Stroke and TIA Survivors’ Perceptions of The COVID-19 Vaccine: Cross Sectional Survey

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Research Article

Keywords: COVID-19, vaccine, vaccine hesitancy, Stroke, Transient ischaemic attack, survey

Posted Date: June 8th, 2021

DOI: https://doi.org/10.21203/rs.3.rs-543899/v1

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Abstract

Background

People who experience a stroke or transient ischaemic attack (TIA) have greater risks of complications from contracting COVID-19. Vaccine uptake in this vulnerable population is important to reduce the burden of COVID-19 on healthcare services and society. To prevent vaccine hesitancy and maximise compliance, we need to better understand individuals’ views on the vaccine. We aimed to explore perspectives of people with stroke/TIA on the COVID-19 vaccine and influences on its uptake.

Method

We conducted a cross-sectional, electronic open survey comprising multiple choice and free text questions. Convenience sampling was used to recruit people who have experienced a stroke and/or TIA, and were residents in the UK or Ireland.

Results

The survey was completed by 377 stroke/TIA survivors. 87% (328/377) had either received the first vaccine or were booked to have it. The vaccine was declined by 2% (7/377) and 3% (11/377) had been offered the vaccine but not yet taken it up. 8% (30/377) had not been offered the vaccine despite being eligible.

Many people expressed concerns around the safety of the vaccine (particularly risk of blood clots and stroke) and some were hesitant to have the second vaccine. Most people had no difficulty accessing the vaccine appointment. Societal and personal benefits were motivations for vaccine uptake. There was uncertainty and lack of information about risk of COVID-19 related complications specifically for people who had a stroke/TIA.

Conclusion

For people with stroke and TIA, confidence in the vaccine’s safety is the overriding behavioural influence on vaccine uptake. Despite high uptake of the first vaccine, many have legitimate concerns and information needs that should be addressed. Our findings can be used to identify targets for behaviour change to improve vaccine uptake specific to stroke/TIA patients, in particular, increase trust in the vaccine’s safety (confidence) and improve understanding of the greater risks of complications from contracting COVID-19 (complacency).

Introduction

COVID-19 has had a significant impact on society since December 2019, particularly in terms of mental health, physical health and widening social inequalities. One major part of the management strategy for this virus is COVID-19 vaccinations. For the vaccine to be effective, we need to ensure that
the population is generally compliant with the vaccination programme. To avoid vaccine hesitancy and maximise compliance, we need to better understand individuals’ views on the vaccine. ‘Vaccine hesitancy’ has been identified as one of the top 10 threats to global health in 2019.(6)

COVID-19 disproportionately affects certain groups, who are considered higher risk. Therefore, it is particularly important for these vulnerable groups to have high uptake of the vaccine and for any ‘vaccine hesitancy’ to be addressed. Previous studies have explored the views of the COVID-19 vaccine from the general population(7–10) and specific groups, including healthcare workers'(11–14) and parents/guardians.(15) However, none have undertaken this research in a vulnerable patient group, who are at high risk of severe COVID-19, like stroke and transient ischaemic attack (TIA) patients.(16) Anecdotal evidence from stroke/TIA forums, patient partners and Stroke Association (UK’s largest stroke charity) enquires suggest some people who have experienced a stroke/TIA had concerns about the vaccine, including: safety and effects on stroke prevention medication, and uncertainty about vaccine eligibility and trusted information sources. Furthermore, there have been initiatives from stroke organisations, including the Stroke Association and British Association of Stroke Physicians, to increase vaccine uptake in this population.(17, 18)

Identifying and understanding influences on individuals’ decisions to receive the COVID-19 vaccine is integral to inform strategies to improve vaccine uptake. Therefore, we conducted a survey to better understand stroke and TIA survivors’ perspectives of the COVID-19 vaccine and influences on uptake of the vaccine.

**Methods**

**Survey development and pre-testing**

Survey content was informed by patient partners, vaccine hesitancy literature and the behaviour change model COM-B (Capability, Opportunity, Motivation - Behaviour).(19) The survey was reviewed by patient partners, the Stroke Association and the UK/Ireland TIA and minor stroke special interest group. Functionality and usability were tested by the research team and patient partners.

The survey comprised questions about receipt of the COVID-19 vaccine, perceptions of the vaccine (including safety, access to the appointment, beliefs and social influences, knowledge and understanding) and perspective of COVID-19. Questions were mapped to COM-B. Demographic information was also collected (Appendix 1).

The study was approved by the University of Birmingham Ethical Review Committee (Reference ERN_21–0156). Participants provided electronic informed consent and no identifiable information was collected.

**Recruitment and survey administration**
We used an electronic, open survey (i.e. not password protected) hosted by SmartSurvey. Completion was voluntary and no incentives were provided. Participants were eligible if they had experienced a stroke or TIA and were residents in the UK or Ireland.

We used convenience sampling with dissemination via social media (Twitter, Facebook); Stroke Association newsletter; and Stroke Association local support services. In some cases where participants were unable to complete the survey, it was administered by interview from a research nurse or carer.

**Context of vaccine roll out**

The survey was open between 26th February and 12th April 2021. Stroke/TIA patients were part of priority group 6 who were eligible to receive the vaccine on 15/02/2021 (i.e. during the time of survey dissemination). In March 2021 there was media coverage around the AstraZeneca vaccine and risk of blood clots.

**Patient and public involvement and engagement**

The original idea of the survey came from one of our patient partners based on personal experience and from observing discussions on stroke/TIA forums. Patient partners were integral to creating the survey content, testing usability and designing recruitment strategies. Patient partners reviewed the results and provided important lived experience insights to interpret the findings. We continue to work with our patient partners to disseminate the findings to stroke/TIA patients and key stakeholders.

**Data analysis**

Quantitative survey data was summarised using descriptive statistics. Tests of statistical significance were not conducted. NVivo 12 was used to manage, sort, code and organise free text comments. The World Health Organisation’s (WHO) 3C’s (Complacency, Convenience and Confidence) model for vaccine hesitancy and COM-B were used as frameworks for a deductive content analysis. Text was coded by GT, an experienced qualitative researcher. The final analysis and interpretation were discussed with the research team and patient partners.

**Results**

The survey was completed by 377 people who have experienced a stroke and/or TIA. The majority of the sample were White (96.0%: 362/377) and 43.2% (163/377) were male (Table 1). Most of the sample had not experienced COVID-19 (78.8%: 297/377).

**Table 1: Demographic characteristics of survey respondents (n=377)**
| Diagnosis         | N (%)                      |
|-------------------|----------------------------|
| Stroke            | 253 (67.1)                 |
| TIA               | 67 (17.8)                  |
| Both              | 47 (12.5)                  |
| Unsure            | 10 (2.7)                   |
| Gender            |                            |
| Male              | 163 (43.2)                 |
| Female            | 213 (56.5)                 |
| Non-binary        | 1 (0.3)                    |
| Age               |                            |
| 18 - 25 years     | 3 (0.8)                    |
| 26 - 35 years     | 7 (1.9)                    |
| 36 - 45 years     | 30 (8.0)                   |
| 46 - 55 years     | 95 (25.2)                  |
| 56 - 65 years     | 130 (34.5)                 |
| 66 - 75 years     | 73 (19.4)                  |
| 76 - 85 years     | 38 (10.1)                  |
| ≥86 years         | 1 (0.3)                    |
| Ethnicity         |                            |
| White             | 362 (96.0)                 |
| Mixed/ multiple ethic groups | 3 (0.8) |
| Asian/ Asian British | 5 (1.3) |
| Black/ African/ Caribbean/ Black British | 5 (1.3) |
| Prefer not to say | 2 (0.5)                    |
| Highest level of education |          |
| No formal qualification | 36 (9.6) |
| GCSE / O-Levels / CSE / Foundation Diploma | 100 (26.5) |
| Apprenticeship    | 15 (4.0)                   |
| AS / A-Levels / BTEC / Advanced NVQs | 72 (19.1) |
| Degree (e.g. BA/BSc) | 92 (24.4) |
Quantitative data

Vaccine uptake

87% (328/377) either had received the first/second vaccine or had an appointment booked for vaccine (Table 2). The vaccine was declined by 2% (7/377) and 3% (11/377) had been offered the vaccine but not yet taken it up. 8% (30/377) had not been offered the vaccine despite being eligible, of these: 23 were definitely or very likely to accept; 3 were likely to accept; and 4 were unlikely or very unlikely to accept the vaccine.

Table 2: Vaccine uptake among survey respondents (n=377)
|                                | N (%) |
|--------------------------------|-------|
| Yes- first dose                | 307 (81.4) |
| Yes- first and second dose     | 12 (3.2) |
| No- I’ve not been offered it yet | 30 (8.0) |
| No- But booked to have vaccine | 9 (2.4)  |
| No- I declined the vaccine     | 7 (1.9)  |
| No- I’ve been offered but not taken up yet | 11 (2.9) |
| No- Other                      | 1 (0.3)  |

Perspectives of the vaccine

Side effects and safety

Figure 1 summarises survey responses to questions about the vaccine's safety and side effects. Around a third of respondents strongly agree/agree that they are concerned about:

- Side effects of the vaccine: 36.0% (131/364)
- The vaccine increasing their stroke risk: 34.1% (124/364)
- Safety of the vaccine: 31.6% (115/364)
- The vaccine affecting blood thinning medication: 29.9% (89/298)
- How new the vaccine is: 29.1% (106/364).

Beliefs and social influences

Figure 2 summarises survey responses to questions about the beliefs and social influences. The vast majority of the sample strongly agree/agree that:

- Having the vaccine is the ‘right thing to do’: 91.8% (328/357)
- The vaccine will protect against COVID-19: 87.1% (311/357)
- The vaccine will help reduce spread of COVID-19: 85.1% (304/357).

98.6% (352/357) of respondents strongly agree/agree that they knew other people who have had the vaccine. Very few respondents strongly agree/agree that they have general mistrust of vaccines (6.2%: 22/357) or religious/cultural beliefs affected their decision (3.4%: 12/357).

Access to the vaccine appointment
Figure 3 summarises survey responses to questions about access to the vaccine appointment. The vast majority of the sample strongly agree/agree that they understood how to get the vaccine (90.8%; 327/360). Most of the sample strongly disagree/disagree that they had difficulty accessing the vaccination appointment (67.8%; 244/360).

**Knowledge and understanding**

Figure 4 summarises survey responses to questions about knowledge and understanding of the vaccine. Most people strongly agree/agree that they are satisfied with their knowledge and understanding of the vaccine (77.8%; 284/365). Two thirds of respondents strongly agree/agree that the understand where stroke/TIA is on the vaccine priority list (66.8%; 244/365). Nearly half of the sample strongly agree/agree that they searched for vaccine information specifically for stroke/TIA patients (47.5%; 169/356). Only a third (33.2%; 121/365) strongly agree/agree that they were satisfied with the information they found.

The most frequently used sources to get of information about the vaccine were: NHS website (n=167); Stroke Association website (n=151); Google (n=132) and Government website (n=132) (Figure 5).

**Perceptions of COVID-19**

Figure 6 summarises survey responses to questions about perceptions of COVID-19. 71.5% (254/355) strongly agree/agree that they are likely to pass COVID-19 on to other people if they were to get it. 36.9% (131/355) strongly agree/agree that they are at high risk of getting COVID-19. Over half strongly agree/agree that they will get very sick if they get COVID-19 (57.5%; 204/355) as well as being at greater risk of COVID-19 related complications due to their stroke/TIA (54.4%; 193/355). A third strongly agree/agree that getting COVID-19 would increase their risk of stroke/TIA: 35.8% (127/355).

**Qualitative data**

**Confidence**

**Blood clots and stroke risk (COM-B: Motivation)**

Many people expressed serious concerns about blood clots and the vaccine causing a stroke/TIA (64 free text comments).

Media attention around the AstraZeneca vaccine and risk of blood clots caused many people to be anxious and hesitant about the vaccine. In many cases, people had their first vaccine before the media attention and were hesitant to have the second vaccine.

"Having had dose 1 of AstraZeneca vaccine prior to blood clot issues being reported I am very concerned as to the risks of my second vaccine. Very concerned when I previously had no hesitancy and am actually a vaccinator."
“Still unsure about the safety issues regarding the AstraZeneca vaccine as regards blood clots in recovering stroke victims. I am unsure about taking my second jab of the AstraZeneca vaccine.”

Some people experienced a stroke/TIA shortly after having the first vaccine and believed the vaccine caused their stroke/TIA.

“I had a mini stroke 1 week after receiving first dose ... I refuse the second dose of Astrazenica [sic] ... I am not being another death statistic.”

“17 days after having first vaccine AstraZeneca I had a TIA I am very worried about getting second jab. I’m almost certain it caused me to have a TIA.”

Side effects and safety (COM-B: Motivation)

Some people were worried about vaccine side effects after having experienced severe side effects themselves or hearing about potential side effects.

“The vaccine first dose really put back my recovery by about 3 plus weeks increase in headaches and vertigo. I don't know whether this means I should or shd [sic] not have second dose.“

“I'm worried about second dose of vaccine because feeling unwell after first dose.”

Some concerns were related to comorbidities or medication.

“Got my message from NHS vaccine but was uncertain of how my prescription medication would effect [sic] me having it.”

“My other concerns were I was worried about my other health conditions and medication interfere with the vaccine.”

Other people's concerns related to unknown long-term side effects. These concerns were often related to the “newness” of the vaccine.

“Not sure that it is safe. Wondering if the whole world will be a grand science experiment as there is no long term study on any of the vaccines.”

“Big worry is that virus is so new how have they found a vaccine in less than 12 months. I was worried I would die”

Vaccine side effects

There were 57 unprompted free text comments relating to people's experience of side effects from the vaccine. A third reported no side effects. Half reported mild or short-lasting side effects, including sore arm, high temperature, cold/flu-like symptoms, headaches, chills, tiredness, sore throat and generally
feeling unwell. The remainder reported moderate, severe or long-lasting side effects, including fatigue, severe migraines, headaches, vertigo, feeling dizzy, nausea, muscle weakness and reduced mobility.

**Mistrust of the government/ vaccine and non-specified concerns (COM-B: Motivation)**

A small minority expressed a mistrust in the government’s response to the virus or the vaccine.

“I do not trust the goverment [sic] statistics. I don’t see any sign of a pandemic any more than the usual flu outbreaks we get yearly. I feel there is more to this than we are being told. I don’t like the fact we are being controlled and made to feel we have to have a vaccine in my body with pier [sic] pressure. Too many control measures being put on us.”

“This government does not give you any options with this vaccine. I don’t trust this government they lie constantly and they haven't listened to the science. I know my doctor will probably say the line that they have been told. I just want the impartial advice. Perhaps I wouldn't feel like this if I thought this government cared.”

Some people had unspecied concerns.

“I cancelled my first date because I was worried about having it [vaccine].”

“Unsure whether to have it [vaccine].”

**Trust/ mistrust in the vaccine’s effectiveness (COM-B: Capability)**

Some people conveyed their trust in the vaccine’s effectiveness; however, often recognised that it is not a “cure”.

“The vaccine will reduce the impact of the virus thus preventing admission to hospital. The vaccine is not a cure.”

“I put my full trust in the vaccine.”

Other people were more sceptical about the vaccine’s effectiveness.

“It is not proven that by getting vaccinated or not is any less likely I wont [sic] get Covid [sic] or pass it on... Testing is the best way not vaccination.”

“Again we really don't know whether this is going to work or not it is down to the facts in two or three years time whether this is worked or not”

**Complacency**

**Value of the vaccine: social and personal motivations (COM-B: Opportunity/ Motivation)**

Some people were motivated to have the vaccine to benefit society and end the pandemic.
“I believe its [sic] a social responsibility to have the vaccine”

“The vaccine is the only way to get out of this pandemic.”

For others, motivations were related to protecting family/ friends or personal benefits.

“If you want to see family members or friends you need to have the vaccine to protect them, although I was initially against having the vaccine.”

“Vaccine is my only hope of getting outside.”

A very small minority voiced concerns about potential government-imposed restrictions for people who refuse the vaccine.

“I should be able to live my life fully if I decline it. Too many restrictions being put in place if I do not have it.”

“I think people have the right to take the vaccine or not. I am concerned about the idea of stopping people getting jobs, going to restaurants, travelling etc if they do not have the vaccine.”

**Perceived personal risk: Knowledge of COVID risk related to stroke/TIA (COM-B: Capability/ Motivation)**

There was uncertainty about risk of COVID specifically for stroke/TIA patients.

“I have no idea how covid [sic] impacts on stroke survivors.”

“I don’t know if getting COVID will increase my chances of having another tia [sic].”

Some people conveyed concerns about COVID caused stroke/TIA or blood clots.

“I had covid [sic] in March 2020 and a tia [sic] in August. I believe covid [sic] was the cause of my tia [sic]. I do not have a family history of strokes.”

“I was not told to shield or take extra precautions, I took it on myself to do so after reading about blood clotting becoming an issue for seriously ill covid [sic] patients in the news.”

For some people, concerns about having COIVD were related to other comorbidities.

“I have conditions other than stroke which make me extra vulnerable to Covid [sic].”

“As i [sic] have other health issues aswell [sic] as stroke/TIA I was massively worried with how my body would cope with if i [sic] contracted covid [sic].”

**Convenience**

**Accessing the appointment (COM-B: Capability/ Opportunity)**
Most people had no issues and could access the appointment either independently or with support.

“I am lucky that I have the support to arrange and access my appointment.”

“My carer arranged the appointment and the travel arrangements, all went smoothly.”

A minority experienced practical issues booking the appointment.

“Two systems working alongside each other have caused confusion… I received letters from two sources with conflicting information. All was cleared up by a phone call to GP reception, who explained they were having a lot of this to help sort out.”

“Letter to request I book an appointment on line. I was offered [location A], [location B], [location C], [location D] and some others all miles from my home town. I rang telephone advice line to be told I would have to wait for my doctor or local NHS to contact me for a local appointment. No-one seemed concerned that I was shielding and very vulnerable. It was two weeks later that by telephone I was offered a local appointment.”

Some people were concerned that they had not been invited for a vaccine appointment yet despite being eligible.

“I was surprised to only just learn that as a stroke survivor, I am in group 6 for the vaccine rollout. Disappointed to have not been invited for the vaccine by my GP.”

“I feel I got left out of Group 6 as others were being vaccinated before me in my area and younger than me.”

**Accessing information (COM-B: Capability/ Opportunity)**

Many people did not actively seek information about the vaccine.

“I didn't research having the vaccine. I believed that whatever the effects would be I would ultimately be in a better position for having it than I would of been not having it.”

“I Haven't searched, relied on my doctor and watching TV News Headlines.”

Some people were disappointed in the lack of proactive information.

“After a TIA I thought my doctor would have contacted me to discuss which vaccine I should receive.”

“I have accessed general information on line but feel my GP surgery should inform its stroke patients with more personalised advice and information for individuals.”

Some people were frustrated with lack of access to their GP to discuss the vaccine.
“I contacted my doctor to discuss my jab, but couldn’t get an appointment because the surgery wasn’t really interested in my concerns! No discussion, just a receptionist who said it was safe to have the vaccine! No reassurance for me at all.”

“The doctors have. Been [sic] really busy you don’t feel like you can ring just because of concerns. But like I said I have so ma[ny] [sic] concerns.”

Some people felt there was a lack of information, in particular personalised information/advice, information on risk of blood clots/stroke and information for younger stroke/TIA patients.

“Due to my age when I research for information about people who had strokes/TIA it was all based on older population, I could bit find information for my age group... I did try to do so much research but as I stated it was all based on over 50’s.”

“I have researched about covid [sic] and I know that can give blood clots. There is such a lack of advice out there.”

A very small minority had physical barriers to accessing information.

“I struggle with information since my strokes hard to take it in an understand it.”

“Stroke affected vision - difficult to access websites.”

**Knowledge about where stroke was on priority list (COM-B: Capability)**

Some people were unclear where stroke was on the vaccine priority list.

“As far as I am aware people who have had a stroke or TIA were not on a priority list.”

“The government website does not make it clear that stroke survivors should fall into group 6.”

**Discussion**

**Principal findings**

Vaccine uptake for the first dose was high: 87% had received the first vaccine or had an appointment booked. However, many people expressed concerns around the safety of the vaccine (particularly risk of blood clots and stroke) and some were hesitant to have the second vaccine. For stroke/TIA patients, vaccine safety (*confidence*) is the overriding behavioural influence on vaccine uptake. Most people had no difficulty accessing the vaccine appointment; however, 8% had not been offered the vaccine despite being eligible (*convenience*). Societal and personal benefits were motivations for vaccine uptake (*complacency-value*). There was uncertainty and lack of information about risk of COVID-19 related complications, specifically for people who had a stroke/TIA (*complacency-perceived personal risk*).

**Strengths and weaknesses**
This is the first study to explore stroke/TIA patients’ perspective of the COVID-19 vaccine. Although descriptive in nature, our findings enable us to begin to understand behavioural influences on vaccine uptake specific to stroke/TIA. However, a key limitation is that 96% of the sample are White; therefore, perspectives from other ethnic groups may not be represented in our findings. This is particularly important as research has found greater vaccine hesitancy among people from some ethnic minority groups.\(^{(20)}\) The survey was only available in English, which hinders participation from non-English language stroke/TIA patients. Furthermore, the survey was electronic and predominantly circulated through social media and email; therefore, bias may be introduced by digital inaccessibility.

**Comparison with other studies**

Much of the published literature on COVID-19 vaccine hesitancy is conducted pre-/early vaccine roll out and investigates vaccine uptake ‘intent’.\(^{(8–10, 14, 21)}\) In contrast, we surveyed vaccine uptake when stroke/TIA patients were eligible for the vaccine which enabled us to identify actual, rather than hypothesised, behaviours and perceptions. No other studies have specifically explored the stroke/TIA populations’ perception and uptake of the vaccine.

Similar to our findings, other studies have identified vaccine safety concerns as important influences on COVID-19 vaccine uptake.\(^{(12, 22–24)}\) Moreover, we found blood clot/ stroke risks were particular concerns for stroke/TIA patients. Concerns about blood clots and stroke side effects may be heightened in the stroke/TIA population because of their previous stroke/TIA experience. Fear of having another stroke is a common form of anxiety post-stroke/TIA.\(^{(25)}\) Antivaxxers and conspiracy theories have been discussed as potential influences on vaccine uptake behaviour; however, these were not common influences within our sample.\(^{(26–28)}\) Similar to our findings, other studies have found risk perceptions (severity of and susceptibility to COVID-19) were significantly associated with vaccine uptake.\(^{(21)}\)

**Implications for clinicians and policymakers**

Our findings can be used to identify targets for behaviour change to improve vaccine uptake specific to stroke/TIA patients (Table 3). Importantly, there is a need to increase trust in the safety of the vaccine (confidence). Fear of the vaccine causing blood clots and stroke could be diminished by provision of up-to-date, accessible education/ information specifically for stroke/TIA patients. For example, vaccine blood clot risk for stroke/TIA patients presented visually (such as infographics) and through illustrative analogies to contextualise information (such as “this equates to one person in a city the size of ...”). This information should be co-produced with stroke/TIA patients and be available through trusted sources, such as government NHS websites. Furthermore, opportunities to discuss individual circumstances with trusted individuals, such as GPs or Stroke Association helplines, could be improved. Proactively targeting newly diagnosed stroke/TIA patients, in hospital or GP follow-up, provides an opportunity to intervene early to dispel misinformation about the vaccine causing their stroke/TIA and reassurance of safety of the second vaccine.
We identified a lack of understanding that stroke/ TIA patients have greater risks of complications from contracting COVID-19 (*complacency*). Therefore, education/ information provision to improve knowledge of personal risks related to COVID-19 could increase individuals’ motivation to have the vaccine. A recent study found provision of information on personal benefit reduced vaccine hesitancy to a greater extent for people who are strongly hesitant, compared to provision of information on collective benefits. (29) Other potential intervention targets include “persuasion”, such as promoting social responsibility and personal gain motivators, and “modelling”, such as positive publicity campaigns of stroke/TIA patients having the vaccine.
| 3C's vaccine hesitancy model | COM-B | Intervention functions | Example |
|-------------------------------|-------|-------------------------|---------|
| **Confidence**- vaccine safety | **Capability**- know the vaccine is safe | **Education** | Provide clear, concise information on the vaccine and risk of stroke/ blood clots, preferably specific to stroke/TIA survivors. Information should be up-to-date and regularly updated as new research emerges. |
| Motivation- do not have overwhelming fear of the vaccine | | | Information should use lay language, be co-produced with patients and be presented visually (e.g. infographics) and using illustrative analogies to contextualise information. |
| | | | Information should be easily available, such as on trusted NHS government websites. |
| | | | Information should be adapted to accommodate accessibility considerations (e.g. visual problems) and stroke-related impairments (e.g. cognitive problems). |
| | | | Empower families/ carers to support people with stroke with their information needs. |
| | **Education** | Initial information provision in the acute setting is crucial and individual concerns/ questions can be discussed. Proactively target newly diagnosed stroke/TIA patients to dispel misinformation about their stroke being related to the vaccine and to promote uptake of the second vaccine. A summary of this information should be included in the discharge letter. |
| | **Education** | Educate healthcare providers and vaccinators to provide information to address vaccine safety concerns, particularly regarding blood clot and stroke risk – i.e. more than the top line message ‘the vaccine is safe’. Concerns should be acknowledged and not dismissed. |
| | | | As trusted information sources, healthcare providers should have knowledge of where to access up-to-date, evidence-based information. |
| Environmental restructuring | **Education** | Improve access to personalised advice, support and reassurance from trusted individuals, such as GPs or the Stroke Association helpline. |
### 3C’s vaccine hesitancy model

| Function | Capability | Motivation |
|----------|------------|------------|
| **Complacency** - perceived risk of COVID | understand personal risks | perceive COVID as health risk |

**Intervention functions**

- **Education**: Increase knowledge of the greater risks of complications from contracting COVID-19 for individuals who have had a stroke/TIA. Focus messaging on ‘get the vaccine to reduce your risk’.

- **Persuasion**: Communicate social responsibility and personal benefit to induce positive feelings and stimulate vaccination uptake.

- **Modelling**: Publicise positive stories of vaccine uptake in stroke/TIA survivors as examples for people to aspire to.

### Unanswered questions and future research

We identified some hesitancy regarding the second vaccine from stroke/TIA patients who already received their first dose. Further research is required to understand if this hesitancy resulted in missed vaccines, the extent of this problem and how to prevent missed second vaccines. We also identified the need for generation of data about the vaccine and risk of stroke/blood clots specifically for the stroke/TIA population. Ethnic minority groups are vastly under-represented in our survey; therefore, research which purposively samples minority groups is essential to understand influences on vaccine uptake specifically for stroke/TIA patients within these minority groups. In the UK, the government is planning a roll out of booster vaccines, starting with the most vulnerable. Further research to understand stroke/TIA patients’ perspectives and understanding of booster vaccines is an important continuation of our research to inform strategies to improve vaccine uptake.

### Conclusion

People who experience stroke/TIA are a clinically vulnerable group, at high risk of severe COVID-19. Despite high uptake of the first vaccine, many have legitimate concerns and information needs that should be addressed, in particular regarding risk of blood clots and strokes. Provision of this information to stroke/TIA patients is important to avoid ‘vaccine hesitancy’ in this patient group. Our findings can be used to identify targets for behaviour change to improve vaccine uptake specific to stroke/TIA patients, in particular increase trust in the vaccine’s safety (*confidence*) and improve understanding of the greater risks of complications from contracting COVID-19 (*complacency*).

### List Of Abbreviations

COM-B: Capability, Opportunity, Motivation - Behaviour
Declarations

Ethics approval and consent to participate

The study was approved by the University of Birmingham Ethical Review Committee (Reference ERN_21-0156). The research was performed in accordance with the Declaration of Helsinki. Participants provided electronic informed consent and no identifiable information was collected.

Consent for publication

Not applicable.

Availability of data and materials

The datasets used and analysed during the current study are available from the corresponding author on reasonable request.

Competing interests

GT, NH, JC and EK are founders of the UK/Ireland TIA and minor stroke special interest group. SH has lived experience of TIA.

Funding

This research received no specific funding.

Authors' contributions

GT and SH were responsible for the conception and design of the study. GT, SH, NH, JC and EK reviewed and disseminated the survey. GT conducted the analysis and all authors were involved in interpretation of
findings. GT drafted the manuscript and all authors reviewed the final manuscript.

Acknowledgements

Thank you to our patient partners, Phil Collis and Lesley Thomson, who provided extremely valuable feedback and insight into the survey design and interpretation of results. We also thank our collaborators from the Stroke Association, in particular Richard Francis, Joshua Edwards and Georgina Hill, for endorsing, reviewing and disseminating the survey. Thank you to Rachel Evans (Senior Research Practitioner) for her role in recruitment and administration of the survey. Finally, we thank everyone who completed and shared the survey.

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**Figures**

**Figure 1**

Survey responses to questions about the vaccine’s safety and side effects (n=364, *n= 297, ^n=290, ~n=298).
### Figure 2

Survey responses to questions about beliefs and social influences (n=357).

| Statement                                                                 | Strongly agree | Agree | Neither agree nor disagree | Disagree | Strongly disagree | Not applicable |
|---------------------------------------------------------------------------|----------------|-------|----------------------------|----------|-------------------|---------------|
| I believe having the vaccine is the right thing to do                      | 67%            | 25%   | 6%                         |          |                   |               |
| I know other people who have had the vaccine                              | 61%            | 37%   | 2%                         |          |                   |               |
| I believe having the vaccine will help reduce the spread of COVID-19     | 49%            | 36%   | 11%                        | 1%       |                   |               |
| I believe the vaccine will protect me against COVID-19                    | 41%            | 46%   | 9%                         |          |                   |               |
| In general, I disagree with or don't trust vaccines                      | 33%            | 15%   | 61%                        | 1%       |                   |               |
| Religious or cultural beliefs impact my decision to have the vaccine     | 21%            | 13%   | 50%                        | 13%      |                   |               |

### Figure 3

Survey responses to questions about access to the vaccine appointment (n=360).

| Statement                                                                 | Strongly agree | Agree | Neither agree nor disagree | Disagree | Strongly disagree | Not applicable |
|---------------------------------------------------------------------------|----------------|-------|----------------------------|----------|-------------------|---------------|
| I understand how to get the vaccine, such as where to go and how to get there | 62%            | 29%   | 9%                         |          |                   |               |
| I need to see my doctor before I attend the vaccination appointment      | 53%            | 11%   | 42%                        | 19%      |                   |               |
| I have difficulty accessing the vaccination appointment (e.g. unable to travel) | 29%            | 6%    | 47%                        | 21%      |                   |               |
| I do not have the time to attend the vaccination appointment             | 20%            | 20%   | 56%                        | 18%      |                   |               |
Figure 4

Survey responses to questions about knowledge and understanding of the vaccine (n=365).

| Question                                                                 | Strongly agree | Agree | Neither agree nor disagree | Disagree | Strongly disagree | Not applicable |
|--------------------------------------------------------------------------|----------------|-------|----------------------------|----------|-------------------|----------------|
| I am satisfied with my knowledge and understanding of the vaccine       | 34%            | 46%   | 10%                        | 8%       | 13%               | 8%             |
| Understand where stroke/TIA patients are on the vaccination priority list | 30%            | 38%   | 13%                        | 11%      | 6%                | 4%             |
| I have searched for information about the vaccine for people who have had a stroke/TIA | 18%            | 30%   | 15%                        | 19%      | 10%               | 8%             |
| I am satisfied with the information I found about the vaccine for people who have had a stroke/TIA | 13%            | 21%   | 21%                        | 18%      | 9%                | 19%            |

Figure 5

Sources information about the vaccine for people who have had a stroke/TIA.
Figure 6

Survey responses to questions about perspectives of COVID-19 (n=355).

**Supplementary Files**

This is a list of supplementary files associated with this preprint. Click to download.

- Appendix1.pdf