't spread it. I think if people knew that, absolutely, they probably would be willing to go back to virtually normal ... But I don't think we know those things yet.' **Louise – Group 5 - -62, SE, Lives Alone, White.**

'If, economically, you've got to get out there to work to start paying the bills again, then your views are very different to someone who can work from home ... So I think it just depends on circumstances, to what risks you're prepared to take.' **Jonathan – Group 5, 47, FT, Lives with Partner/children, White.**

Concerns were raised about the risks to those with a negative antibody test. One participant commented that those who tested positive may not understand 'they're still a potential carrier and a potential risk' and get too close to others (**Nigel – Group 4**). A few mentioned the potential for people to copy the behaviour of others. A scenario was suggested in which the actions of those tested positive, such as relaxing the current measures, may result in conflict or mimicking the behaviours. This led to questions about the whole point of antibody testing.

'I don't see the benefit of it because if ... I've already had it, I'll just walk closer to somebody – you're giving off bad habits and people start either getting the hump with you or copying you. Then it just becomes a bit unruly and then everyone will think 'well ... ' and it just sort of falls down. I think it all needs to play by the same rules until we get more under control ... It's too much uncertainty there, I think. **Thomas – Group 5, 27, FT. Lives with Partner, White.**

If the measures were relaxed for those with a positive antibody test, the issue was raised as to whether those tested negative may try to become infected. Views on this were mixed: some said it was a possibility and others that they could not believe anyone would take such a risk.

7.4. Understanding of the meaning of a negative or positive antibody test

One potential perceived benefit of antibody testing mentioned by participants was the relaxation of restrictive measures. During the discussions, it transpired that there were different understandings as to whether those with a negative or a positive result would return to their workplace. Most appeared to assume that it would be those who test positive who would return to workplaces but there were alternative views.

'For the ones that are at home, self-isolating, if they've not – well, say that they're self-isolating because they've got symptoms and they were negative, then yes, they'd be probably more inclined to come to work. Because they don't feel like they've got something they could pass onto their team or the customers.' **Joyce – Group 3–30, FT, Lives with Partner, White.**

Discussion about teachers being part of an antibody testing programme highlighted perceptions of risks to teachers and their families rather than to the pupils. If teachers who tested negative returned, one participant pointed out there would be a need for repeat testing. The second quotation illustrates this participant's lack of recognition of the uncertainties about the risk of reinfection and transmission with a positive antibody test.

'If the schools do go back and you've got a class full of 30 kids, the likelihood is that it's going to transmit to (teachers) at some point. So it goes back to that point the gentleman made ... about how many times they have the test, how regularly. So I see it as a bit pointless really.' **Dave – Group 2–52, FT, Lives with Partner/children, White.**

'If a teacher knows that they've had it because they've had the antibody test, they can go into school and teach the key workers' children rather than teachers who are currently just doing like a rota of who goes in on which days. They can prioritise the people that they know have had that so they're not going to catch it and take it back home to their families. So I imagine, if you're a teacher, you're quite worried about teaching key workers' children, simply because of the risk of the infection from them.' **Anita – Group 2–49, SE, Lives with Partner, White.**

Although not frequently observed in the group discussions, there were some comments that suggested confusion about positive or negative antibody test results in terms of which is the better of the two.

Irene: 'If I had 98% test, I'd feel very secure in going out and socialising again.'

Facilitator 1: 'Is that if you tested positive or negative?'

Irene: 'If I passed, you know, if I passed in a good way.'

Irene – Group 3, 46, FT, Lives with Partner.

'If you are all high risk and classed to spread the virus on, you're more likely to stay home than to go to your parents' house or grandmother's house and pass on the disease to them. So if I had information that I'm high risk, I probably would stay to myself until there's a cure out there.' **Martin – Group 1, 28, FT, Lives with Partner.**

8. Discussion

This qualitative study highlights the confusion amongst some members of the UK public in the early stages of the pandemic about the different tests for COVID-19, worries over the uncertainties in the scientific community regarding reinfection and transmission for those with a positive test, the meaning of positive and negative test results for future behaviour with regard to the restrictive measures and the potential inequities these tests could create.

The findings of this study are congruent with Protection Motivation Theory (PMT), which states that protection motivation, or the intention to adopt protective behaviours is a function of a threat appraisal, considering severity and vulnerability of a potential health threat, a coping appraisal of the efficacy and costs of potential responses, and the self-efficacy to execute them (Rogers 1983). From an individual perspective, positive antibody tests were seen to affect threat appraisal through lowered perceptions of susceptibility. Participants highlighted that unknowns about antibody testing affected their ability to evaluate the nature of the threats about infection, reinfection and transmission with and without antibodies. Whilst they considered others to become less likely to adhere to protective measures after a positive antibody test, many did not expect a positive antibody test to affect their own behaviour, arguably due to the lack of certainty. This was also due to their coping appraisal. Participants held strong beliefs, at the time of the fieldwork, that the restrictive measures would protect participants and their families and there was a high level of reported self-efficacy and adherence to those measures that were in operation at that time.

From a collective perspective in the Spring of 2020, antibody testing was discussed in the context of its effectiveness as a potential strategy to manage the pandemic by excluding those with a positive antibody test from restrictive protective measures. Participants were unconvinced that this would be an efficient response due to uncertainties about test accuracy and immunity effects and fear of being infected or infecting others. This was especially the case as a number of participants were in the higher risk group (had co-morbid conditions or were key workers). Social distancing and personal protective behaviours were viewed as the more efficient response and one that participants had confidence in, in spite of its cost to personal, social and economic life.

The focus groups highlighted the significance of uncertainties about antibody testing as a new threat. Uncertainties about the test had to be evaluated in addition to threats from the virus. There is a risk that the overall levels of uncertainty about the meaning and implications of a positive or negative antibody test will produce raised levels of anxiety without adaptive behaviour (Lazarus 1980). In consideration of the wider public response to a positive test, the majority view in this study was that it would lead to a large proportion of the population ignoring the restrictive measures. A widespread reduction in adherence to the measures could impact on social norms and lead to those with a negative antibody test copying behaviours of those with a positive antibody test assuming their immunity. This was considered a danger to everyone and impacted on their threat appraisal. Where the nature of the threat is uncertain, as here, it is not surprising that participants varied in the

responses that they said themselves and others would make. It is not clear how stable these views were and when the fieldwork was conducted, neither we nor the respondents had any sense of the restrictions continuing beyond the end of 2020.

Other key findings were that with a negative test, some participants considered themselves to be at greater risk, and they would be more careful and go out less. The data show a danger that testing could result in some members of the public who had a negative test being anxious about changing their behaviour anyway when control measures were relaxed. This highlights that if a testing programme were to proceed, there would be a need to advise the public about protective behaviours for both positive and negative test results. Another downside to population-wide antibody testing revealed in this investigation was the potential for inequities. A society composed with one group who have a positive test result and another a negative test result (or not tested) was thought to be potentially divisive and setting a worrying precedent, particularly if the former have greater freedoms. Concerns were raised about the potential for workplace discrimination. It was feared that test results could be used by employers to dictate who can return and who is retained if there were a need to reduce staff numbers. These concerns have been raised by others (Kofler 2020; Nuffield 2020) who also argue that more affluent people will be able to purchase an antibody test, further discriminating against poor, marginalised and vulnerable groups (Kofler 2020). The potential implication is a situation where the wealthy enjoy greater freedoms, which could be beneficial from both a psychological and economic perspective. Sociologists have coined the term *biocitizenship* to refer to differences in citizenship rights rooted in biological states (Rose 2005). There are concerns that immunity could be one such biological state used to determine personal freedoms and concerns about the inequalities that could then arise. There are historical parallels with immunity to yellow fever being associated with racialized injustice in 19th century USA (Brown 2020).

When we embarked upon this research, COVID-19 antibody testing was a hotly debated topic and was thought to be a viable policy option. However, it has proven to be a more difficult strategy to bring to bear on the pandemic than was originally assumed. The reasons include uncertainties about immunity and the lifespan of antibodies, and the technical and logistical aspects of testing. In addition to these issues our study has shown that in terms of public attitudes and beliefs, antibody testing as part of a COVID-19 strategy is very complex and not a simple game-changer.

At the time of finalising this article, in the period since the data were gathered, the UK Government has not followed through with national policies about public antibody testing. There has been a further wave of infection starting towards the end of 2020, new mutations of the virus have appeared and death rates per day are higher in January 2021 than at the time the fieldwork was originally conducted. The UK is once again in a form of almost total lockdown and the basic message from government is to stay home and as far as possible keep away from others. In the UK a rollout of vaccines has begun, and it may be that the possibility of immunity through this route, will have crystalized people's thinking about antibody testing, or rendered the whole approach redundant. However, based on current early research findings (Hay, 2021) it has been reported in journals and the media that natural immunity from infection could offer more protection than some of the vaccines (Ledford 2021; Sample 2021). With antibody tests readily available to purchase online and through local pharmacies, members of the public who are unsure about being vaccinated – or do not want to wait until they are offered one – may resort to having these tests before immunity is fully understood. The concerns raised by those in the focus groups of widespread reduction in adherence to the measures based on a positive test could be realised.

But should antibody testing be adopted we would argue an information campaign, designed in collaboration with the members of the public, would be required. Test accuracy would need to be carefully framed with guidance on protective behaviours to reassure those who

are anxious about less than 100% accuracy. The uncertainties would need to be fully explained and guidance on protective behaviours for both positive and negative test results provided. Format and modes of delivery of this campaign would also need to be explored in collaboration with members of the public.

8.1. Policy implications

There are several implications for policies on antibody testing. If these tests should form part of a COVID-19 policy pathway there are four key points to consider. First, there is a need to address the uncertainties about the meaning of a positive antibody test result and manage expectations about the perceived individual benefits of testing. Second, there is a danger that those with a positive test result will assume they are safe and disregard protective measures which could lead to a general undermining of population adherence to restrictions. Without reducing uncertainty about immunity, it is questionable whether messaging will affect this potential public response. Third, there is also a risk of elevating general levels of anxiety resulting in a reluctance to follow less stringent government restrictive measures, and a potentially detrimental impact on mental health. Finally, there is the danger of exacerbating social divisions through these tests, particularly between those who could or could not afford to purchase an antibody test, and this must be avoided or carefully managed. *Inter alia* these points also perhaps speak to framing any campaigns about vaccination.

8.2. Strengths and limitations

This was a qualitative study and therefore the views of those who participated may not be representative of the wider UK population. The study was conducted at a particular moment in the pandemic. The death toll is now very much higher than was probably anticipated in the Spring of 2020 when the fieldwork was done. Vaccines are now available, but new variants of the virus have appeared and they seem to be much more transmissible than during the initial phases. It is difficult to judge without further empirical investigation how much attitudes may have changed or remained stable. It was also not possible to explore whether participants expressed views were consistent with their behaviour. The need to conduct online focus groups enabled the inclusion of individuals from different regions across the UK, something that would have been difficult logistically with face-to-face focus groups. Group participants could compare and discuss regional differences particularly concerning adherence to the restrictive measures. One limitation of this mode of data collection is that those without internet access were excluded.

The focus groups provided a window on the discussions between members of the public, and through this, valuable insights into their understanding about antibody testing at a specific point in time. Clearly, this method does not allow for an in-depth exploration of the views of individuals, but this study had no aim to do so. We found a higher level of self-reported adherence with the restrictive measures than in contemporary quantitative studies (Smith 2020). It may be that our study attracted those who were more anxious about being infected, and hence were more compliant with the restrictive measures. Another explanation for the high level of reported adherence could be that the online 'face-to-face' focus group format introduced social desirability bias. New research has been published since our fieldwork, specifically about the lifespan of antibodies, and it seems likely that more will be learned about immunity in due course.

9. Conclusions

There is a wealth of information and misinformation that the public can access about the pandemic. Some aspects are technical and difficult for non-specialists to understand, and sometimes they are contradictory. Nonetheless, if in the future antibody tests can offer the promise, or be part of a return to usual activities, any information developed to assist

their implementation must clearly communicate: What the test measures and how it differs from the test that determines if the person is currently infected with the virus; test accuracy; uncertainty about re-infection and transmission following a positive test result; and guidance on appropriate and safe behaviours for both test outcomes. There is a clear risk that those tested positive may be less adherent to social distancing measures and in doing so, add risk and shift the social norm for others. To ensure clarity, information should be developed in collaboration with members of the public. The findings provide a starting point for communications with the general public about antibody testing.

CRediT author statement

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Acknowledgements

We thank the members of the public who participated in the on-line focus groups.

The authors acknowledge the support of Dave Green and Irene Soulsby from the Patient and Public Involvement Strategy Group (NIHR Policy Research Unit in Behavioural Science) for their review of the focus group topic guides and early manuscript.

Appendix A. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.socscimed.2021.113778>.

Disclaimer

This paper is independent research commissioned and funded by the National Institute for Health Research Policy Research Programme. The views expressed in this publication are those of the author(s) and not necessarily those of the NHS, the National Institute for Health Research, the Department of Health and Social Care or its arm's length bodies, and other Government Departments. This project is funded by the National Institute for Health Research (NIHR) [Policy Research Unit in Behavioural Science (project reference PR-PRU-1217-20,501)].

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