Perspective

Attitudes Towards Vaccination Against Coronavirus Disease 2019 in Patients with Severe Alpha-1 Antitrypsin Deficiency

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Abstract

Patients with severe alpha-1 antitrypsin deficiency (AATD) are at increased risk for the development of chronic obstructive pulmonary disease (COPD), particularly if they smoke. This, coupled with their predilection for dysregulated inflammation and autoimmunity, makes affected individuals priority candidates for vaccination against Coronavirus Disease 2019 (COVID-19). To promote vaccine uptake effectively, an understanding of the factors motivating people to proceed with vaccination is essential. The attitudes of patients with AATD towards COVID-19 vaccination have yet to be described.

We prospectively studied 170 Pi*ZZ AATD patients, 150 patients with nonheritable (Pi*MM) COPD and 140 Pi*MM individuals without lung disease receiving first-dose vaccination with ChAdOx1 nCoV-19 (AstraZeneca). Patient attitudes towards vaccination and motivations for getting vaccinated were assessed at the time of the vaccine being offered. Following completion of the two-dose vaccine series, Pi*ZZ patients were then re-assessed regarding their attitudes towards booster vaccination.

The most common primary motivation for accepting vaccination in Pi*ZZ participants ≥50 years was a fear of illness or death from COVID-19. In contrast, Pi*ZZ patients <50 years most often cited a desire to socialize. The motivation pattern of younger Pi*ZZ AATD patients was similar to that of non-deficient individuals of comparable age, whereas older Pi*ZZ individuals were more closely aligned with Pi*MM COPD and differed from age-matched controls without lung disease. When considering booster vaccination, Pi*ZZ patients were increasingly motivated by a desire to reacquire social freedoms. A desire to reduce the risk of transmission was not a prominent consideration in any of the groups studied. The most commonly cited reason for
booster hesitancy was a lack of incentive, given that no additional social freedoms were available to triple-vaccinated individuals compared to those who were double-vaccinated at the time. Taken together, these data may inform policymakers attempting to promote vaccine uptake among patients with AATD.
Introduction

Effective vaccines against coronavirus disease 2019 (COVID-19) have been developed with unprecedented speed, but uptake in some regions has been slow. To maximize vaccine coverage, policymakers must appeal to unvaccinated individuals by targeting personal factors that influence decision-making. Assessing attitudes towards vaccination in different patient populations is therefore essential, since individuals with certain conditions may prioritize issues differently to the general population.

Alpha-1 antitrypsin deficiency (AATD) is an autosomal codominant disorder resulting from mutations in the SERPINA1 gene (1-3). The normal, non-mutated Pi*M allele is associated with the healthy Pi*MM genotype and serum alpha-1 antitrypsin (AAT) concentrations of 20-53μM (4). Patients who are homozygous for the pathologically mutated Pi*Z allele display a severe functional AAT deficiency with circulating levels substantially below the putative protective threshold of 11μM (5), a pro-inflammatory phenotype (6-9), and a significantly increased risk of developing early-onset emphysema, particularly if they smoke (10-12).

Although vaccination against COVID-19 is indicated as a priority for patients with chronic lung disease, no AATD-specific data regarding this essential public health measure are available. We prospectively investigated 170 Pi*ZZ individuals to determine the factors influencing patients with severe AATD to proceed with vaccination.

Methodology

Ethical approval for the study was granted by Beaumont Hospital Ethics Committee. Patients with Pi*ZZ AATD (n=179) and Pi*MM COPD (n=164) were consecutively identified from the Irish Alpha-1 Patient Registry, Alpha-1 National Targeted Detection Programme (NTDP), the
Irish national AATD clinic at Beaumont Hospital and Beaumont Hospital respiratory outpatient department, and offered vaccination with ChAdOx1 nCoV-19 (Astra Zeneca) following the categorization of AATD patients as high-priority candidates for vaccination by the Irish government. Non-lung disease controls were selected at random from the list of patients due to attend the vaccination clinic during the same week as AATD and/or COPD patients. Individuals who had previously been diagnosed with COVID-19 or had already been vaccinated were excluded. Patient AAT protein phenotypes in were previously determined by immunofixation of glycoforms via isoelectric focusing gel electrophoresis with confirmatory genotyping, following a serum AAT level. Patients in the non-lung disease control group were deemed eligible following review of their medical records and serum AAT levels. Patients accepting the offer of vaccination were then referred to a hospital-based vaccination clinic overseen by the Health Service Executive (HSE) of Ireland. Non-pulmonary patients attending this vaccination clinic included patients referred from other medical clinics, non-clinical hospital staff and community referrals from family practitioners.

Patients who accepted the offer of vaccination were included in the study analysis and matched with non-lung disease controls (n=140) attending for vaccination in the same week. Patient attitudes towards vaccination, motivations for getting vaccinated and pre-vaccine concerns were assessed using predetermined questionnaires at the time of the first vaccine being offered. Patients who accepted the offer of vaccination were surveyed immediately after accepting the offer of vaccination, and before they attended for their vaccination appointment. Non-lung disease controls were also surveyed before they attended for their vaccination appointment. The time between vaccine offer and vaccine appointment was approximately 5 days. In order to
ensure the survey was taken under circumstances that were as comparable as possible, non-lung disease controls were also surveyed 5 days before their scheduled appointment. Similarly, the study groups were matched for date of vaccination so as to minimize the potential confounding effects of differences in extrinsic factors such as media coverage on patient attitudes. For each of the groups studied, participant surveys were conducted between 10 March 2021 and 28 April 2021. In the Pi*ZZ cohort, we subsequently assessed factors influencing the decision to accept a scheduled booster dose.

Results

Baseline characteristics of the Pi*ZZ cohort

The mean age of the Pi*ZZ cohort was 58 +/- 13 years; 86 were male, 84 were female. Pi*ZZ patients had a mean FEV$_1$ of 61.7 +/- 31.6% of the predicted value and diffusing capacity for carbon monoxide (DLCO) of 57.4 +/- 25.3%. A total of 39 patients (23%) had known hepatic involvement on ultrasound. Six were active smokers, 99 were ex-smokers and 4 were active vapers. Twelve were receiving supplemental oxygen and 13 were receiving augmentation therapy with plasma-purified AAT. By comparison, the mean FEV$_1$ (pp) in the Pi*MM COPD group (n=150, 71 male, 79 female) was 57.5%. The three study groups were matched for age, sex and other known co-morbidities.

Patient views prior to vaccination

At the time of study commencement, 2 vaccines were in use in Ireland – ChAdOx1 nCoV-19 and the mRNA vaccine BNT162b2 (“Comirnaty”, BioNTech/Pfizer), with only the former available to AATD patients under the age of 80 years. Of the 179 Pi*ZZ individuals initially surveyed, 9
declined the opportunity to receive ChAdOx1 nCoV-19 while 14 out of 164 Pi*MM COPD patients turned down the vaccine (Table S1). However, Pi*ZZ patients who accepted the offer did not necessarily have full confidence in the vaccine (Figure 1). When asked which vaccine they would choose if both options were made available, 90% stated they would instead select BNT162b2. This pattern was reflected in the Pi*MM COPD and non-lung disease groups, where BNT162b2 was favored by 81% and 88%, respectively. This suggests that even though ChAdOx1 nCoV-19 was not the vaccine of choice for many individuals, it was viewed as a better option than remaining unvaccinated until access to BNT162b2 was extended to all groups, and did not deter patients from attending for vaccination.

Motivations for accepting vaccination among patients with Pi*ZZ AATD

Motivations for accepting vaccination with ChAdOx1 nCoV-19 varied within groups, most notably according to age. In the Pi*ZZ AATD group, the most common reason for getting vaccinated in people over the age of 50 was a fear of serious illness or death, which was cited as the primary motivation for accepting vaccination by 62%, followed by an increased freedom to socialize (12%) and a desire to return to work (11%, Fig. 1A). In contrast, only 27% of younger Pi*ZZ individuals listed protection against illness as their main consideration – the same percentage of younger people as accepted based on an eagerness to socialize (Fig. 2A). A similar percentage (60%) of Pi*MM COPD patients ≥50 years were driven primarily by the threat of illness (Fig. 1B), but this figure was lower (51%) in non-lung disease controls of comparable age (Fig. 1C), consistent with the concept that a respiratory virus might be expected to impact those with pre-existing lung disease more severely. Societal pressures – predefined as direct perceived pressure from peers, perceived pressure from social media and news outlets, and/or a fear of peer
judgment – did not markedly influence older study participants, but had a clear impact on younger people, serving as the top motivation for getting a vaccine in 15% of under-50’s without lung disease (Fig. 2B). The percentage of study participants who cited a fear of transmitting SARS-CoV-2 to a more vulnerable person as their main motivation was low, ranging from 7% in Pi*ZZ patients \( \geq 50 \) years to only 2% in Pi*ZZ patients under the age of 50.

**Attitudes towards COVID-19 booster vaccination**

Following the October 2021 announcement by Irish public health officials that a COVID-19 booster vaccine program would be required, we revisited the Pi*ZZ cohort to see whether the key motivating factors for accepting a booster (Fig. 3A, 3B) differed from those identified at the outset of the initial ChAdOx1 nCoV-19 vaccine course (Fig. 1, Fig. 2). In both Pi*ZZ subgroups, fewer study participants considered a fear of illness or death to be their primary motivation, with patients instead influenced by the desire to socialize and travel (Fig. 3A, 3B). This shift was most apparent in younger AATD patients, only 16% of whom cited a fear of illness or death as the primary reason they would undergo booster vaccination (Fig. 3B).

**Booster hesitancy**

A total of 62 Pi*ZZ patients (36%) expressed some degree of booster hesitancy, the most common reasons being uncertain coverage against escape variants such as Omicron, and a lack of incentive given that, in Ireland, no additional social liberties would be afforded to triple-vaccinated citizens compared to those who were double-vaccinated (Fig. 3C). 138 Pi*ZZ individuals who received ChAdOx1 nCoV-19 experienced local adverse events (AEs) following the initial vaccine dose, with 103 having systemic AEs and 55 having an AE duration of at least...
3 days. Despite this, the large majority (91%) of Pi*ZZ participants who experienced AEs still planned to attend for a booster if offered one. Of the Pi*ZZ patients reporting booster hesitancy, only 6 (10%) cited a prolonged or severe vaccine-associated AE as the underlying cause.

**Discussion**

Here we report the attitudes, motivations and concerns of people with Pi*ZZ AATD regarding vaccination against COVID-19. ChAdOx1 nCoV-19 was not the preferred vaccine option for most of those included in the final analysis, with a sizeable number also expressing safety concerns in advance of being vaccinated. However, the overwhelming majority of people offered ChAdOx1 nCoV-19 accepted, rather than holding out for an alternative. Factors influencing the decision of Pi*ZZ patients to accept an offer of vaccination differed according to age. In Pi*ZZ individuals greater than 50 years, a fear of severe illness or death was by a distance the primary motivation, in contrast to Pi*ZZ’s under the age of 50, for whom the desire to socialize was equally as important. This trend was even more pronounced in the non-lung disease group, where the percentage of people motivated by a return to socializing was more than double that motivated by a fear of illness. Reducing the risk of transmitting SARS-CoV-2 was not a prominent consideration among Pi*ZZ study participants, particularly those less than 50 years old. This was somewhat surprising given that, at the time the study was conducted, many of these individuals were in regular contact with direct relatives affected by the same condition. In general, participants under the age of 50 were also more likely to be influenced by societal pressures and a fear of judgment by peers than their older counterparts.
While these results provide an insight into how patients with AATD and COPD interact with new public health policies and interventions, they should also be taken in context. The data reported here are based on the most important factor motivating respondents to accept an offer of vaccination. When designing the study, our priority was to identify the factors that most materially affected patient decision-making. We felt that, by compelling a given patient to commit to a single answer – as opposed to a collection of them – we stood a better chance of identifying the salient factor that ultimately determined their decision and informing more focused consultations and public health messaging.

Patients were surveyed in the first half of 2021 – it stands to reason that as the COVID-19 landscape evolved, so too did the factors motivating patients to attend for first-dose vaccination. Indeed, this is reflected in the responses of the Pi*ZZ cohort prior to the second vaccine dose. The availability of free vaccination and public healthcare services in Ireland also meant that financial concerns such as the potential cost of a COVID-19-related hospitalization were less likely to influence Irish patient decisions to the same extent as those made by patients from other jurisdictions. The cohort was limited to Ireland primarily because the variability in vaccine rollout schemes and dosing schedules between countries at the time the surveys were conducted made standardizing an international study unfeasible.

In broad terms, vaccine motivations in young patients with severe AATD were aligned with non-deficient individuals of comparable age, whereas older Pi*ZZ individuals were more closely aligned with Pi*MM COPD and differed from age-matched healthy controls. When considering booster vaccination, lowering the personal risk of death or severe illness – or indeed the risk to others – influenced decision-making in younger Pi*ZZ patients to a lesser degree than
anticipated. Although these results suggest that linking personal freedoms such as air travel to vaccination status may improve booster uptake, the corollary – that inclusion of triple-vaccinated individuals in future lockdown restrictions may reduce enthusiasm for accepting a vaccine – may also apply. These data may therefore inform policymakers attempting to promote vaccine uptake among younger people.

While this study is smaller than similar studies in more common chronic lung diseases, it is considerably larger than most observational studies of Pi*ZZ AATD published to date, and is the first to examine COVID-19 vaccine behavior in patients with this rare disease. As the pandemic has evolved, so too has the concept of what makes vaccination valuable to patients. It is incumbent on healthcare providers and policymakers to involve patient-relevant goals in consultations and vaccination initiatives, if they are to succeed.
References


Figure legends

Figure 1. Primary motivations for accepting offer of first-dose ChAdOx1 nCoV-19 in patients ≥50 years of age.

Older Pi*ZZ individuals who accepted the offer of vaccination (Panel A) were primarily influenced by a fear of severe illness or death, and were more closely aligned with Pi*MM COPD (Panel B) than age-matched controls without lung disease (Panel C). Individual percentages are available in the supplementary appendix (Table S2).

Figure 2. Primary motivations for accepting offer of first-dose ChAdOx1 nCoV-19 in patients less than 50 years of age.

Although young Pi*ZZ AATD patients (Panel A) were motivated by a fear of illness or death to a greater degree than individuals <50 years without lung disease (Panel B), the general motivation pattern was similar between the two groups, and different from that of older study participants. Individual percentages are available in the supplementary appendix (Table S2).

Figure 3. Attitudes towards booster vaccination in patients with Pi*ZZ AATD.

When considering booster vaccination, Pi*ZZ patients <50 years (Panel A) were primarily motivated by a desire to socialize and travel, with only 16% listing a fear of illness or death as their main reason for accepting a booster offer. A shift towards an increased desire to reacquire social freedoms was observed in older Pi*ZZ individuals (Panel B), though a fear of illness or death remained the primary motivator. A total of 62 patients reported hesitancy regarding booster vaccination (Panel C), the two main reasons being an insufficient social incentive (defined as a lack of additional social freedoms available to triple-vaccinated patients compared to double-
vaccinated individuals) and the potential that a booster would not protect against impending escape variants such as Omicron. Individual percentages are available in the supplementary appendix (Tables S2 and S3).
Figure 1

A
Pi*ZZ AATD and ≥50yrs

B
Pi*MM COPD and ≥50yrs

C
No lung disease and ≥50yrs

- afraid of severe illness or death
- want to return to work
- want to socialize
- want to travel
- afraid of transmitting SARS-CoV-2
- societal pressures

Figure 2

A
Pi*ZZ AATD and <50yrs

B
No lung disease and <50yrs

- afraid of severe illness or death
- want to return to work
- want to socialize
- want to travel
- afraid of transmitting SARS-CoV-2
- societal pressures
Figure 3
Supplementary Appendix
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Acknowledgements

We thank the study participants for engaging with this project, Beaumont Hospital Ethics Committee (BHEC) for their input regarding the study protocol and questionnaire, and the healthcare provider colleagues who facilitated the study on a goodwill basis.

Reasons for declining the offer of vaccination with ChAdOx1 nCoV-19

Although the number of patients who declined the offer of vaccination with ChAdOx1 nCoV-19 was small (9 patients with Pi*ZZ AATD, 14 patients with Pi*MM COPD), the reasons for declining provided by these patients do provide some insights into the decision-making process. Of the 9 patients with Pi*ZZ AATD who declined, 7 were female, of whom 5 were of reproductive age. While none of the Pi*ZZ females surveyed considered it to be their reason for declining a vaccine, 4 said they would consider a COVID-19 vaccine to be potentially unsafe in pregnancy. Of the 14 Pi*MM COPD patients who declined a vaccine, 8 were female. The primary reason for declining the offer of vaccination, along with additional reasons (if any), are provided in Table S3 below. At the time of writing, 2 of these patients (both Pi*MM COPD) have died following hospitalization for COVID-19, while the remainder have remained unvaccinated.
Counseling at time of vaccine offer

All prospective study participants received counseling regarding the COVID-19 vaccine, using a standardized template provided by the Health Service Executive (HSE) of Ireland. This material is available via the following links:

https://www2.hse.ie/screening-and-vaccinations/covid-19-vaccine/vaccine-types/
https://www2.hse.ie/screening-and-vaccinations/covid-19-vaccine/side-effects/
### Table S1. Reasons for declining an initial offer of vaccination with ChAdOx1 nCoV-19

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Patients declining vaccine identified as D1, D2, etc.
M – male
F – female
AATD – alpha-1 antitrypsin deficiency
COPD – chronic obstructive pulmonary disease
### Table S2. Individual percentage values for vaccine motivation data presented in main manuscript

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<th>Afraid of severe illness or death</th>
<th>Want to return to work</th>
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### Table S3. Individual percentage values for vaccine hesitancy data presented in main manuscript

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<td>Lack of protection against escape variants</td>
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### Table S4. Breakdown of cohort sizes by age and sex

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<th>Pi*MM COPD</th>
<th>Non-lung disease controls</th>
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<td>41</td>
<td>N/A</td>
<td>70</td>
</tr>
<tr>
<td>Female</td>
<td>40</td>
<td>N/A</td>
<td>36</td>
</tr>
<tr>
<td>≥50 years</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Male</td>
<td>46</td>
<td>78</td>
<td>35</td>
</tr>
<tr>
<td>Female</td>
<td>43</td>
<td>72</td>
<td>35</td>
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</tbody>
</table>
Supplementary figures

Figure S1. Vaccine preferences in the cohorts.

Patients were asked to identify their preferred choice of vaccine prior to first-dose ChAdOx1 nCoV-19. In patients without lung disease (BNT162b2 = 88%; ChAdOx1 nCoV-19 = 8%; no preference = 4%; Panel A), Pi*MM COPD (BNT162b2 = 81%; ChAdOx1 nCoV-19 = 7%; no preference = 12%; Panel B) and Pi*ZZ AATD (BNT162b2 = 90%; ChAdOx1 nCoV-19 = 5%; no preference = 5%; Panel C), BNT162b2 was preferred to ChAdOx1 nCoV-19.
Attitudes towards vaccination against COVID-19 in Irish patients – Participant questionnaire form

Study lead – Oliver J. McElvaney MB, BCh, BAO, MRCPI, PhD

Study lead contact – olivermcelvaney@rcsi.ie

Prior to administering questionnaire, confirm:

- Patient consent completed
- Date vaccination offer accepted
- Date of vaccination appointment
- Patient ID code
Thank you for completing the following survey. The information disclosed on this form will not be passed on to any third party, and you will not be identifiable based on it.

Please answer all questions truthfully. If you are unsure about the meaning of a question, you are encouraged to ask the study team member administering the survey to explain it further. However, the answers provided must be yours – members of the study team are not permitted to answer questions for you, or advise you on what answers to give.

You will previously have been consented to participate in this survey. You are free to withdraw your consent for the answers and information you provide to be used in the study analysis at any time. You are also entitled to remove your answers and information from the study database at any time.

NOTE: All questions marked with an asterisk (*) are required. Questions that are not marked with an asterisk are optional.

**Section 1: Your basic details**

1. Please state your age in years in the box provided

2. Please select your sex
   - [ ] Male
   - [ ] Female
   - [ ] Prefer not to say

3. Have you previously been diagnosed with SARS-CoV-2 or coronavirus disease 2019 (COVID-19)?
   - [ ] Yes
   - [ ] No

4. Have you previously received a COVID-19 vaccine dose?
   - [ ] Yes
   - [ ] No
Section 2: The COVID-19 vaccine offered to you

There are currently two vaccines against COVID-19 that are licensed for use in Ireland – ChAdOx1 nCoV-19 (AstraZeneca) and BNT162b2 (BioNTech/Pfizer). The type of COVID-19 vaccine available to a person in Ireland currently depends on their age and, in some cases, their medical history. You have recently accepted an offer of vaccination with ChAdOx1 nCoV-19 (AstraZeneca).

1. If given the choice, which of these two vaccines would you prefer to receive?
   - [ ] ChAdOx1 nCoV-19 (AstraZeneca)
   - [ ] BNT162b2 (BioNTech/Pfizer)
   - [ ] No preference

2. Are you satisfied with ChAdOx1 nCoV-19 (AstraZeneca) as your assigned vaccine?
   - [ ] Yes
   - [ ] No

3. Do you believe the ChAdOx1 nCoV-19 (AstraZeneca) vaccine is safe?
   - [ ] Yes
   - [ ] Not sure, but willing to proceed with vaccination anyway
   - [ ] No, but willing to proceed with vaccination anyway
Section 3: Your main reason for getting vaccinated

What was the single most important factor motivating you to accept the offer of vaccination with ChAdOx1 nCoV-19 (AstraZeneca)?

**NOTE: select only ONE answer**

- Afraid of severe illness or death due to COVID-19
- Want to return to work
- Want to socialize
- Want to travel
- Afraid of transmitting SARS-CoV-2 to another person or more vulnerable person
- Feel pressure from society† to get vaccinated
- Other (please specify in the box provided)

† For the purpose of this survey, “pressure from society” refers to pressure you may feel from your peers/social media/news outlets, and/or a fear of being judged by your peers.
Section 4: Other things you considered when making your decision

You have already selected the factor that influenced/motivated your decision to get vaccinated the most. However, some people may be motivated (to a lesser degree) by multiple additional factors.

Please list any additional factors that motivated you in the box provided:
Section 5: How you felt when making your decision

1. Did you feel pressure from your peers/social media/news outlets when making your decision to get vaccinated?*
   - Yes
   - No

2. Did you fear being judged by your peers if you decided not to get vaccinated?*
   - Yes
   - No

3. If you had a severe side-effect following a COVID-19 vaccine, would you feel comfortable reporting it?*
   - Yes
   - No

4. If you had a severe side-effect following a COVID-19 vaccine, would you be afraid of being described as “anti-vaccine” for reporting it?*
   - Yes
   - No

5. When making your decision to accept or decline vaccination with ChAdOx1 nCoV-19 (AstraZeneca), did you trust the information provided by the Irish government/Department of Health?*
   - Yes
   - No

6. When making your decision to accept or decline vaccination with ChAdOx1 nCoV-19 (AstraZeneca), did you trust the information provided by the Health Service Executive (HSE)?*
   - Yes
   - No
7. When making your decision to accept or decline vaccination with ChAdOx1 nCoV-19 (AstraZeneca), did you trust the information provided by the National Public Health Emergency Team (NPHET)?*
   - Yes
   - No

8. When making your decision to accept or decline vaccination with ChAdOx1 nCoV-19 (AstraZeneca), did you trust the information provided by your physician?*
   - Yes
   - No

9. If a safety issue with ChAdOx1 nCoV-19 (AstraZeneca) were to arise, would you trust the Irish government/Department of Health to disclose this information to you in an honest and transparent manner?*
   - Yes
   - No

10. If a safety issue with ChAdOx1 nCoV-19 (AstraZeneca) were to arise, would you trust the Health Service Executive (HSE) to disclose this information to you in an honest and transparent manner?*
    - Yes
    - No

11. If a safety issue with ChAdOx1 nCoV-19 (AstraZeneca) were to arise, would you trust the National Public Health Emergency Team (NPHET) to disclose this information to you in an honest and transparent manner?*
    - Yes
    - No

12. If a safety issue with ChAdOx1 nCoV-19 (AstraZeneca) were to arise, would you trust your physician to disclose this information to you in an honest and transparent manner?*
    - Yes
    - No
Section 6: Your vaccine history

1. Have you previously received the influenza (“flu”) vaccine?
   - Yes
   - No

2. Have you received a vaccine of any description in the past 5 years?
   - Yes
   - No

3. If you answered “Yes” to the previous question, please select which vaccines you received in the past 5 years from the following list (if you answered “No” to the previous question, please skip to question 4 in this section)
   - Influenza (“flu”) vaccine
   - Pneumococcal vaccine
   - Hepatitis A/Hepatitis B vaccine
   - Human papillomavirus (HPV) vaccine
   - Tetanus (“lockjaw”) vaccine
   - Rubella (“German measles”) vaccine
   - Haemophilus influenzae type B (HiB) vaccine
   - Herpes zoster (“shingles”) vaccine
   - Varicella (“chickenpox”) vaccine
   - Diphtheria, tetanus, and pertussis (“DTaP”) vaccine
   - Measles, mumps and rubella (“MMR”) vaccine
   - Yellow fever vaccine
   - Dengue vaccine
   - Polio vaccine
   - Other (please specify in the box provided)
4. Have you ever had an adverse event or side-effect following a vaccine?

☐ Yes
☐ No

If yes, please specify in the box provided:

Thank you for taking the time to complete this survey. If you have any questions or comments related to the content of the survey, please notify the study team member administering the survey, or alternatively contact the study co-ordinator at olivermcelvaney@rcsi.ie.