Short Communication

The good, the bad, and the neutral: Vaccine hesitancy mediates the relations of Psychological Capital, the Dark Triad, and the Big Five with vaccination willingness and behaviors

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ABSTRACT

The COVID-19 pandemic has made it apparent that many people are unwilling to be vaccinated, and certain types of people seem predisposed to support or oppose vaccines. We perform a multiple-wave survey study to determine whether the Big Five, Dark Triad, and Psychological Capital (PsyCap) indirectly relate via vaccine hesitancy to vaccination willingness, vaccination, and vaccine word-of-mouth. Our results show that conscientiousness, extraversion, narcissism, psychopathy, and PsyCap each influence our outcomes via dimensions of vaccine hesitancy. PsyCap had an additional direct effect beyond these mediators. The overall effects of extraversion and PsyCap were negative on vaccine hesitancy, positive on pro-vaccination outcomes, and negative on anti-vaccination outcomes. The overall effects of conscientiousness, narcissism, and psychopathy were positive on vaccine hesitancy, negative on pro-vaccination outcomes, and positive on anti-vaccination outcomes. To conclude, we identify theoretical frameworks that can provide further insights into these relations. We suggest that the effects of conscientiousness may be understood by integrating research on overconfidence; the effects of extraversion and PsyCap may be understood by applying the situation, trait, and outcome activation model; and the effects of narcissism and psychopathy may be understood with Life History Theory.

1. Introduction

The COVID-19 pandemic has caused more than 5,500,000 deaths globally (January 10th, 2022; Johns Hopkins University, 2022), and it will result in significantly more before it has subsided. Researchers have discovered that the most effective approach to preventing fatality from COVID-19 is vaccination, which both inhibits infection and reduces severity (Liang et al., 2021). Unfortunately, the COVID-19 pandemic has made it apparent that many people are unwilling to be vaccinated (Howard, 2021). The refusal to be vaccinated not only puts the person at risk, but it also puts others at risk who are unable to be vaccinated or have not yet been given the opportunity to be vaccinated. Further, the COVID-19 pandemic has caused many people to be vocal regarding their support or opposition for vaccines, including citizens and politicians alike (Luo et al., 2021; Sgaier, 2021). These expressions of support or opposition have significant effects, as they encourage or discourage others from becoming vaccinated. Thus, encouraging vaccination has become a primary public health objective, and many authors have called for future research to identify predictors of vaccination willingness,

vaccination, positive word-of-mouth, and negative word-of-mouth (Dudley et al., 2020; Luo et al., 2021).

Vaccine hesitancy has been identified as key to understanding these behaviors (Dudley et al., 2020; Howard, 2021). Vaccine hesitancy refers to "the specific situation of having concerns about vaccines, regardless of actual vaccine receipt" (Dudley et al., 2020, p. 711), and it is recognized to be a multidimensional construct. Howard (2021) recently developed and empirically supported an eight-dimensional conceptualization of vaccine hesitancy, which represents perhaps the most comprehensive conceptualization of vaccine hesitancy (dimensions described in Appendix A). The author also provided a scale with supportive psychometric properties and validity evidence, enabling future researchers to study vaccine hesitancy more easily. Following these recent trends, we consider vaccine hesitancy to be a primary predictor of our studied outcomes (vaccination willingness, vaccination, positive vaccine word-of-mouth, and negative vaccine word-of-mouth), and we therefore investigate antecedents of vaccine hesitancy to understand their ultimate effect on our studied outcomes.

Popular press and academic articles alike have suggested that certain

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types of people seem predisposed to support or oppose vaccines (Murphy et al., 2021; Sgaier, 2021), and we propose that this is indeed the case. In an exploratory manner, the current article investigates three frameworks of relatively stable individual differences: the Big Five, the Dark Triad, and Psychological Capital (PsyCap) (dimensions described in Appendix A). We chose these frameworks because they collectively span a wide range of individual differences (more so than any single framework) by representing relatively neutral (Big Five), maladaptive (Dark Triad), and beneficial (PsyCaP) orientations. Therefore, the current article provides broad insights into whether certain types of people are indeed more likely to hold specific perceptions regarding vaccines, which may subsequently relate to vaccination willingness and behaviors.

The current article provides four primary benefits. First, identifying predictors of vaccination willingness, vaccination, and positive word-of-mouth can provide immediate real-world implications, such that policymakers can develop interventions catered for those least likely to perform these behaviors. Likewise, identifying predictors of negative word-of-mouth can provide a better understanding of those who are likely to spread misinformation. Second, our investigation can provide further support for Howard's (2021) conceptualization of vaccine hesitancy. This eight-dimension conceptualization is a new understanding of vaccine hesitancy, and studies are needed to ensure that it is a valid representation via its relations with theoretically relevant constructs. Third, studying three individual difference frameworks can determine which is most closely associated with vaccine hesitancy and our outcomes of interest, providing relative comparisons for the strength of our effects. It can also determine whether our outcomes are driven by relatively neutral, maladaptive, or beneficial individual differences. Fourth, our results provide initial insights into which theoretical perspectives may best detail the links between individual differences and vaccination outcomes, such as the situation, trait, and outcome activation (STOA) model (Zettler et al., 2020) and Life History Theory (McDonald et al., 2012). Thus, the current article advances several domains of research to open avenues for future study.

2. Method

2.1. Participants

Participants (M_{age} = 38.35; SD_{age} = 11.63, 48% female, 89% Western English-Speaking Countries) were recruited from Amazon's Mechanical Turk (MTurk) and provided US$1.25. We utilized this sampling source because it has been shown to provide participants with an array of backgrounds, helping to ensure that the current results are broadly generalizable and represent people with a range of beliefs regarding vaccination (Aguinis et al., 2021). Participation was restricted to those who had only completed more than 50 MTurk tasks with more than a 95% lifetime approval rate. We removed participants if they failed more than one of eight attention checks (18 participants). All statistics, including sample sizes below, reflect the sample after removing these participants. An a priori power analysis supported our sample size, and our data quality controls (time-separated design, restricting participation, and attention checks) have been shown to produce high-quality data when obtaining participants via MTurk (Aguinis et al., 2021).

2.2. Procedure

Participants enrolled via the MTurk platform and immediately completed the first survey that contained demographic information alone (n = 590). One week later, they completed the second survey that included measures of the Big Five, Dark Triad, and PsyCap (n = 327). One week after the second survey, they completed the third survey that included the vaccine hesitancy measure (n = 294). One week after the third survey, they completed a fourth survey that included the measures of vaccination willingness, behaviors, and word-of-mouth (n = 258). We

applied this methodological design to partially address concerns with common method bias as well as to obtain a proper temporal sequencing of our investigated constructs.

2.3. Measures

Due to word count constraints, our measures are reported in Supplementary Material A.

3. Results

Supplementary Material B includes our dataset, and Supplementary Material C includes correlations and Cronbach alphas. Supplementary Material D provides regression results of the Big Five, Dark Triad, and PsyCap predicting the vaccine hesitancy dimensions. Supplementary Material E provides hierarchical regression results of the Big Five, Dark Triad, PsyCap (Step 1), and vaccine hesitancy dimensions (Step 2) predicting our outcomes. Supplementary Material F includes the reporting of our indirect effects, whereas Fig. 1 illustrates the significant direct and indirect effects. We used Hayes's PROCESS macro to calculate estimates of indirect effects. This macro provides percentile bootstrapped estimates, which is among the most accurate approaches for calculating indirect effects. For all analyses, VIF values were below 2.5, well below the standard cutoff of 3.0.

We provide overviews of trends to obtain a holistic understanding of our relations, and readers can refer to supplemental materials for specific statistical results. In our primary text, we focus on analyses that assess the impact of each predictor together (e.g., regression, tests of indirect effects). Agreeableness, neuroticism, and Machiavellianism did not significantly relate to any vaccine hesitancy dimension (all $p > .05$). Extraversion (negative) and narcissism (positive) significantly related to Health Risks alone (both $p < .05$). Openness (negative), Conscientiousness (positive), and PsyCap (negative) each significantly related to three vaccine hesitancy dimensions (all $p < .05$). Psychopathy positively and significantly related to five dimensions (all $p < .05$).

PsyCap was the only individual difference that had a significant relation with vaccination willingness, as it had a positive relation with flu vaccination willingness ($p < .05$). Inconvenience significantly related to COVID-19 vaccination willingness ($p < .05$), whereas Health Risks and Healthy significantly related to both flu and COVID-19 vaccination willingness (all $p < .01$). Machiavellianism was the only individual difference that had a significant relation with vaccination, as it positively and significantly related to both flu and COVID-19 vaccination (both $p < .05$). Physical Pain, Personal Reactions, and Healthy each significantly related to COVID-19 vaccination alone, whereas Cost significantly related to other vaccination alone (all $p < .05$). Health Risks again significantly related to both flu and COVID-19 vaccination ($p < .05$). Agreeableness positively and significantly related to negative word-of-mouth; conscientiousness (negative) and narcissism (positive) significantly related to positive word-of-mouth (both $p < .05$); and PsyCap significantly related to both – negatively with negative word of mouth and positively with positive word of mouth (all $p < .05$). Cost, Personal Reactions, and Access significantly related to negative word-of-mouth alone, whereas Health Risks and Healthy significantly related to both (all $p < .05$).

We now report the significant indirect effects. Conscientiousness (negative), extraversion (positive), and psychological capital (positive) had significant indirect effects via Health Risks on flu vaccination willingness, COVID-19 vaccination willingness, COVID-19 vaccination, and positive word-of-mouth. Conscientiousness (positive), extraversion (negative), and psychological capital (negative) also had a significant indirect effect on negative word-of-mouth via Health Risks. Narcissism had negative and significant indirect effects via Health Risks on the outcomes of COVID-19 vaccination willingness, COVID-19 vaccination, and positive word-of-mouth. Conscientiousness (negative), extraversion (positive), narcissism (negative), and psychopathy (negative) each had

	Flu Vaccination Willingness									COVID-19 Vaccination Willingness									Flu Vaccination									COVID-19 Vaccination								
	DE	HR	C	PP	I	PR	A	H	F	DE	HR	C	PP	I	PR	A	H	F	DE	HR	C	PP	I	PR	A	H	F	DE	HR	C	PP	I	PR	A	H	F
1.) Open.																																				
2.) Consc.		*				*				*					*														*							
3.) Extra.		*				*				*					*														*							
4.) Agree.																																				
5.) Neuro.																																				
6.) Mach.																			*									*								
7.) Narc.						*				*					*														*							
8.) Psych.						*									*																					
9.) PsyCap	*	*								*																			*							

	Other Vaccination									Negative Word-of-Mouth									Positive Word-of-Mouth								
	DE	HR	C	PP	I	PR	A	H	F	DE	HR	C	PP	I	PR	A	H	F	DE	HR	C	PP	I	PR	A	H	F
1.) Open.																											
2.) Consc.											*								*	*						*	
3.) Extra.											*									*						*	
4.) Agree.										*																	
5.) Neuro.																											
6.) Mach.																											
7.) Narc.																			*	*						*	
8.) Psych.																										*	
9.) PsyCap										*	*								*	*							

Fig. 1. Visual representation of indirect effects.

Note: Section headers indicate the outcome; columns indicate the mediator; and rows indicate the predictor. Blackened cells for DE (Direct Effect) columns indicate that the row had a significant direct effect on the outcome. All other blackened cells indicate significant indirect effects, such that the row had a significant indirect effect on the outcome via the column. For instance, in the first blackened cell, conscientiousness had a significant indirect effect on flu vaccination willingness via the mediator of health risks.

DE = Direct Effect; HR = Health Risks; C = Cost; PP = Physical Pain; I = Inconvenience; PR = Personal Reactions; A = Access; H = Healthy; F = Forget; Open = Openness; Consc. = Conscientiousness; Extra. = Extraversion; Agree. = Agreeableness; Neuro. = Neuroticism; Mach. = Machiavellianism; Narc. = Narcissism; Psych. = Psychopathy.

significant indirect effects via Healthy on flu vaccination willingness, COVID-19 vaccination willingness, and positive word-of-mouth.

4. Discussion

Our results showed that openness, conscientiousness, extraversion, narcissism, psychopathy, and PsyCap each related to various vaccine hesitancy dimensions, supporting that they are key in understanding perceptions of vaccination. Health Risks and Healthy were the two most consistent direct predictors of our outcomes, and PsyCap intermittently produced direct effects on our outcomes. All other predictors only produced two or fewer direct effects, which is likely why Health Risks and Healthy were key mediators of our indirect effects. Indeed, conscientiousness, extraversion, narcissism, and PsyCap produced consistent indirect effects on our outcomes via Health Risks; conscientiousness, extraversion, narcissism, and psychopathy produced significant indirect effects via Healthy. Together, the individual differences of conscientiousness, extraversion, narcissism, psychopathy, and PsyCap each influenced our outcomes via the mediators of Health Risks and Healthy, and PsyCap had an additional influence beyond these mediators.

The directions of these effects should be discussed. Via their overall effects (i.e., both direct and indirect together), extraversion and PsyCap produced negative effects on vaccine hesitancy, positive effects on pro-vaccine outcomes, and negative effects on anti-vaccine outcomes. On the other hand, conscientiousness, narcissism, and psychopathy produced positive effects on vaccine hesitancy, negative effects on pro-vaccine outcomes, and positive effects on anti-vaccine outcomes. Therefore, those high in extraversion and PsyCap may hold particularly positive perceptions of vaccines and behave more in support of vaccines, whereas those high in conscientiousness, narcissism, and psychopathy may hold particularly negative perceptions of vaccines and behave more in opposition of vaccines.

Our results involving conscientiousness are the most surprising of all. Research has supported that conscientious people are more likely to engage in other preventive behaviors, such as exercise (Zettler et al., 2020). It is seemingly contradictory that they would hold more negative perceptions toward and behave in opposition to vaccines. This finding does, however, coincide with some prior research. Conscientiousness has been shown to significantly relate to overconfidence, perhaps because conscientious individuals believe that their hard work can overcome most obstacles (Schaefer et al., 2004). It is possible that conscientious individuals feel that their other disciplined actions, such as social distancing, can compensate for not becoming vaccinated, causing them to see less value in vaccination. Future research should therefore probe overconfidence as a mediator between conscientiousness and vaccine hesitancy.

Alternatively, our findings regarding extraversion and PsyCap may be explained by a common theoretical rationale. Both constructs are associated with positivity, and those high in extraversion and PsyCap are believed to hold more positive expectations (Choi and Lee, 2014). These constructs' negative relations with Health Risks suggests that those high in extraversion and PsyCap may expect greater benefits and fewer detriments of vaccination, ultimately causing these people to perform more pro-vaccination behaviors. Frameworks involving positivity with these two constructs may be apt at further detailing their relations with vaccination outcomes, such as the STOA model (Zettler et al., 2020). The STOA model identifies outcome domains via situational affordances. The outcome domain most closely associated with extraversion, sociality, includes the subdomain of positivity, and this outcome domain may likewise be associated with PsyCap. Future research is needed to support that the STOA model can explain nuances of these links, and future researchers should apply the SOTA model to better understand these

predictors of vaccination hesitancy and outcomes.

Our results regarding the Dark Triad likewise align with prior research. While each Dark Triad dimension is unique, they each share a common association with callousness, antisociality, and distrust. Vaccination is a unique preventive behavior, because it requires trust in vaccine manufacturers to produce a safe product. The association of narcissism and psychopathy with Health Risks suggests that those high in these traits do not trust vaccine manufacturers. This may coincide with the Dark Triad's association with a "Fast Life" in Life History Theory (McDonald et al., 2012). Those high in Dark Triad traits are more likely to value benefits to their short-term reproductive success, such as short-term mates. It is possible that they are less trusting of vaccines because their presumed detriments are immediate (side effects) and the detriments of not becoming vaccinated (illness) are more temporally distal. Future research should assess the validity of this framework to understand the cause of our observed effects.

Lastly, our results provide direct support for Howard's (2021) multidimensional conceptualization of vaccine hesitancy. The dimensions were again shown to be relatively unique in the current sample, and the same dominant dimensions arose as Howard's (2021) original investigation – Health Risks and Healthy. Future research should have more confidence in the consistency of Howard's (2021) conceptualization, encouraging its further application.

Supplementary data to this article can be found online at https://doi.org/10.1016/j.paid.2022.111523.

CRediT authorship contribution statement

The primary author completed all aspects of the current manuscript.

Appendix A. Constructs and definitions studied in the current article

Construct	Description
1.) Vaccination behaviors	The action of receiving a vaccine.
2.) Vaccination willingness	The mindset of being inclined to receive a vaccine.
3.) Positive word-of-mouth	The action of speaking positively regarding vaccines to others.
4.) Negative word-of-mouth	The action of speaking negatively regarding vaccines to others.
5.) Vaccine hesitancy	The state of having active concerns regarding vaccination.
5a.) Health risks	The belief that vaccines pose serious health risks.
5b.) Cost	The belief that vaccines cost too much money.
5c.) Physical pain	The belief that it is physically painful to receive a vaccine.
5d.) Inconvenience	The belief that it is inconvenient to receive a vaccine.
5e.) Personal reactions	The belief that the respondent may have negative bodily reactions to receiving a vaccine that are specific to themselves (e.g., allergic reaction).
5f.) Access	The belief that vaccines are difficult to receive due to supply issues.
5g.) Healthy	The belief that the respondent is too healthy to need a vaccine.
5h.) Forget	The belief that it is easy to forget to get vaccinated.
6.) Big Five	Broad personality framework that includes five dimensions.
6a.) Openness	The tendency to be creative, curious, and appreciate abstractness.
6b.) Conscientiousness	The tendency to be duty-oriented, detail-oriented, and disciplined.
6c.) Extraversion	The tendency to be sociable, sensation seeking, and impulsive.
6d.) Agreeableness	The tendency to be trusting, helpful, and take interest in others.
6e.) Neuroticism	The tendency to be emotionally unstable, anxious, and pessimistic.
7.) Dark Triad	Framework of maladaptive personality that includes three dimensions.
7a.) Machiavellianism	The tendency to manipulate others, lack morality, and be self-interested.
7b.) Narcissism	The tendency to be grandiose, prideful, egotistical, and lack empathy.
7c.) Psychopathy	The tendency to be antisocial, impulsive, selfish, and remorseless.
8.) Psychological Capital	The tendency to be confident, optimistic, persistent, and resilient. Also characterizes by a general positive expectation for future events.

Note: These descriptions are not intended to be comprehensive, but they are instead intended to provide a general description of the constructs. Health, Cost, Physical Pain, Inconvenience, Personal Reactions, Access, Healthy, and Forget are dimensions of vaccine hesitancy. Openness, Conscientiousness, Extraversion, Agreeableness, and Neuroticism are dimensions of the Big Five. Machiavellianism, Narcissism, and Psychopathy are dimensions of the Dark Triad. Self-efficacy, hope, optimism, and resilience are dimensions of Psychological Capital (PsyCap). The dimensions of vaccine hesitancy, Big Five, and Dark Triad are typically studied as separate constructs, whereas the dimensions of PsyCap are typically aggregated to study as a single construct. This is why the dimensions of vaccine hesitancy, the Big Five, and the Dark Triad are defined separately, whereas only the definition of PsyCap is provided.

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