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A lack of perceived benefits and a gap in knowledge distinguish the vaccine hesitant from vaccine accepting during the COVID-19 pandemic

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Somewhere between 60 and 90% of populations need to be immune to the coronavirus disease 2019 (COVID-19) to stop its spread (Anderson, Vegvari, Truscott, & Collyer, 2020). Mass vaccination programmes are underway, yet around 32% of people worldwide may refuse a vaccine (Wang et al., 2020). Ending the pandemic depends on individual decision-making.

Hesitancy varies by socio-demographic background, but the variance explained is small (Freeman et al., 2020). This limits the effectiveness of targeting public health communication by social groups. A better method to inform communication may be to investigate what influences the decisions of vaccine-hesitant individuals.

This study uses behavioural science to investigate how people decide whether to take a COVID-19 vaccine. Given variation in experiences of and emotional responses to the pandemic, people may vary in perceptions of the benefits and risks of vaccines, with implications for how they resolve the trade-offs. Trade-off decisions are influenced by level of expertise (Shaddy, Fishbach, & Simonson, 2021). Yet little is known about how much people know about COVID-19 vaccines. Most research was carried out before details about approved vaccines were publicly available. We know of no research that investigated how knowledge about the vaccines themselves relates to intention.

A large ($N = 1600$) nationally representative sample in the Republic of Ireland carried out a series of interactive computerised tasks, online between 21 and 27 January 2021. Ireland was experiencing a third wave of infections and strong public health restrictions. The vaccine programme had begun but most people had not yet been offered a vaccine.

Participants were first asked whether they definitely would, probably would, probably would not or definitely would not get a COVID-19 vaccine, with an option for those unable to take it.

An interactive computerised environment systematically manipulated the factors that participants were asked to consider at one time. Participants listed, in open text boxes, the risks and benefits of the vaccine that came to mind. They also ranked a list of potential risks and benefits, made explicit trade-offs between them to determine relative influence, and completed a knowledge test about COVID-19 vaccines. The test comprised 13 multiple choice questions, making a total score of 0–18 (some had multi-select options). The test covered efficacy, side effects, development, herd immunity, and misinformation. Socio-demographic variables and perceived severity of and susceptibility to COVID-19 were also collected.

Research questions, methods and hypotheses were pre-registered on Open Science Framework and reported in a preprint (Robertson, Mohr, Barjaková, & Lunn, 2021).[†1] The research was funded by the Irish Government's Department of Health and approved under the ESRI's ethical review policy.

Intention was close to expectations: 67.1% said they would accept a COVID-19 vaccine, 21.1% leaned towards yes, 6.2% leaned towards no and 4.9% said they would not.

There are two key findings: hesitant participants differed from accepting participants more in how they called to mind the *benefits* of the vaccine than in how they called to mind the *risks*. Second, hesitant participants had a substantial gap in knowledge compared to accepting participants.

In open text responses, vaccine-hesitant participants were less likely to list any benefits of COVID-19 vaccines, even when asked explicitly to write down any risks and benefits they could think of. The effect was large: 91% of the most accepting group reported at least one benefit, but only 5% of the most hesitant (Fig. 1).

[†]The notes appear after the main text.

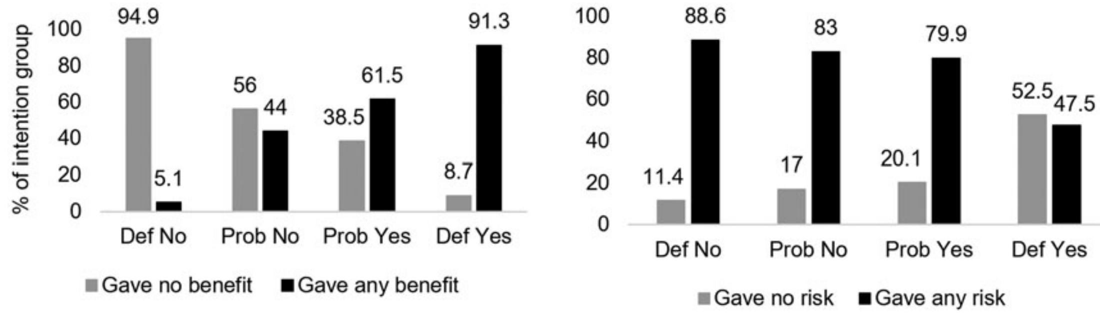

Fig. 1 Proportion of participants listing risks and benefits in unprompted open text by intention to take the vaccine

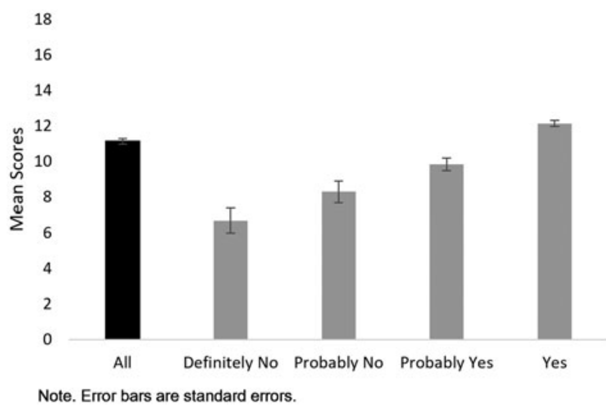

Fig. 2 Mean knowledge scores by intention to take the vaccine.

Table 1. Logistic regression showing likelihood of mentioning both risks and benefits in the open text task given scores on the objective knowledge task

DV: Gave risk and benefit in open text	*B* (S.E.)
Knowledge score	0.12 (0.02)***
Intention (Ref: def. no.)	
Prob no	2.33 (0.63)***
Prob yes	2.71 (0.60)***
Def yes	2.29 (0.60)***
Constant	−4.10 (0.61)***

*$p < 0.05$, **$p < 0.01$, ***$p < 0.001$. *B* = beta-coefficient. S.E. = standard error.

In the knowledge test, the most accepting participants scored an average of 67%, but the most hesitant only scored 37% (Fig. 2). This trend was present for almost every individual question (online Fig. S1 in Supplementary Material). Knowledge about efficacy, development and novelty of mRNA vaccines was associated with how individuals perceived the relevant risks and benefits of those aspects of the vaccine (online Supplementary Tables S1–S3).

Relating the two, those with greater knowledge were more likely to list both risks and benefits than only risks or only benefits (Table 1).

We tested whether these factors predicted vaccine intention over and above socio-demographic differences using logistic regression. To retain statistical power, we collapsed hesitant and resistant categories into one. Consistent with previous studies, age, gender, education, and ethnicity were associated with intention (Table 2). However, knowledge and perception of risks and benefits were stronger predictors. When these were added to the model, socio-demographic differences became non-significant.

The strengths of this study are the interactive behavioural method, large nationally representative sample, and data collection after vaccines were publicly available. The main limitations are that it measures intention not behaviour and that having asked about intention first (to avoid contamination by later tasks) some responses might reflect post rationalisation of the initial response. However, poor knowledge and an observed asymmetry in responses to risks and benefits is not obviously explained by post rationalisation.

The strong relationship between hesitancy and failing to perceive benefits may relate to the 'affect heuristic', whereby emotional responses induce an inverse relationship between perceived risks and benefits (Slovic & Peters, 2006). Additionally, people sometimes respond more negatively to an action that incurs risk (e.g. getting vaccinated) than to inaction that incurs risk (e.g. not getting vaccinated and risking getting COVID-19) – 'omission–commission bias' (Ritov & Baron, 1992). Importantly, risk–benefit relationships can be modified: information that highlights benefits can increase intention to be vaccinated against other diseases (Mostafapour, Meyer, & Scholer, 2019).

There are at least two policy implications from this research. First, better knowledge is associated with greater intention to be vaccinated, independently of educational attainment. From a policy perspective, this is important. People who plan to accept the vaccine are, on average, making a more informed decision. This supports information campaigns about the vaccines and their development. Second, current communications often focus on relative risk of COVID-19 as a rationale for vaccination. Communications showing that COVID-19 vaccines work, are overwhelmingly safe, and allow restrictions on social activity to be lifted, may be more useful for hesitant individuals who otherwise may not see benefits.

Good science communication conveys information accurately, succinctly, and accessibly. The present findings can help it to target psychological barriers preventing more informed decisions.

Supplementary material. The supplementary material for this article can be found at https://doi.org/10.1017/S0033291721003743

Table 2. Logistic regression showing relationship between socio-demographic characteristics, knowledge and perception of risks and benefits, and intention to be vaccinated

Definitely would take vaccine	(1) B (s.e.)	(2) B (s.e.)	(3) B (s.e.)	(4) B (s.e.)
Age (ref: under 40)				
40–60	0.07 (0.14)	−0.10 (0.14)	−0.22 (0.15)	−0.17 (0.20)
60+	0.86 (0.17)***	0.51 (0.18)**	0.43 (0.19)*	0.19 (0.26)
Male	0.46 (0.11)***	0.58 (0.12)***	0.53 (0.13)***	0.10 (0.17)
Has child	−0.29 (0.12)*	−0.35 (0.12)**	−0.32 (0.13)*	−0.17 (0.17)
Employed	−0.11 (0.12)	−0.05 (0.12)	0.05 (0.13)	−0.09 (0.17)
High education	0.31 (0.12)**	0.34 (0.12)**	−0.18 (0.13)	0.21 (0.17)
BAME	−0.93 (0.25)***	−0.84 (0.26)**	−0.21 (0.29)	−0.50 (0.37)
Susceptibility		−0.04 (0.04)	−0.04 (0.05)	0.02 (0.06)
Severity		0.25 (0.04)***	0.22 (0.05)***	0.13 (0.06)*
Risk appetite		−0.16 (0.06)*	−0.05 (0.07)	−0.13 (0.09)
Knowledge			0.30 (0.02)***	0.20 (0.03)***
Gave any risk				−0.83 (0.18)***
Gave any benefit				1.12 (0.20)***
Rank benefit: protect from COVID-19				0.14 (0.05)**
Rank benefit: protect from long COVID-19				0.17 (0.05)**
Rank benefit: prevent spread of COVID-19				0.13 (0.05)*
Rank benefit: return to normal				0.03 (0.05)
Rank benefit: protect economy				0.11 (0.06)[†]
Rank benefit: protect others				0.04 (0.05)
Rank benefit: reduce case numbers				0.02 (0.05)
Rank risk: mild side effects				0.03 (0.05)
Rank risk: future side effects				−0.16 (0.06)**
Rank risk: speed of development				−0.22 (0.05)***
Rank risk: novelty of vaccine				−0.03 (0.05)
Rank risk: effects in subgroups				−0.20 (0.05)***
Rank risk: fear needles				−0.03 (0.07)
Rank risk: serious side effects				−0.11 (0.05)*
Vaccine risk > getting COVID-19				−0.94 (0.30)**
Vaccine risk > spreading COVID-19				−0.49 (0.26)[†]
Vaccine risk > extended lockdown				−0.89 (0.22)***
Vaccine risk > flu vaccine				−0.94 (0.27)**
Vaccine risk > flu				−1.18 (0.18)***
Constant	0.41 (0.14)**	−0.13 (0.26)	−3.26 (0.37)***	0.55 (1.04)

Note: *** $p < 0.001$, ** $p < 0.01$, * $p < 0.05$, [†] $p < 0.06$. B = beta-coefficient, s.e. = standard error.

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Conflict of interest. The authors have no financial interests to declare. Professor Pete Lunn is a member of the Covid-19 Communications and Behavioural Advisory Group to the Government of Ireland Department of Health. The Department of Health funded this study. The funder had no role in study design, data collection, data analysis, data interpretation, or writing of the report.

Ethical standards. The authors assert that all procedures contributing to this work comply with the ethical standards of the relevant national and institutional committees on human experimentation and with the Helsinki Declaration of 1975, as revised in 2008.

Notes

1 Available here: https://osf.io/43xeg/

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