Social patterning and stability of COVID-19 vaccination acceptance in Scotland: Will those most at risk accept a vaccine?

Lynn Williams1, *, Paul Flowers1, Julie McLeod1, David Young1, Lesley Rollins1, and the CATALYST project team1

1 University of Strathclyde, Glasgow, UK

* Correspondence: lynn.williams@strath.ac.uk

Abstract: Vaccination is central to controlling COVID-19. Its success relies on having safe and effective vaccines and also on high levels of uptake by the public over time. Addressing questions of population-level acceptability, stability of acceptance and sub-population variation in acceptability are imperative. Using a prospective design, a repeated measures two-wave online survey was conducted to assess key sociodemographic variables and intention to accept a COVID-19 vaccine. The first survey (time 1) was completed by 3436 people during the period of national lockdown in Scotland and the second survey (n=2016) was completed two months later (time 2) when restrictions had been eased. At time one, 78% reported being willing to receive a COVID-19 vaccine. Logistic regression analyses showed that there were clear sociodemographic differences in intention to accept a vaccine for COVID-19 with intention being higher in participants of white ethnicity in comparison to Black, Asian, and minority ethnic (BAME) groups, and in those with higher income levels and higher education levels. Intention was also higher in those who were ‘shielding’ due to underlying medical conditions. Our results suggest that future interventions such as mass media and social marketing need to be targeted to a range of sub-populations and diverse communities.

Keywords: COVID-19; vaccination; vaccine hesitancy; interventions; social patterning; inequalities
1. Introduction

Vaccination will be vitally important in controlling future waves of the COVID-19 pandemic. Despite uncertainty regarding the specifics of potential vaccines (e.g. efficacy and required doses) and rollout in terms of priority access within the population, it is clear that high levels of overall public acceptance will be required. In recent years, vaccination rates have fallen and public confidence in vaccines is inconsistent [1]. In addition, preliminary evidence from the current pandemic suggests that a sizable proportion of the public are currently either undecided or unwilling to receive a future vaccine for COVID-19 [2, 3]. The importance of high levels of uptake was demonstrated in a recent study which suggests that in order to “extinguish an ongoing epidemic”, the efficacy of a vaccine as the sole intervention needs to be at least 80% when uptake is at 75%. If uptake is lower than this then an even more efficacious vaccine would be needed [4].

A recent global survey from Ipsos MORI [5], conducted in July and August 2020, of 20,000 adults from 27 countries found that 74% of people would get a vaccine if it was available. However, only 37% strongly agree that they would want to get it, while 37% somewhat agree. Large variations in acceptance levels were also shown across countries, ranging from 97% in China, to 54% in Russia. The primary reason that people gave for not wanting to accept the vaccine was worry about the side effects, followed by concern about the effectiveness of a vaccine, and not feeling at risk of contracting COVID-19 [5].

Emerging research also suggests that particular sub-populations have lower acceptance intentions. In France, during late March 2020, 26% of the sample reported that they would not accept a vaccine. COVID-19 vaccination hesitancy was more prevalent in those with low income, young women, and among older adults aged 75+, and it was associated with political views [6]. In Australia, more positive views were reported in April shortly after the introduction of lockdown, with 4.9% stating they would not get the vaccine, and 9.4% stating indifference. Here, COVID-19 vaccination hesitancy was associated with lower education levels and health literacy, and the belief that the threat of
COVID-19 had been exaggerated [7]. A study conducted two months later in Australia, when restrictions had been eased, found that those who were unwilling or unsure about accepting a COVID-19 vaccine had increased by 10% [2], suggesting that COVID-19 vaccination levels may fluctuate depending on the context of infection rates and restrictions. A further study from the US reports an acceptance level of 67% and found that acceptance levels were lower in unemployed participants and in Black American participants [3].

Together, these initial studies suggest that COVID-19 vaccine acceptance differs both across countries and in different sub-populations within countries. The research to-date has been based on cross-sectional designs and has not yet explored how intention to accept a COVID-19 vaccine may change in line with rates of infection or lockdown restrictions. We explored this question of intention to vaccinate against COVID-19 in a prospective survey in Scotland at two time points (during national lockdown and during the easing of restrictions). The present study has three key research questions (RQs):

RQ1: What proportion of people would accept a vaccine for COVID-19?

RQ2: Is COVID-19 vaccine acceptance stable over time in the context of different infection levels and restrictions?

RQ3: What socio-demographic factors are associated with intention to accept a future vaccine for COVID-19?

2. Materials and Methods

The present study consisted of an online survey at two time points. The first survey (time one) was conducted during lockdown restrictions (20th May-12th June 2020, weeks 9-12 of national lockdown). The second survey (time two) was conducted two months later (during August 2020) when lockdown restrictions in Scotland had been eased and there was little community transmission. Ethical approval was received from the University Ethics Committee prior to
commencement of the study. The data reported here are part of the larger CATALYST project which
examined the changes that people had experienced during lockdown.

2.1. Participants and procedure

3436 participants (79% female) residing in Scotland, aged over 18, were recruited for the current
study. The sample was comprised of participants aged between 18 and 92 ($M = 46.21$, $SD = 15.26$).

For time one, participants were recruited with convenience sampling through advertisements on
social media, including Facebook and Twitter, which directed participants to Qualtrics where they
could access the online questionnaire. Included in the survey for time one was an information sheet
and consent form which participants read and signed before completing the survey. For time two,
participants were re-contacted via email and provided with a Qualtrics link to the online
questionnaire, inviting them to take part at time two. Of the original sample, 2016 participants took
part at time 2, representing a 59% follow-up rate. Participant socio-demographic characteristics
from time one and time two are shown in Table 1.
Table 1. Sociodemographic and health variables for the sample at time 1 and time 2

| Variables                  | Time 1 |   | Time 2 |   |
|----------------------------|--------|---|--------|---|
| **Age**                    |        |   |        |   |
| 18-49                      | 1847   | 53.8 | 974    | 48.3 |
| 50+                        | 1578   | 45.9 | 1034   | 51.5 |
| **Gender**                 |        |   |        |   |
| Female                     | 2719   | 79.1 | 1632   | 82.1 |
| Male                       | 666    | 19.4 | 355    | 17.9 |
| **Ethnicity**              |        |   |        |   |
| White                      | 3308   | 96.3 | 1949   | 96.7 |
| BAME                       | 101    | 2.9  | 52     | 2.6  |
| **Household Income**       |        |   |        |   |
| <£16,000                   | 334    | 9.7  | 196    | 9.7  |
| £16,000 - £29,999          | 611    | 17.8 | 348    | 17.3 |
| £30,000 - £59,999          | 1203   | 35.0 | 717    | 35.6 |
| £60,000+                   | 902    | 26.3 | 519    | 25.7 |
| **Education Level**        |        |   |        |   |
| No quals/left school 16    | 168    | 4.9  | 77     | 3.8  |
| High School/College        | 780    | 22.7 | 439    | 21.8 |
| University                 | 2435   | 70.9 | 1467   | 72.8 |
| **High risk/Shielding**    |        |   |        |   |
| Yes                        | 508    | 14.8 | 316    | 15.7 |
| No                         | 2855   | 83.1 | 1677   | 83.2 |

Note. % calculations includes missing data

2.2. Questionnaire

2.2.1 Demographics and Health

Participants provided self-reported sociodemographic and health data at time one for the following variables: age (18-49, 50+); gender (female, male); ethnicity (white, BAME); annual household income (<£16,000, £16,000 – £29,999, £30,000 - £59,999, £60,000+); level of education (no qualifications/left school at 16, high school/college, university) and risk group/shielding status (i.e. those who had been classified as high risk based on underlying health conditions or age) (yes/no).

2.2.2 COVID-19 vaccination intention

Intention to be vaccinated for COVID-19 was measured by self-report at time one and again at time two. Participants were asked “If a vaccine for Coronavirus (Covid-19) becomes available, would you
want to receive it?” and provided response options “I definitely would not want to receive it”, “I probably would not want to receive it”, “Unsure”, “I probably would want to receive it” and “I definitely would want to receive it”.

2.3. Statistical Analysis

The COVID-19 vaccination intention response options of “I definitely would not want to receive it”, “I probably would not want to receive it”, and “Unsure” were coded as “Vaccine Hesitant” and the options “I probably would want to receive it” and “I definitely would want to receive it” were coded as “Vaccine Willing” to create dichotomous “willing” versus “hesitant” variables. Frequency responses to the vaccination intention questions were calculated (RQ1). In addition, a McNemar’s test was used to examine any changes in vaccine willingness across the two time points from lockdown (time 1) to the easing of restrictions (time 2) for those participants who completed the survey at both time points (RQ2). Univariate and multivariate logistic regression analyses were carried out to examine the socio-demographic factors associated with COVID-19 vaccination intention at time 1 (we selected time 1 intention as the dependent variable in order to maximise sample size) (RQ3). All analyses were conducted using IBM SPSS Statistics (version 25) at 5% significant levels.

3. Results

3.1. RQ1: What proportion of people would accept a vaccine for COVID-19?

A frequency analysis of the proportion of participants that reported willingness and hesitancy to accept a COVID-19 vaccine across the two time points are shown in Table 2. At time 1, 78% of participants were willing to receive a COVID-19 vaccine, and at time 2 this figure was slightly higher at 81% (the % figures in Table 2 below are slightly different as they reflect only those participants who completed the survey at both time points).
3.2. RQ2 – Is COVID-19 vaccine acceptance stable over time in the context of different infection levels and restrictions?

Table 2 presents the results relating to stability of COVID-19 vaccination intention for those participants who completed the questionnaire at both time points. McNemar’s test on these participants showed that there had been a significant shift in vaccine intention over time, \( p = .037 \).

Of the 56 participants who reported that they definitely would not want vaccinated at time 1, 14 (25%) reported that they would now accept the vaccine. Of the 274 who were unsure, 106 (38.6%) reported at time 2 that they would now accept the vaccine. Of the 995 people who initially definitely would want vaccinated, 7.2% would now not take it.

Table 2. Intention to accept a COVID-19 vaccine at time 1 and time 2

| COVID-19 vaccine intention | Time 1 (national lockdown) | Time 2 (easing of restrictions) |
|----------------------------|-----------------------------|---------------------------------|
| N                          | %                           | N                               | %                       |
| I definitely would not want to receive it | 56 3% | 49 3% |
| I probably would not want to receive it | 74 4% | 94 5% |
| Unsure                     | 274 14%                     | 235 12%                        |
| I probably would want to receive it | 628 32% | 622 31% |
| I definitely would want to receive it | 955 48% | 987 50% |
| Vaccine Hesitant           | 404 20%                     | 378 19%                        |
| Vaccine Willing            | 1583 80%                    | 1609 81%                       |

3.3. RQ3: What socio-demographic and health factors are associated with intention to accept a future vaccine for COVID-19?

As shown in Table 3, univariate logistic regression analyses showed that there was a significant effect of gender, ethnicity, education level, household income and high risk/shielding status on intention to accept a COVID-19 vaccine. There was no effect of age on intention to accept a COVID-19 vaccine. In relation to gender, males reported higher levels of intention than females. We also found that participants of white ethnicity had higher levels of intention than those from BAME groups. In relation to education, those with higher levels of education had higher levels of intention to receive...
the vaccine. In addition, with regards to household income, those with higher levels of annual household income had higher intention levels than those with lower income levels. Finally, those participants at high risk or in the shielding category had higher levels of intention than those not in this group.

Table 3. Univariate analysis of socio-demographic factors and intention to accept a COVID-19 vaccine

| Variable                | p-value | Comparison                        | Coefficient | p-value |
|-------------------------|---------|-----------------------------------|-------------|---------|
| Age                     | .122    | 50+ vs. 18-49                     | 0.87        | -       |
| Gender                  | .040    | Male vs. Female                   | 1.26        | -       |
| Ethnicity               | .005    | White vs. BAME                    | 1.87        | -       |
| Education               | <.001   | High school/College vs. No qualifications/left at 16 | 1.90 | .001 |
|                         |         | University vs. No qualifications/left at 16 | 2.55 | <.001 |
| Household income        | <.001   | £16000 - £29999 vs. <£16000       | 1.15        | .378    |
|                         |         | £30000 - £59999 vs. <£16000       | 1.71        | <.001   |
|                         |         | £60000+ vs. <£16000               | 2.12        | <.001   |
| High risk/Shielding     | .022    | Yes vs. No                        | 1.34        | -       |

For the multivariate logistic regression we entered those variables that were significant in the univariate analysis (i.e. gender, ethnicity, education, household income, and high risk/shielding). All factors remained significantly associated with intention to receive a COVID-19 vaccine in the multivariate analysis. When considering the coefficients (see Table 4), those participants of white ethnicity are almost twice as likely to accept a COVID-19 vaccine compared to those from BAME groups. Similarly, those from the highest education group are two and a half times more likely than those from the lowest education group to accept it, and those in the highest income group are twice as likely to accept the vaccine compared to those in the lowest income group. In addition, men are 1.26 times more likely to accept the vaccine than women, and those in a high risk/shielding group are 1.34 times more likely to accept a COVID-19 vaccine than those not in a high risk/shielding group.
Table 4. Multivariate analysis of socio-demographic factors and intention to accept a COVID-19 vaccine

| Variable              | p-value | Comparison                                | Coefficient | 95% CI        | p-value |
|-----------------------|---------|-------------------------------------------|-------------|--------------|---------|
| Gender                | .037    | Male vs. Female                           | 1.30        | 1.02-1.65    | -       |
| Ethnicity             | .002    | White vs. BAME                            | 2.11        | 1.32-3.39    | -       |
| Education             | <.001   | High school/College vs. No qualifications/left at 16 | 1.74        | 1.16-2.62    | .007    |
|                       |         | University vs. No qualifications/left at 16 | 2.13        | 1.45-3.12    | <.001   |
| Household income      | <.001   | £16000 - £29999 vs. £16000                | 1.09        | 0.79-1.49    | .602    |
|                       |         | £30000 - £59999 vs. £16000                | 1.61        | 1.20-2.17    | .002    |
|                       |         | £60000+ vs. £16000                        | 2.04        | 1.48-2.81    | <.001   |
| High risk/Shielding   | <.001   | Yes vs. No                                | 1.69        | 1.26-2.25    | -       |

Discussion

The present study is the first to examine intention to accept a COVID-19 vaccine in Scotland. The study also extends existing research that has examined acceptance levels in other countries by adopting a prospective design, allowing us to examine stability in vaccine intentions over time. We found that 78% of the sample at time 1 intended to receive a COVID-19 vaccine (during the period of national lockdown). Interestingly, two-months later, intention levels had shifted significantly. The greatest shift in intention levels was apparent in the group who were “Unsure” at time one, with 39% of those participants now saying they would accept a vaccine. The second survey was carried out when restrictions had been eased and there was little transmission of COVID-19, it is therefore notable that intention to receive a COVID-19 vaccine was still high at this time. Stability in intention to receive a COVID-19 vaccination will be particularly important given that two doses of the vaccine are likely to be needed over time.

Our findings suggest that although the majority of respondents in Scotland indicated that they would want to receive a COVID-19 vaccine, there is a sizable minority of the public who were hesitant about receiving a vaccine, mirroring the overall picture that is emerging from other countries.
Indeed, the intention levels reported here are similar to those emerging globally from the recent Ipsos survey in which 74% of people overall said they would get a COVID-19 vaccine [5].

We also found that intention to accept a COVID-19 vaccination varied by sub-population. There was a significant effect of gender, ethnicity, education level, household income and high risk/shielding status on intention to accept a COVID-19 vaccine. Of particular note, those of white ethnicity are almost twice as likely to accept a COVID-19 vaccine compared to those from BAME groups, those from the highest education group are two and a half times more likely than those from the lowest education group to accept it, and those in the highest income group are twice as likely to accept the vaccine compared to those in the lowest income group.

Overall, those most at risk of the negative sequelae of COVID-19 had less intentions to get vaccinated than those at lower risk [8]. For example, intention was higher in participants of white ethnicity in comparison to BAME groups. However, it should be noted that this binary approach to looking at differences in ethnicity is problematic, as it may mask important differences between diverse racialised and minoritised communities with distinct cultures and social norms. We also found that intentions for vaccination were higher in those with higher levels of income, again raising questions about why those most likely to suffer the negative consequences of COVID-19 would be the least likely to intend to vaccinate. These findings fit with the emerging literature on COVID-19 vaccine acceptance which suggests that those from BAME groups may be less likely to accept a vaccine [3] and that COVID-19 vaccine hesitancy is more prevalent in those with lower income [6]. If these inequalities in intention translate into uptake then these findings are very important as they suggest the likelihood that vaccination programmes, unless implemented with targeted and tailored interventions to enhance vaccination rates, may actually amplify existing inequalities. More positively, intention to accept a COVID-19 vaccine was higher among those who were shielding (i.e. those who had been classified as high risk based on underlying health conditions or age).
Together, these initial studies highlight the need for government and public health bodies to think carefully about how to approach their publics with further demands for behavioural change (i.e., uptake of a COVID-19 vaccine). The findings here suggest, for example, that a ‘one size fits all’ approach to mass media interventions represents at best a partial solution to increasing vaccination uptake and at worst, a solution that backfires, amplifying existing inequalities. These findings suggest that future interventions need to be targeted to a range of sub-populations and diverse communities [9]. The range of interventions should offer different kinds of educational, persuasive or enabling approaches [10] to different groups of people and there is growing recognition that such interventions should be co-produced. Issues of visual cultural representation, identifiable local key opinion leaders, readability and reading levels, and trust will all be important considerations. These emerging findings also lend themselves to considering the wider opportunities to targeting afforded by social media. Whilst marketing and politics are capitalising on these new opportunities, it is less clear if and how public health can do so. Equally these initial findings also suggest that health care professionals should be trained to anticipate and respond to diverse segments of the population differently with overt and inclusive demonstrations of cultural competencies.

If we imagine a future of targeted interventions to improve COVID-19 vaccination uptake, it is also important to focus now on the granularity of messaging that will shortly be needed. Whilst evidence is emerging concerning where and amongst whom interventions need to be targeted, it is currently unclear how intervention content should be tailored to these populations and communities and their particular beliefs. We need to use the full range of social and behavioural sciences now to address this key gap and ensure that when viable vaccines do become available we are prepared and ready to support the whole population in gaining maximum benefit from them. One preliminary study in this area used the Behaviour Change Wheel [11] to provide recommendations for the design of interventions aimed at maximising public acceptance of COVID-19 vaccine. The findings suggested that interventions should utilise the behaviour change techniques [12] of information about health, emotional, social and environmental consequences, and salience of consequences in order to
provide the public with information about the beneficial consequences for themselves and for others [13]. Further, more in-depth research like this which focuses on intervention development is required.

Strengths of the current study include the large sample size, the use of two waves of data collection to examine stability in COVID-19 vaccination intention and the inclusion of a range of sociodemographic factors to allow us to understand the social patterning of COVID-19 vaccination acceptance. However, it is important to note that the study is not nationally representative, and some groups are under-represented in the study. Furthermore, we experienced a participant drop-out rate of 41% from time one to time two meaning that we cannot draw any conclusions about the change in COVID-19 vaccination intention in those participants who were lost at follow-up. In addition, participants were answering about their intention to accept a hypothetical COVID-19 vaccine, without information regarding the specifics of the vaccine in terms of number of doses needed, potential side-effects, or prioritisation of delivery across the population. All of which may influence eventual uptake of a COVID-19 vaccination.

5. Conclusions

Intention to accept a COVID-19 vaccine is currently high in Scotland and our findings suggest that intention to receive the vaccine did not fall in the context of lower infection rates and fewer restrictions. However, the data also point to a sizable minority of the public who are hesitant about receiving a future COVID-19 vaccine. Of note, intention was higher in participants of white ethnicity in comparison to those from BAME groups, and in those with higher levels of income and education. Our findings and those from other studies suggest that future interventions need to be targeted to a range of sub-populations and diverse communities. To do so, we need to better understand the barriers to vaccination in these groups so that we can collectively be better prepared to deliver appropriate evidence-based culturally and community-appropriate messaging aimed at maximising COVID-19 vaccine uptake.
**Author Contributions:** Conceptualization, L.W. and P.F; methodology, L.W and L.R.; formal analysis, J.M and D.Y.; investigation, L.R; writing—original draft preparation, L.W., P.F., J.M.; writing—review and editing, all authors.; funding acquisition, L.W and P.F. All authors have read and agreed to the published version of the manuscript. The CATALYST project team: Leanne Fleming, Xanne Janssen, Alison Kirk, Madeleine Grealy, Bradley MacDonald.

**Funding:** This research was funded by the Chief Scientist Office in Scotland (Ref COV/SCL/20/09).

**Conflicts of Interest:** The authors declare no conflict of interest. The funders had no role in the design of the study; in the collection, analyses, or interpretation of data; in the writing of the manuscript, or in the decision to publish the results.

**References**

[1] de Figueiredo, A.; Simas, C.; Karafillakis, E.; Paterson, P.; Larson, H.J. Mapping global trends in vaccine confidence and investigating barriers to vaccine uptake: a large-scale retrospective temporal modelling study. *Lancet* **2020**, *396*, 898-908. [https://doi.org/10.1016/S0140-6736(20)31558-0](https://doi.org/10.1016/S0140-6736(20)31558-0)

[2] Rhodes, A.; Hoq, M.; Measey, M-A.; Danchin, M. Intention to vaccinate against COVID-19 in Australia. *Lancet Infect Dis* **2020**. [https://doi.org/10.1016/S1473-3099(20)30724-6](https://doi.org/10.1016/S1473-3099(20)30724-6)

[3] Malik, A.M.; McFadden, S.M.; Elharake, J.; Omer, S.B. Determinants of COVID-19 vaccine acceptance in the US. *EClinical Medicine* **2020**. [https://doi.org/10.1016/j.eclinm.2020.100495](https://doi.org/10.1016/j.eclinm.2020.100495)

[4] Bartsch, S.M.; et al. Vaccine efficacy needed for a COVID-19 coronavirus vaccine to prevent or stop an epidemic as the sole intervention. *Am J Prev Med* **2020**, *59*, 493-503. [https://doi.org/10.1016/j.amepre.2020.06.011](https://doi.org/10.1016/j.amepre.2020.06.011)

[5] IPSOS MORI: News Three in four adults globally say they would get a vaccine for COVID-19. Available online: [https://www.ipsos.com/ipsos-mori/en-uk/three-four-adults-globally-say-they-would-get-vaccine-covid-19](https://www.ipsos.com/ipsos-mori/en-uk/three-four-adults-globally-say-they-would-get-vaccine-covid-19) (accessed on 10th November 2020).
[6] The COCONEL Group. A future vaccination campaign against COVID-19 at risk of vaccine hesitancy and politicisation. *Lancet Infect Dis* **2020**, *20*, 769–70. [https://doi.org/10.1016/s1473-3099(20)30426-6](https://doi.org/10.1016/s1473-3099(20)30426-6)

[7] Dodd, R.H.; Cvejic, E.; Bonner, C.; Pickles, K.; McCaffery, K.J.; Sydney Health Literacy Lab COVID-19 group. Willingness to vaccinate against COVID-19 in Australia. *Lancet Infect Dis* **2020**. [https://doi.org/10.1016/S1473-3099(20)30559-4](https://doi.org/10.1016/S1473-3099(20)30559-4)

[8] Office for National Statistics Deaths involving COVID-19 by local area and socioeconomic deprivation: deaths occurring between 1 March and 31 July 2020. Available online: [https://www.ons.gov.uk/peoplepopulationandcommunity/birthsdeathsandmarriages/deaths/bulletins/deathsinvolvingcovid19bylocalareasanddeprivation/deathsoccurringbetween1marchand31july2020](https://www.ons.gov.uk/peoplepopulationandcommunity/birthsdeathsandmarriages/deaths/bulletins/deathsinvolvingcovid19bylocalareasanddeprivation/deathsoccurringbetween1marchand31july2020) (accessed on 12th November 2020).

[9] Dube, E.; Leask, J.; Wolff, B.; Hickler, B.; Balaban, V.; Hosein, E.; Habersaat, K. The WHO Tailoring Immunization Programmes (TIP) approach: Review of implementation to date. *Vaccine* **2018**, *36*, 1509-1515. [https://doi.org/10.1016/j.vaccine.2017.12.012](https://doi.org/10.1016/j.vaccine.2017.12.012)

[10] Dube, E.; Gagnon, D.; MacDonald, N.E.; the SAGE Working Group on Vaccine Hesitancy. Strategies intended to address vaccine hesitancy: Review of published reviews. *Vaccine* **2015**, *33*, 4191-4203. [https://doi.org/10.1016/j.vaccine.2015.04.041](https://doi.org/10.1016/j.vaccine.2015.04.041)

[11] Michie, S.; Stralen, M. M.; West, R. The behaviour change wheel: A new method for characterising and designing behaviour change interventions. *Implement Sci* **2011**, *6*, 42. [https://doi.org/10.1186/1748-5908-6-42](https://doi.org/10.1186/1748-5908-6-42)

[12] Michie, S.; Richardson, M.; Johnston, M.; Abraham, C.; Francis, J.; Hardeman, W.; . . . Wood, C. E. (2013). The behavior change technique taxonomy (v1) of 93 hierarchically clustered techniques: Building an international consensus for the reporting of behavior change interventions. *Ann Behav Med* **2013**, *46*, 81–95. [https://doi.org/10.1007/s12160-013-9486-6](https://doi.org/10.1007/s12160-013-9486-6)
[13] Williams, L.; Gallant, A.J.; Rasmussen, S.; Brown Nicholls, L.A.; Cogan, N.; Deakin, K.; Young, D.;
Flowers, P. Towards intervention development to increase the uptake of COVID-19 vaccination
among those at high risk: Outlining evidence-based and theoretically informed future intervention
content. *Br J Health Psychol* 2020, 25, 1039-1054. https://doi.org/10.1111/bjhp.12468