An Roinn Sláinte
Department of Health

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Review of international evidence on beliefs and intentions with regard to uptake of COVID-19 vaccines

A research paper produced for the COVID-19 Communications and Behavioural Advisory Group, 2021

Contents

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This is a collaboration between the University of Limerick (Prof Orla Muldoon, Dr. Daragh Bradshaw, Dr. Sarah Jay, Dr. Elaine Kinsella, Dr. Paul Maher) and the Research Services and Policy Unit, Department of Health (Mr Robert Murphy, Dr. Carol Taaffe)

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Executive Summary

Mass vaccination has a vital role to play in ending the COVID-19 pandemic. As COVID-19 vaccines become available to the general adult population in Ireland, personal attitudes will become an increasingly important factor in the success of the vaccination programme. This report reviews the international evidence on beliefs and intentions around COVID-19 vaccines to better support vaccine uptake.

Key messages for policy and communications:

1. Reported vaccination intention rates in OECD countries (60-80%) suggest uptake will need to be promoted and supported; previous research suggests that a vaccination rate of 75-90% is needed to achieve herd immunity.
2. There are significantly lower intentions for sub-groups, most commonly women, younger people and those with lower levels of education.
3. Variation in intentions appears to be linked to trust or lack of trust in government and health professionals, vaccine history, and perceived impact of vaccine on national/community life.

Recommendations for research:

1. Using common questions and responses will help with comparative findings.
2. Models should examine how demography and psychological factors are additive/ interactive in predicting intentions to vaccinate.
3. Studies should include questions about prior vaccine history to consider its role as a determinant of other vaccination intentions.
4. Countries with opinion polls could usefully add to understanding of vaccine uptake by modelling these relationships.

This report includes peer-reviewed studies published up to and including December 2020 and does not include public opinion surveys not found in databases of peer-reviewed literature, for example, the Amárach public opinion survey which is updated on a weekly basis.

Introduction

Mass vaccination has a vital role to play in ending the COVID-19 pandemic. The initial rollout of the vaccination programme among older people in Ireland was limited primarily by availability and distribution, with reports of over 99% acceptance among older cohorts offered the vaccine.[1] However, as COVID-19 vaccines become available to the general adult population, personal attitudes will become an increasingly important factor in the success of the programme. This report reviews the international evidence on beliefs and intentions around COVID-19 vaccines to better support vaccine uptake among the wider population in Ireland.

To that end, this review addresses the following questions:

- What are the uptake intentions and beliefs around COVID-19 vaccines in OECD countries?
- Are subgroups and demographic variation associated with different views?
- What factors are driving, or predictive of, vaccination intentions?

Method

A systematic search was undertaken of Web of Science (all databases), PsycINFO (no restrictions) and PubMed (no restrictions) on 4th of January 2021 using the search string below. The search was confined to studies published between January and December 2020.

> *(vaccine* OR *immunis*) AND (survey* OR sampl* OR questionnaire*) AND (attitude* OR belief* OR inten* OR behave* OR hesitan* OR reject* OR anti* OR trust* OR psychological*) AND (COVID-19 OR SARS-CoV-2 OR "coronavirus disease 2019")*

The studies included were surveys carried out in OECD countries. Excluded studies addressed only child vaccination or were carried out below the country/ region level. The screening profile is shown in Figure 1. This review includes 18 studies carried out in single nations including France, Italy, Turkey, the UK, USA, Australia, Israel, and 4 studies using pooled cross-national data from Austria, Bosnia and Herzegovina, Canada, Croatia, Czech Republic, Denmark, Finland, France, Germany, Greece, Hungary, Ireland, Italy Latvia, Lithuania, Mexico, Montenegro, Netherlands, Norway, Poland, Portugal, Romania, Russia, Slovakia, Spain Sweden, Turkey, UK, Ukraine and USA.

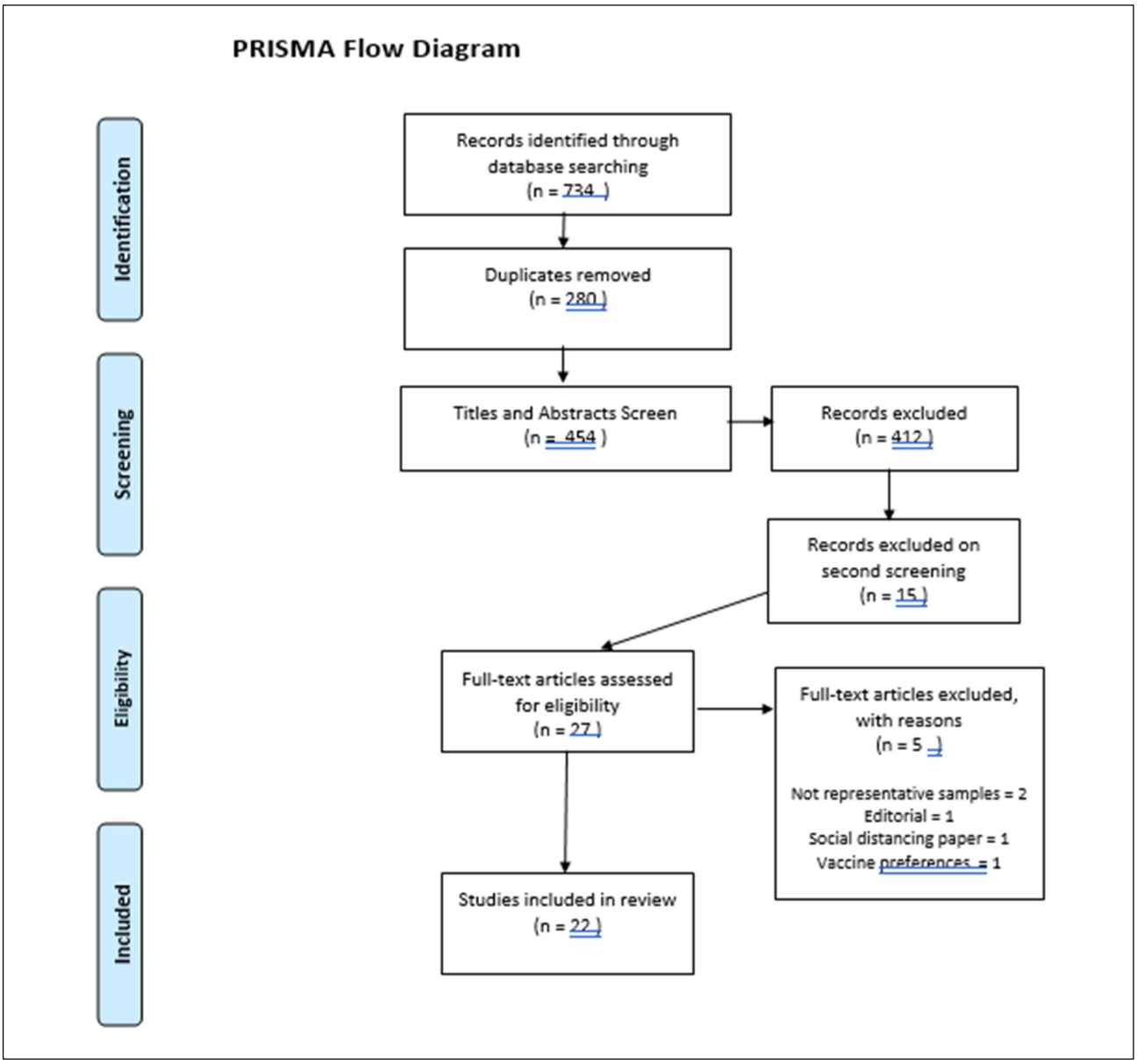
In preparing this report, the authors followed the Irish Government Economic and Evaluation Service (IGEES) quality assurance process, seeking feedback on the analysis

[1] https://www.breakingnews.ie/ireland/over-99-have-accepted-offer-to-receive-covid-vaccine-says-hse-1073137.html

format (structure); clarity (quality of writing); accuracy (reliability of data); robustness (methodological rigour); and consistency (between evidence and conclusions). The report was circulated for review to the following:

- Internal/ Departmental
    - Line management – Research Services and Policy Unit
- Internal/ External
    - COVID-19 Communications and Behavioural Advisory Group.

Figure 1

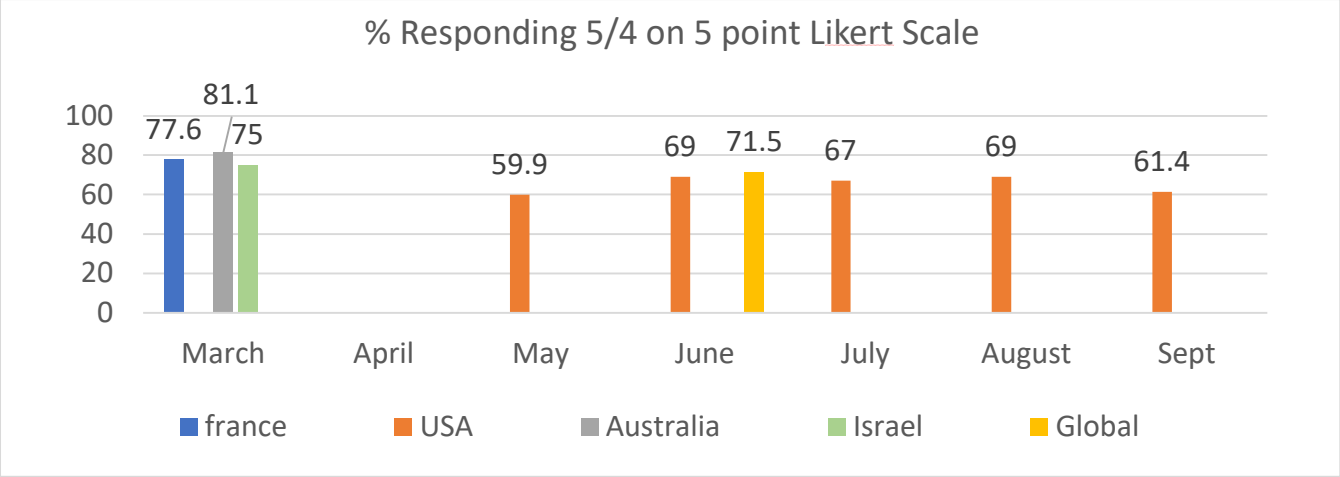


1. Take-up intentions for COVID-19 vaccines

Typically, the proportion of respondents who intend to 'definitely' or 'possibly' vaccinate is between 60-80%. However, in determining intentions to take a COVID-19 vaccine it must be noted that comparability across studies is limited by different questions, different response options and incomplete reporting. Some of the variability is to do with response format and some is due to the question asked. For example, questions such as 'If a COVID-19 vaccine that is proven safe and effective is available to me, I will take it' and "Do you intend to take a vaccine should it become available' are likely to elicit different responses.

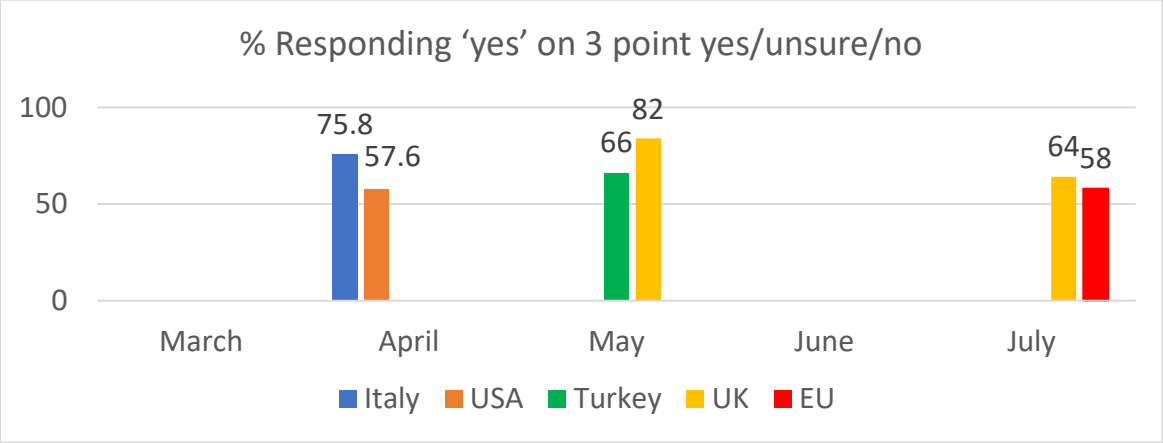
In Figures 2 and 3 we have findings when the most common five-point response options (8 papers) and three-point response options (6 papers) are used.[2]

Figure 2



[2] Two additional papers use a four-point response format; another a two-point response format (yes/no); another a seven-point response format; and a final paper has an option that allows respondents to indicate if they would only take the vaccine if it were free. Five papers also use a five-point response format but offer no breakdown of results.

Figure 3



Previous research suggests that approximately 75-90% uptake is needed to achieve herd immunity presuming a vaccine efficacy of 80%.[3] If the proportion who intend to 'definitely' or 'possibly' vaccinate is between 60-80%, this suggests that herd immunity is achievable with supportive action. However, the intention-action gap also needs to be taken into consideration. This is generally estimated to reduce by 15-48% the conversion of intentions into actions.[4]

[3] Anderson, R. M., Vegvari, C., Truscott, J., & Collyer, B. S. (2020). Challenges in creating herd immunity to SARS-CoV-2 infection by mass vaccination. The Lancet, 396(10263), 1614-1616.

[4] Bish, A., Yardley, L., Nicoll, A., & Michie, S. (2011). Factors associated with uptake of vaccination against pandemic influenza: a systematic review. Vaccine, 29(38), 6472-6484.
Rhodes, R. E., & de Bruijn, G. J. (2013). How big is the physical activity intention–behaviour gap? A meta-analysis using the action control framework. British journal of health psychology, 18(2), 296-309.
Schmid, P., Rauber, D., Betsch, C., Lidolt, G., & Denker, M. L. (2017). Barriers of influenza vaccination intention and behavior–a systematic review of influenza vaccine hesitancy, 2005–2016. PloS one, 12(1), e0170550.

2. Reasons for willingness and unwillingness to vaccinate

The reasons for willingness to vaccinate are presented in Table 1. The three most frequent reasons are: vaccine efficacy and evidence of testing; protection of self and others; knowledge of the vaccine.

Table 1 Reasons or factors for Willingness to Vaccinate

Nature of reason or factor	No. of studies where factor was identified
Efficacy and evidence of clinical testing	4
Protection of self, family and others	3
Knowledge/ vaccine literacy	3
Prior flu vaccine	2
Health care recommendation	2
Trust in government	2
Trust in science	1
Voluntary programs	1
Confidence in health care professionals	1
Communication from reliable sources of information	1

The reasons for unwillingness to vaccinate are presented in Table 2. The three most frequent reasons are: concerns about side effects; conspiracy beliefs; belief of rushed vaccine development.

Table 2 Reasons or factors for Unwillingness to Vaccinate

Nature of reason or factor	No. of studies where factor was identified
Concerns about side effects	5
Conspiracy beliefs	4
Belief in rushed testing and development	3
History of previous vaccine hesitancy	2
Lack of Trust in government agencies	2
Safety concerns about the vaccine	2
Fear of needles	1
Employer mandated vaccination programmes	1
Pregnancy	1
Religiosity	1
Lack of proper information	1

Trust is a cross-cutting feature of responses on both sides, whether it is trust in government, agencies, or science and healthcare professionals.

3 Group differences in intention to vaccinate

Where group differences were explored the findings were remarkably consistent. This is shown in Table 3.

- Men, older people, higher educated, higher income and majority ethnic groups had more positive intentions.
- The pattern of findings comparing health care workers to other occupations was inconsistent.
- Willingness to vaccinate one's children was lower than willingness to vaccinate oneself (asked in only three studies).

Table 3

Group	Pattern of intention to vaccinate	Pattern reported		Not reported
		Statistical Difference	No statistical difference	
Gender	M>F	14	6	3
Age	Older>Younger	12	1	10
Income	Hi>Lo	11	0	12
Education	More>Less	13	2	8
BME	Majorities>Ethnic Minority	9	4	12
Occupation	In 3 studies HCW>Other Occupation In 1 study Other> HCW	4	2	17
Previous flu vaccine	Had flu jab>Had never had flu vaccine	2	1	20

4 Models to predict vaccination intentions

Subgroup analysis shows some predictors of vaccination intentions. Papers typically reported difference at 5% significance level, though many were significant at the more stringent 1% level. Significant predictors are age (12 of 13 studies), gender (11 of 15 studies) and education (8 of 11 studies). The pattern appears more variable for race/ ethnicity (6 of 10 studies) and income level (3 of 5 studies).

Though many reasons were cited for (un)willingness to vaccinate, studies also directly tested if psychological and other predictors are also significant in indicating vaccination intentions:

- Trust in government, science and HCWs are usually predictors (8 of 9 studies)
- Vaccine history is an important predictor (5 of 5 studies)
- Impact on nation or community is a consistent predictor (3 of 3 studies)
- Worry, anxiety, and perceived personal fear or risk of COVID-19 are more often than not predictive of vaccine intentions (7 of 10 studies)
- Knowledge is predictive in only 1 of 4 studies[5]
- Conspiracy belief/ susceptibility to misinformation is predictive in 2 of 2 studies.

See Table 4 for tested models predicting vaccination intentions.

[5] Though knowledge was often offered by respondents as a determinant of vaccination intentions, statistical models showed that other factors were usually more important determinants of vaccination intentions and that this factor was a comparatively weak predictor of vaccination intentions.

Table 4 Tested models predicting vaccination intentions

Study N	Significant predictors	Non-significant predictors in final model	Additional significant predictors	Method
3	Fear of COVID19 (+)[5] Individual perceived risk (+) History of vaccine hesitancy and non-uptake (-)	Chronic medical condition	Age, gender, HCW	Ordinal regression models
4	Conspiracy belief endorsement (-)	Knowledge, Medical mistrust, age, race	Gender, education	Logistic and linear regression
5	Concern about outbreaks (+) belief in science (+) confidence in government (+) knowledge about illness (+)	Ethnicity, education, self-rate health, exposure to media coverage, likelihood of infection, severity of illness, perceived effectiveness.	Gender age, flu vaccine history	Ordinal logistic regression
6	Perceived personal risk (+), had has flu vaccine (+)	Self-rated health	Age, gender, race, income, education	Multinomial logistic regressions
8	Norms (+), attitudes (+) susceptibility (+) benefits (+) barriers (-), self-efficacy or self- belief in their ability to take the vaccine (+)	Gender, political leaning, religiosity, behavioural control, perceived severity	Race, education, insurance	Hierarchical linear regression
9	Altruism (+), perceived threat of COVID (+) Covid perceived as a major community problem (+) worries about covid (+) received a flu vaccine (+)	Relationship status, children in home, employment status, ever received a COVID test, underlying condition	Age, race, Education, employed in health care (-), political liberalism. Gender not included in the main model but had a sig relationship	Hierarchical multiple Linear regression

5 A positive sign (+) indicates predicts positive relationship with intention to vaccinate; a negative sign (-) indicates predicts negative relationship with intention to vaccinate.

Study N	Significant predictors	Non-significant predictors in final model	Additional significant predictors	Method
11	Trust in government (+) x nation comparison	COVID19 in friends or family	Age, gender, income, education	Univariate regression to predict willingness
14	Confidence in healthcare professionals, own physician, CDC, state and local health departments.	N.A.	Age, race, education, gender	Logit model
16	Religiosity had a direct effect (-) on vaccine intentions and indirect effect through Health locus of control	No other variables entered in model	No other variables entered in model	Mediation model
17	Vaccine History (+), Perceived impact of COVID19 on America (+)	Understanding, knowledge; know people with COVID, income, political lean	None reported	SEM
18	Worry about COVID 19 (+), institutional trust (+)	Beliefs origin of virus, gender, ethnicity and employment status	Age	Multinomial logisitic regression
19	Healthcare provider recommended (+), perceived severity of COVID 19 (+), perceived effectiveness of vaccine (+), likelihood of getting COVID19 (+), potential harms of vaccine (-)	Personal history of COVID19, knowledge about COVID19	Age, Gender, race, income, political leaning	Relative risk regression model
20	Trust in scientists (+), susceptibility to misinformation (-)	Education level, political leaning, self-identified minority status, numeracy	Age, gender	Logistic regression model

Study N	Significant predictors	Non-significant predictors in final model	Additional significant predictors	Method
21	COVID anxiety (+), perceived risk (+), frequency of watching news (+) Satisfaction government response (+)	Race and Education in Turkey	Gender, education and race (UK only)	Logistic regression model
22	vaccinated for influenza last winter (+) perceiving a greater risk of COVID-19 to people in the UK (+) COVID-19 vaccination attitudes (+) vaccination would cause side effects or be unsafe (-), perceived information sufficiency (+) only people who are at risk of serious illness should be vaccinated for COVID-19 (-)	Gender, ethnicity, religion, qualifications, employment status, occupation, general vaccination beliefs, perceived risk to oneself, had COVID, knowing someone with COVID, wants return to normal life	Age	A linear regression model.
23	Perceived threat (+), response efficacy (+)	Gender, Annual income, self - efficacy	Age, education	Logistic regression
24	Support for far right parties (-), didn't vote in the last election (-), felt close to government parties (+)	education	Gender age	Logistic regression

Conclusions

Key messages for policy and communications are:

1. Reported vaccination intention rates in OECD countries (60-80%) suggest uptake will need to be promoted and supported; previous research suggests that a vaccination rate of 75-90% is needed to achieve herd immunity.
2. There are lower intentions for sub-groups, most commonly women, younger people and those with lower levels of education.
3. Variation in intentions appears to be linked to trust or lack of trust in government and health professionals, vaccine history, and perceived impact of vaccine on national/community life.

This review makes the following recommendations for research:

1. Using common questions and responses will help with comparative findings.
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3. Studies should include questions about prior vaccine history to consider its role as a determinant of other vaccination intentions.
4. Countries with opinion polls could usefully add to our understanding of vaccine uptake by modelling these relationships.

Papers Reviewed

The numbering in the list below refers to the 26 full-text papers reviewed. On full consideration, four of these did not meet the study criteria and were excluded.

1. Akarsu, B., Canbay Özdemir, D., Ayhan Baser, D., Aksoy, H., Fidancı, İ., & Cankurtaran, M. (2020). While studies on COVID-19 vaccine is ongoing, the public's thoughts and attitudes to the future COVID-19 vaccine. International journal of clinical practice, e13891.

3. Detoc, M., Bruel, S., Frappe, P., Tardy, B., Botelho-Nevers, E., & Gagneux-Brunon, A. (2020). Intention to participate in a COVID-19 vaccine clinical trial and to get vaccinated against COVID-19 in France during the pandemic. Vaccine, 38(45), 7002-7006.

4. Earnshaw, V. A., Eaton, L. A., Kalichman, S. C., Brousseau, N. M., Hill, E. C., & Fox, A. B. (2020). COVID-19 conspiracy beliefs, health behaviors, and policy support. Translational behavioral medicine, 10(4), 850-856.

5. Faasse, K., & Newby, J. (2020). Public Perceptions of COVID-19 in Australia: Perceived Risk, Knowledge, Health-Protective Behaviors, and Vaccine Intentions. Frontiers in psychology, 11, 551004. https://doi.org/10.3389/fpsyg.2020.551004

6. Fisher, K. A., Bloomstone, S. J., Walder, J., Crawford, S., Fouayzi, H., & Mazor, K. M. (2020). Attitudes toward a potential SARS-CoV-2 vaccine: a survey of US adults. Annals of internal medicine, 173(12), 964-973. https://doi.org/10.1177/1075547020960463

8. Guidry, J. P., Laestadius, L. I., Vraga, E. K., Miller, C. A., Perrin, P. B., Burton, C. W., ... & Carlyle, K. E. (2020). Willingness to get the COVID-19 vaccine with and without emergency use authorization. American journal of infection control. https://doi.org/10.1016/j.ajic.2020.11.018

9. Head, K. J., Kasting, M. L., Sturm, L. A., Hartsock, J. A., & Zimet, G. D. (2020). <? covid19?> A National Survey Assessing SARS-CoV-2 Vaccination Intentions: Implications for Future Public Health Communication Efforts. Science Communication, 42(5), 698-723. https://doi.org/10.1177/1075547020960463

10. Did not meet inclusion criteria.

11. La Vecchia, C., Negri, E., Alicandro, G., & Scarpino, V. (2020). Attitudes towards influenza vaccine and a potential COVID-19 vaccine in Italy and differences across occupational groups. https://dx.doi.org/10.23749/mdl.v111i6.10813

12. Largent, E. A., Persad, G., Sangenito, S., Glickman, A., Boyle, C., & Emanuel, E. J. (2020). US Public Attitudes Toward COVID-19 Vaccine Mandates. JAMA network open, 3(12). https://doi:10.1001/jamanetworkopen.2020.33324

13. Lazarus, J. V., Ratzan, S. C., Palayew, A., Gostin, L. O., Larson, H. J., Rabin, K., ... & El-Mohandes, A. (2020). A global survey of potential acceptance of a COVID-19 vaccine. Nature medicine, 1-4.

14. Malika, A. A., McFadden, S. M., Elharake, J., & Omer, S. B. (2020). Determinants of COVID-19 vaccine acceptance in the US. EClinicalMedicine, 26. https://doi.org/10.1016/j.eclinm.2020.100495

15. Marcec, R., Majta, M., & Likic, R. (2020). Will vaccination refusal prolong the war on SARS-CoV-2?. Postgraduate Medical Journal. Study 15 - 214.

16. Olagoke, A., Olagoke, O., & Hughes, A. M., (2020). Intention to vaccinate against the novel 2019 Coronavirus disease: The role of health locus of control and religiosity. Research Square. https://doi.org/10.21203/rs.3.rs-31214/v1

17. Pogue, K., Jensen, J. L., Stancil, C. K., Ferguson, D. G., Hughes, S. J., Mello, E. J., Burgess, R., Berges, B K., Quaye, A., & Poole, B. D. (2020). Influences on attitudes regarding potential COVID-19 vaccination in the United States. Vaccines, 8 (582). doi:10.3390/vaccines8040582

18. Prati, G. (2020). Intention to receive a vaccine against SARS-CoV-2 in Italy and its association with trust, worry and beliefs about the origin of the virus. Health education research, 35(6), 505-511.

19. Reiter, P. L., Pennell, M. L., & Katz, M. L. (2020). Acceptability of a COVID-19 vaccine among adults in the United States: How many people would get vaccinated?. Vaccine, 38(42), 6500-6507.

20. Roozenbeek, J., Schneider, C. R., Dryhurst, S., Kerr, J., Freeman, A. L., Recchia, G., ... & Van Der Linden, S. (2020). Susceptibility to misinformation about COVID-19 around the world. Royal Society open science, 7(10), 201199.

21. Salali, G. D., & Uysal, M. S. (2020). COVID-19 vaccine hesitancy is associated with beliefs on the origin of the novel coronavirus in the UK and Turkey. Psychological medicine, 1-3.

22. Sherman, S. M., Smith, L. E., Sim, J., Amlôt, R., Cutts, M., Dasch, H., ... & Sevdalis, N. (2020). COVID-19 vaccination intention in the UK: results from the COVID-19 vaccination acceptability study (CoVAccS), a nationally representative cross-sectional survey. Human vaccines & immunotherapeutics, 1-10.

23. Vai B, Cazzetta S, Ghiglino D, Parenti L, Saibene G, Toti M, Verga C, Wykowska A and Benedetti F (2020) Risk Perception and Media in Shaping Protective Behaviors: Insights From the Early Phase of COVID-19 Italian Outbreak. Front. Psychol. 11:563426. doi: 10.3389/fpsyg.2020.563426

24. Ward, J. K., Alleaume, C., Peretti-Watel, P., & COCONEL Group (2020). The French public's attitudes to a future COVID-19 vaccine: The politicization of a public health issue. Social science & medicine (1982), 265, 113414. https://doi.org/10.1016/j.socscimed.2020.113414

25. Did not meet inclusion criteria.

26. Dror, A.A., Eisenbach, N., Taiber, S. et al. Vaccine hesitancy: the next challenge in the fight against COVID-19. Eur J Epidemiol 35, 775–779 (2020). https://doi.org/10.1007/s10654-020-00671-y