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Vaccination anxiety when vaccinations are available: The role of existential concerns

Ehud Bodner[1,2] | Yoav S. Bergman[3] | Boaz Ben-David[4,5,6] | Yuval Palgi[7]

[1]Interdisciplinary Department for Social Sciences, Bar-Ilan University, Ramat Gan, Israel

[2]Department of Music, Bar-Ilan University, Ramat Gan, Israel

[3]Faculty of Social Work, Ashkelon Academic College, Ashkelon, Israel

[4]Baruch Ivcher School of Psychology, Interdisciplinary Center (IDC) Herzliya, Herzliya, Israel

[5]Toronto Rehabilitation Institute, University Health Networks (UHN), Toronto, ON, Canada

[6]Department of Speech-Language Pathology, University of Toronto, Toronto, ON, Canada

[7]Department of Gerontology, University of Haifa, Haifa, Israel

Correspondence
Ehud Bodner, Interdisciplinary Department for Social Sciences, Bar-Ilan University, Ramat-Gan 5290002, Israel.
Email: ehud.bodner@biu.ac.il

Abstract

This study examined how existential fears are related to COVID-19 vaccination anxiety and followed the Terror Management Theory (TMT) by examining the contribution of two existential concerns, subjective nearness-to-death (SNtD) and death anxiety, to COVID-19 vaccination anxiety during the first month of COVID-19 vaccinations. Data were collected during January 2021, when Israel was in lockdown, from a convenience sample of 381 Jewish Israelis (M = 55.39, SD = 17.17). Participants completed questionnaires examining demographics, SNtD, death anxiety and COVID-19 vaccination anxiety. A hierarchical regression analysis examined the connections between these variables and COVID-19 vaccination anxiety while controlling for demographics and for receiving COVID-19 vaccinations. In line with the hypotheses, SNtD and death anxiety were each positively associated with COVID-19 vaccination anxiety, and death anxiety levels moderated the positive connection between SNtD and COVID-19 vaccination anxiety, as this association was not significant for individuals with low death anxiety. The findings of this study provide preliminary evidence concerning the role of death anxiety in moderating the effect that SNtD has on COVID-19 vaccination anxiety. These findings are in line with the TMT and justify further investigation and may be utilized in future research in order to address COVID-19 vaccination anxiety more effectively.

KEYWORDS
COVID-19, death anxiety, pandemic, subjective-nearness-to-death, vaccination anxiety

1 | INTRODUCTION

The COVID-19 vaccination became gradually available for Israeli citizens on 19 December 2020, and by the end of January 2021, over 3 million Israeli citizens (or 34.5% of the population) had received the first dose (Ministry of Health, 2021). Interestingly, after an initial surge, there had been a relative decrease in vaccination compliance. According to the Ministry of Health, the majority of vaccine receivers (2.1 million individuals) responded during January, 2021, whereas during the following month, this rate was reduced to 1.6 million individuals (Ministry of Health, 2021). As there is little doubt regarding the necessity of COVID-19 inoculations for one's own sake and for that of the general society, it is important to examine the underlying mechanisms, which may be associated with COVID-19 vaccination anxiety among individuals eligible for receiving the vaccination. As will be elaborated, it has been suggested that COVID-19 is linked with increased existential fears and concerns (Pyszczynski et al., 2020), which may subsequently affect COVID-19 health-related decisions (see also Courtney et al., 2020). Accordingly, we focused on how subjective perceptions of feeling close to death during COVID-19 are associated with vaccination anxiety, and whether death anxiety moderates this association.

According to Dubé et al. (2013), there are several definitions for vaccination anxiety, and attitudes toward vaccinations may be conceptualized on a continuum ranging from an active desire and/or demand for vaccination to a complete refusal of any available vaccine. As most vaccinations are provided during childhood, it is not surprising that most studies tend to focus on vaccination concerns among young parents and their attitudes toward child vaccinations (see also Leask et al., 2012). In their review, Dubé and her colleagues suggest that parental vaccination attitudes are subjected to various historical (e.g., past experiences with vaccinations), political (e.g., governmental attitudes) and socio-cultural factors (e.g., religion and/or moral convictions). While studies focusing on vaccination anxieties targeted at one's own self are less frequent, the general picture regarding vaccination anxiety is quite similar, as was demonstrated during the 2009–2010 H1N1 pandemic (Kanadiya & Sallar, 2011; Savas & Tanriverdi, 2010). In the COVID-19 context, Hornsey et al. (2020) report that supporters of Donald Trump, who displayed anti-vaccination attitudes, demonstrated increased vaccine concerns after being exposed to an alleged anti-vaccination tweet by the former President.

Since COVID-19 vaccinations are quite novel, little information is currently available on the role of psychological mechanisms, which underlie ambivalence and concerns about the vaccination. However, it seems that research pertaining to attitudes toward vaccinations in other circumstances may offer an important direction. For example, Palamenghi et al. (2020) claimed that general mistrust of science may be a contributing factor to Italian citizens' low willingness to receive COVID-19 vaccinations when they were to become available. However, the researchers assert that citizens' worries regarding the vaccination may play a decisive role in cultivating such reluctance. This direction is enhanced by studies reporting similar worries (e.g., side effects, ineffectiveness and general negative emotions) toward flu vaccinations, despite scientific evidence pointing to their efficacy and safety (Lehmann et al., 2014).

In light of the crucial importance of global vaccination to the management of COVID-19, the importance of understanding psychological mechanisms, which contribute to attitudes toward vaccinations, cannot be understated (see Barello et al., 2020). Accordingly, several attempts have been made to suggest a psychological profile of COVID-19 vaccine hesitancy. For example, in a study conducted prior to the availability of COVID-19 vaccinations, Murphy et al. (2021) reported that COVID-19 vaccine hesitant/resistant individuals exhibit a different psychological profile when compared to individuals willing to accept COVID-19 vaccinations (e.g., higher religiosity, disagreeableness and emotional instability). In contrast, Khaled et al. (2021) report that receiving a diagnosis of depression or anxiety was not significantly linked with attitudes toward COVID-19 vaccinations (i.e., demonstrating acceptance, hesitancy or resistance).

There is little doubt regarding the importance of understanding the psychological mechanisms, which underlie vaccine hesitancy. However, it is crucial to note that the aforementioned studies, and, to the best of our knowledge, studies concerning attitudes toward COVID-19 vaccinations thus far, were prospective in nature. Therefore, such studies could not have examined COVID-19 vaccination anxiety when vaccinations were available to the general population. While Palgi et al. (2021) stress the important role of vaccine hesitancy in their examination of psychological morbidity among vaccinated individuals, it is still not clear how the uncertainty and fears, which have engulfed the world during COVID-19, may have contributed to anxiety regarding COVID-19 vaccinations. It seems that at least in theory, existential fears and uncertainties have become more pronounced during COVID-19 (see Pyszczynski et al., 2020), and may be linked with attitudes toward COVID-19 vaccinations. Accordingly, the current study focuses on the empirical link between such existential concerns and COVID-19 vaccination anxiety in the Israeli population.

The COVID-19 pandemic has resulted in profound psychological distress, concerns and fear for our own lives, as well as for those of our loved ones (e.g., Bergman et al., 2021; Menzies & Menzies, 2020; Steele, 2020). In fact, Pyszczynski et al. (2020) suggested that the COVID-19 pandemic 'poses a ubiquitous dramatic reminder of vulnerability and death' (p. 176). Accordingly, it seems appropriate to examine the role of such existential concerns in relation with vaccination anxiety. Terror management theory (TMT; Greenberg et al., 1986) stipulates that human awareness of mortality bears an ever-present potential for high levels of distress. As maintaining everyday functioning under such mortality awareness is all but impossible, the dual-process model of terror management (see Pyszczynski et al., 1999) suggests that several defence mechanisms are activated in sequence, in order to ward off this awareness and maintain a sense of meaning in life, despite the inevitability of death (see also Kosloff et al., 2019). According to this model, when individuals experience mortality salience, proximal defenses, aimed at unconscious suppression of death-related thoughts and/or conscious distraction, are initially activated. However, when thoughts of death gradually recede from individuals' consciousness, distal defenses appear. Such defenses are aimed not at removing the threat of death, but rather, at enhancing the individual feeling that life bears meaning despite its transiency, and this may be established by enhancing the sense of self-esteem and the feeling that one is living his/her life in accordance with cultural expectations (i.e., cultural worldview validation).

Upon focusing on the underlying constructs of engaging in health-promoting behaviors, theories such as the health belief model (see Champion & Skinner, 2008; Prentice-Dunn & Rogers, 1986) state that a critical component in the decision to engage in such behaviors is the extent to which the behavior is seen as effective (see also Cooper et al., 2010). However, it seems that existential concerns and death anxiety may also be linked with individual tendencies of engaging in health-promoting decisions. Accordingly, the Terror Management Health Model (TMHM; see review by Bultmann & Arndt, 2019) proposes that certain health scenarios may be experienced as death reminders, which activate terror management defenses. The model, which has been adapted to COVID-19 (Courtney et al., 2020), claims that health decisions are, to a large extent, guided by proximal motivations, which focus on reducing one's perceived

vulnerability to a given health threat, thereby reducing the fear of mortality. In contrast, when death awareness is outside one's focal attention, such decisions are regulated by distal motivational goals, which are directed at enhancing the symbolic value of oneself.

This line of thought is strengthened by studies which focused on reactions to global pandemics. For example, research has shown that when people were primed with information on current epidemics or virus outbreaks (e.g., Ebola, swine flu) this information was comparable to mortality salience primes, as it had increased the accessibility of death-related thoughts, and defensive behavior (e.g., Arrowood et al., 2017; Bélanger et al., 2013; Van Tongeren et al., 2016). In the context of COVID-19, the desire to protect oneself and others from COVID-19 infection, as well as to help stop the virus spread, were among the most common justifications for receiving COVID-19 vaccinations (Dodd et al., 2021). Accordingly, it may be argued that such motivations can be viewed as TMHM-related proximal defenses, as they are not focused on imbuing meaning through self-esteem and/or cultural worldview validation. Rather, they are aimed at reducing the perception of one's own vulnerability to COVID-19 and its possible detrimental consequences.

In recent years, research has attempted to link TMT ideas and constructs with various subjective time perceptions, which focus on how individuals perceive the passage of time and how long they think they will live. In this regard, it was suggested that the concept of subjective nearness-to-death (SNtD; Kotter-Grühn et al., 2010), or how close individuals perceive themselves to be to their own death, may constitute a form of constant mortality salience (see Bergman & Bodner, 2020). Research has demonstrated that in line with TMT assumptions, SNtD was associated with increased psychological distress, as well as with avoidance of cues, which may serve as death reminders (e.g., older adults; Bergman, Bodner, & Shrira, 2018). Interestingly, death anxiety has been linked with several aspects of COVID-19-related anxieties (see review by Menzies & Menzies, 2020). However, as vaccinations have become available only recently, it is important to examine whether such existential concerns, which are part and parcel of the COVID-19 psychological experience (Menzies & Menzies, 2020), are associated with COVID-19 vaccination anxiety.

Faced with the constant awareness of death during the COVID-19 pandemic, individuals may find it difficult to employ the standard TMT defences, which enable them to ward off the difficult death-related fears. For example, Pyszczynski et al. (2020) claim that sources of self-esteem (e.g., holding a job, pursuing personal goals) and close relationships, which serve as resources for maintaining meaning in life, are also compromised by COVID-19. It can be assumed that the very essence of SNtD, which suggests that death awareness is active and conscious, should activate proximal defences. However, initial evidence demonstrates that this reasonable assumption remains at this point unfounded. For example, while SNtD demonstrated a significant connection with self-esteem ($r = -0.29$; Bergman & Bodner, 2020), its connection with meaning in life, which according to TMT, is the consequence of holding strong cultural worldviews and self-esteem (see Rogers et al., 2019) is weaker, though still significant ($r = -0.16$; Bergman, Bodner, & Haber, 2018) Accordingly, it is difficult at this point to ascertain which defences may be able to mitigate death anxiety, which is linked with SNtD. Nevertheless, we can speculate that certain individuals are able to regulate death-related anxieties and concerns, and this may reduce the deleterious effect of feeling close to death.

1.1 | The current study

In line with the literature review, the current study has three aims. First, due to the assumed heightened state of mortality awareness during COVID-19, and the effects of such awareness on health perceptions and decisions, it is important to examine how increased mortality awareness (i.e., high levels of SNtD) is associated with vaccination anxiety. Accordingly, we hypothesized (H1) that high levels of SNtD will be associated with high levels of vaccination anxiety. Second, since feeling close to death and fearing death, while similar in certain aspects, are distinct constructs (see Bergman, Bodner, & Shrira, 2018), it is important to examine how death anxiety is associated with vaccination anxiety. Therefore, we hypothesized (H2) that high levels of death anxiety would be linked with high levels of vaccination anxiety. Third, in line with the aforementioned distinction between SNtD and death anxiety, we sought to examine whether the SNtD-vaccination anxiety link is affected by different levels of individuals' death anxiety, and hypothesized (H3) that the surmised positive connection between SNtD and vaccination anxiety would be more pronounced among individuals who report high levels of death anxiety.

2 | METHODS

2.1 | Participants and procedure

Data were collected through the Qualtrics web-based platform from 381 Jewish Israelis (age range 21–100; $M = 55.39$, $SD = 17.17$), using a snowball design, via various social platforms (e.g., Facebook; Whatsapp). Most participants ($n = 226$, 59.3%) were women, were Jewish ($n = 265$, 69.6%, as opposed to 116 participants, or 30.4%, who reported that they were not Jewish), and were currently in a relationship ($n = 284$, 74.5%). From a health perspective, most participants ($n = 246$, 64.6%) reported that they did not suffer from COVID-19-related illnesses (see details below), and that they had received at least one of the required two COVID-19 vaccinations ($n = 250$, 65.6%; see Table 1 for means, SDs and correlation matrix for study variables).

Data were collected between January 1st and February 1st, 2021, during which Israel was in lockdown. On the last day of collection, over 3 million Israelis (34.5% of the population) had been vaccinated against COVID-19 (Ministry of Health, 2021). Following informed consent, participants were provided with an anonymous link to a designated website, which contained the study scales, and took about 15 min to complete. Inclusion criteria were Hebrew-

TABLE 1 Means, SDs and correlation matrix for study variables

	Variable	M/%	SD	1	2	3
1.	Subjective nearness-to-death	1.62	0.98	–		
2.	Death anxiety	2.13	0.98	0.36***	–	
3.	COVID-19 vaccination anxiety	2.25	0.91	0.19***	0.29***	–
4.	Gender[a] (male)	40.7%	–	−0.06	0.11*	0.12*
5.	Age			0.38***	−0.05	−0.15**
6.	Relationship status[b] (in a relationship)	74.5%	–	−0.11*	−0.11*	−0.04
7.	Religion[c] (Jewish)	69.6%	–	0.25***	0.20***	0.13**
8.	COVID-19 medical conditions[d]	1.64	0.48	−0.33***	−0.13*	0.03
9.	COVID-19 exposure[e]	1.52	1.52	0.19***	0.21***	0.09
10.	Anti-vaccination attitudes	0.66	1.00	0.01	0.05	0.39***
11.	Vaccination[f] (yes)	65.6%	–	−0.07	0.07	0.37***

Note: $n = 381$. Correlation values are Pearson coefficients, except for values involving items 4, 6 and 7, which are point-biserial coefficients.

[a]0 = male; 1 = female.

[b]0 = not in a relationship; 1 = in a relationship.

[c]0 = Jewish; 1 = non-Jewish.

[d]0 = had not been diagnosed with one of six medical conditions which increase mortality risk in COVID-19 (cardiovascular diseases, stroke, diabetes, chronic pulmonary diseases, hypertension, cancer); 1 = had been diagnosed with one or more of the aforementioned medical conditions.

[e]Sum of positive responses to eight types of exposure to COVID-19.

[f]0 = has been vaccinated for COVID-19; 1 = has not been vaccinated for COVID-19.

*$p < 0.05$, **$p < 0.01$, ***$p < 0.001$.

speaking individuals over the age of 18, and no compensation was given for participation. No personal identifying information was requested or provided, and the study received the approval of the IRB of the first author's university.

2.2 | Measures

SNtD was examined using a single item based on the item suggested by Kotter-Grühn et al. (2010). Participants were asked to rate their agreement with the statement 'I have a feeling that my life is approaching its end' on a scale ranging from 1 ('*not at all*') to 5 ('*very much*'). This item has been used across various age-groups to examine how close individuals feel to the end of their lives (see Bergman, Bodner, & Haber, 2018).

Death anxiety was measured by the relevant subscale of the Fear of Death Scale (Carmel & Mutran, 1997). This subscale is comprised of six items (e.g., '*I am very afraid of death*'), rated on a scale ranging from 1 ('*completely disagree*') to 5 ('*completely agree*'). A mean index is calculated, and high scores indicate high levels of death anxiety. This scale demonstrated reasonable internal consistency (Carmel & Mutran, 1997), and in the current study, Cronbach's α was 0.91.

COVID-19 vaccination anxiety was examined by seven items adapted from Giambi et al. (2018), which assess various concerns and fears relating to the COVID-19 vaccination on a scale ranging from 1 ('*totally disagree*') to 5 ('*totally agree*'). In order to examine the structure of this scale, we conducted an exploratory factor analysis with varimax rotation, and found that the scale is comprised of a single factor (Eigenvalue = 4.51), accounting for 64.35% of the total variance (see Table 2 for item details and factor loadings). Accordingly, a mean index was calculated, with high scores indicating high levels of COVID-19 vaccination anxiety. Cronbach's α in the current study was 0.91.

In addition to the study variables, participants also provided socio-demographic information such as age, gender, relationship status (not in a relationship/in a relationship), and religion (Jewish/non-Jewish). Moreover, individuals completed four additional scales. First, participants rated on a single item whether they had been diagnosed with one of six chronic medical conditions related to increased mortality due to COVID-19 (i.e., cardiovascular diseases, stroke, diabetes, chronic pulmonary diseases, high blood pressure and cancer; see Shrira et al., 2020). Second, we examined COVID-19 exposure by an eight-item scale, adapted from Bergman et al. (2020). Here, participants were asked to indicate experiencing COVID-19-related events (e.g., '*knowing family members who were tested positive*'), and the sum of positive answers was calculated. Kuder-Richardson's reliability was 0.67. Third, in order to control for possible confounding effects of general anti-vaccination attitudes, we summed participants' positive responses to three items ('*I am generally concerned about COVID-19 vaccinations because I am opposed to vaccinations*'; '*I refused receiving vaccinations for me/my child because I think vaccinations are useless or harmful; I refused receiving vaccinations for me/my child because of my reservations, even when my GP advised me*

TABLE 2 Factor analysis and item description for COVID-19 vaccination anxiety

Items	Vaccine anxiety
1. I am afraid of long-term damage which might occur following COVID-19 vaccinations	0.87
2. COVID-19 vaccinations may be more dangerous than the illness they prevent	0.85
3. The approval for COVID-19 vaccinations was provided too fast, without necessary tests and inspections	0.83
4. I don't know enough about COVID-19 vaccinations	0.79
5. I am afraid of negative side effects which might follow COVID-19 vaccinations	0.78
6. I don't think COVID-19 vaccinations will be effective for COVID-19 mutations	0.74
7. COVID-19 vaccinations my weaken or overload my immune system	0.74
Eigenvalue	4.51
Variance explained	64.35%

Note: Presented are factor loadings obtained in a principal component analysis using varimax rotation.

otherwise'). Fourth, participants indicated whether they had already received at least one of the required two COVID-19 vaccinations.

2.3 | Data analysis

Data were analyzed using the SPSS 24 software, and significant interactions were probed using Model 1 of the PROCESS 3.4 macro for SPSS (Hayes, 2018). Initial correlations between the study variables were calculated, and the hypotheses were examined by a hierarchical regression, with COVID-19 vaccination anxiety as the dependent variable. The first step included sociodemographic and health variables, as well as variables pertaining to vaccination attitudes, in order to control for their possible confounding effects. These variables included participants' gender (male/female), age, relationship status (not in a relationship/in a relationship), religion (Jewish/non Jewish), COVID-19-related medical conditions, COVID-19 exposure, general anti-vaccination attitudes, and receiving COVID-19 vaccination (yes/no). The second step included the main effects of SNtD and death anxiety, and the third and final step included the SNtD × death anxiety interaction, which was mean-centered (see Table 3 for details and regression coefficients). Potential multicollinearity was rejected, as the tolerance and VIF values (0.54–0.96; 1.04–1.86, respectively) are in line with literature requirements (O'Brien, 2007). Moreover, a power analysis for detecting a medium effect size (0.15) with a total of 11 predictors required a sample size of 119, indicating that the current sample was sufficient for the study model.

3 | RESULTS

Initial correlations indicated that high SNtD was associated with increased death anxiety ($r = 0.36$, $p < 0.001$) and COVID-19 vaccination anxiety ($r = 0.19$, $p < 0.001$). Moreover, high death anxiety was associated with increased COVID-19 vaccination anxiety ($r = 0.29$, $p < 0.001$; see Table 1). In line with the first two hypotheses, the regression analysis demonstrated a significant main effect for both SNtD ($B = 0.15$, $SE = 0.05$, $\beta = 0.16$, $p < 0.01$) and death anxiety ($B = 0.17$, $SE = 0.05$, $\beta = 0.18$, $p < 0.001$) in connection with COVID-19 vaccination anxiety. Finally, in line with the third hypothesis, a significant interaction of SNtD × death anxiety was discovered (see Table 2). Using Model 1 of PROCESS (Hayes, 2018), we probed the interaction using the Johnson-Neyman technique (see Figure 1). This analysis indicated that the association between SNtD and COVID-19 vaccination anxiety was not significant for individuals who reported low levels of death anxiety (i.e., up to a mean score of 1.91 for death anxiety). However, for individuals reporting death anxiety levels exceeding 1.91, high levels of SNtD were associated with increased COVID-19 vaccination anxiety. It should be noted that when covariates were excluded from the regression analysis, the results remained unchanged. Moreover, in order to rule out the possible confounding effects of receiving COVID-19 vaccination, we examined a possible three-way interaction between SNtD, death anxiety, and having been vaccinated for COVID-19 in relation to vaccination anxiety. This three-way interaction was not significant.

4 | DISCUSSION

Although COVID-19 vaccinations have recently become available in Israel and in other countries, attitudes toward the vaccinations are often ambivalent, as indicated by the decline in the percentage of vaccinated individuals in Israel (Ministry of Health, 2021). Accordingly, the aim of the current work was to examine vaccination anxiety and its links to existential fears and concerns, which are all but inevitable during the COVID-19 pandemic. As Pyszczynski et al. (2020) suggest, the pandemic poses an ever-present reminder of human mortality, and accordingly, we examined whether the notion of SNtD, which has been suggested as a constant state of mortality awareness (Bergman & Bodner, 2020), is linked with COVID-19 vaccination anxiety, and whether this connection is moderated by death anxiety levels. In accordance with our first two hypotheses, both SNtD and

TABLE 3 Regression coefficients for predicting vaccination anxiety

Predictor	ΔR^2	*B*	*SE*	LLCI[a]	ULCI[a]	*β*	*T*	*p*
Step 1	0.267***							
Gender[b]		0.21	0.09	0.04	0.39	0.12	2.47	0.014
Age		−0.01	0.01	−0.01	0.01	−0.05	−0.82	0.414
Relationship status[c] (in a relationship)		−0.07	0.10	−0.26	0.13	−0.03	−0.67	0.504
Religion[d] (Jewish)		−0.25	0.10	−0.45	−0.06	−0.13	−2.52	0.012
Illnesses[e]		−0.11	0.10	−0.32	0.09	−0.06	−1.08	0.280
COVID-19 exposure[f]		−0.01	0.03	−0.06	0.06	−0.01	−0.12	0.906
Anti-vaccination attitudes		0.31	0.04	0.22	0.39	0.34	7.23	<0.001
Vaccination[g]		0.49	0.10	0.30	0.68	0.26	4.98	<0.001
Step 2	0.064***							
Subjective nearness-to-death		0.15	0.05	0.05	0.25	0.16	3.00	0.003
Death anxiety		0.17	0.05	0.08	0.26	0.18	3.61	<0.001
Step 3	0.009*							
Subjective nearness-to-death × death anxiety		0.08	0.03	0.01	0.15	0.10	2.09	0.037
Total R^2	0.340***							
N	381							

[a]Lower/Upper 95% limit for confidence interval.

[b]0 = male; 1 = female.

[c]0 = not in a relationship; 1 = in a relationship.

[d]0 = Jewish; 1 = non-Jewish.

[e]0 = had not been diagnosed with one of six medical conditions which increase mortality risk in COVID-19 (cardiovascular diseases, stroke, diabetes, chronic pulmonary diseases, hypertension, cancer); 1 = had been diagnosed with one or more of the aforementioned medical conditions.

[f]Sum of positive responses to eight types of exposure to COVID-19.

[g]0 = has been vaccinated for COVID-19; 1 = has not been vaccinated for COVID-19.

*$p < 0.05$, ***$p < 0.001$.

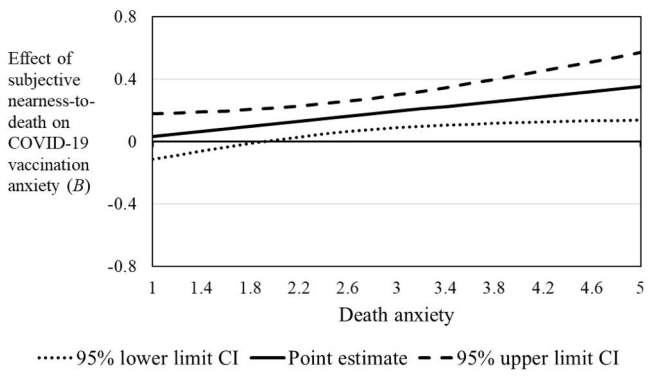

FIGURE 1 The association between subjective nearness-to-death and COVID-19 vaccination anxiety for different values of the moderator (death anxiety), using the Johnson-Neyman technique. A significant positive association is found for low levels of death anxiety (below 1.91), but this association becomes insignificant in higher levels of death anxiety (above 1.91)

death anxiety were positively associated with COVID-19 vaccination anxiety. Interestingly, these connections remained significant after even controlling for whether participants had received COVID-19 vaccinations or not. This important finding highlights the fact that existential concerns are part and parcel of vaccination anxiety, and this may emphasize the importance of addressing concerns, especially when one considers potential vaccination ratio fluctuations as vaccinations are becoming available to larger portions of the population. It seems that such an understanding may enable practitioners and policy makers to gain a deeper understanding into the fears and concerns surrounding COVID-19 vaccinations, in order to address them more effectively, which may contribute to reduce such anxiety and promote COVID-19 vaccination.

This line of thought is enhanced by the significant moderation effect of death anxiety on the link between SNtD and vaccination anxiety, which demonstrates that when death anxiety is low, SNtD is not associated with COVID-19 vaccination anxiety. This is in line with TMT, which postulates that individuals may employ several defence

mechanisms aimed at warding off mortality awareness. While such defences may be compromised to some extent during COVID-19 (Pyszczynski et al., 2020), it can nevertheless be suggested that as the connection between SNtD and COVID-19 vaccination anxiety is not significant among low-death anxiety individuals, they may have played a part in mitigating the effect of feeling close to death. It is important that future studies delve further into the underlying mechanisms of these defences, in order to gain a better understanding of how they are able to reduce both the feeling that life is nearing its end, and its associations with death-related and vaccination-related anxieties and concerns.

Several strengths and limitations of the current study should be highlighted. First, this is, to our knowledge, one of the first studies to examine vaccination anxiety not as a prospective study, but among a population in which vaccinations are available to all eligible adults. Moreover, it demonstrates that existential fears and concerns are associated with vaccination anxiety even among individuals who have received COVID-19 vaccinations. However, it should also be noted that our findings are based on a single convenience sample, which cannot be assumed to be a representative sample of the population in Israel. Moreover, causality cannot be inferred due to the cross-sectional nature of the study, and it is important to examine our study model using additional cohorts, while employing longitudinal and/or experimental designs. Additionally, the study scales were not counterbalanced, and as the SNtD scale was presented before the death anxiety and vaccination anxiety scales, this may have produced a priming effect. Although our findings are in line with the theoretical stipulations of TMT and TMHM, it is nevertheless important to rule out the possibility of such an effect in future studies, and further examine whether SNtD elicits proximal and/or distal defenses, which affect health-related decisions. In this regard, it should be mentioned that receiving COVID-19 vaccinations was strongly associated with vaccination anxiety. Maximizing the number of vaccinated individuals is of crucial importance for achieving herd immunity and managing this global pandemic (see Randolph & Barreiro, 2020). Thus, it is imperative that future studies consider how feeling close to death and/or fearing it may enhance our understanding of how the decision to receive or to refuse COVID-19 vaccination is reached. Finally, we used a novel instrument to examine vaccination anxiety, and it is important to examine the internal structure of this scale among additional populations.

Nevertheless, this study provides important, albeit initial, indications regarding the role of existential concerns and their association with COVID-19 vaccination anxiety among a population which has undergone an extensive vaccination program. We hope that this study will serve as a tool for societies and governmental institutions when they consider their own agendas and public health initiatives for vaccinating people worldwide in order to ultimately defeat COVID-19.

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CONFLICT OF INTEREST

The authors have declared that they have no conflict of interest.

DATA AVAILABILITY STATEMENT

The data that support the findings of this study are available from the corresponding author upon request.

ORCID

Ehud Bodner https://orcid.org/0000-0003-2815-8734
Yoav S. Bergman https://orcid.org/0000-0002-7868-9464
Boaz Ben-David https://orcid.org/0000-0002-0392-962X
Yuval Palgi https://orcid.org/0000-0002-8675-5513

REFERENCES

Arrowood, R. B., Cox, C. R., Kersten, M., Routledge, C., Shelton, J. T., & Hood, R. W., Jr. (2017). Ebola salience, death-thought accessibility, and worldview defence: A terror management theory perspective. *Death Studies*, *41*(9), 585–591. https://doi.org/10.1080/07481187.2017.1322644

Barello, S., Nania, T., Dellafiore, F., Graffigna, G., & Caruso, R. (2020). 'Vaccine hesitancy' among university students in Italy during the COVID-19 pandemic. *European Journal of Epidemiology*, *35*(8), 781–783. https://doi.org/10.1007/s10654-020-00670-z

Bélanger, J. J., Faber, T., & Gelfand, M. J. (2013). Supersize my identity: When thoughts of contracting swine flu boost one's patriotic identity. *Journal of Applied Social Psychology*, *43*, 153–155. https://doi.org/10.1111/jasp.1203

Bergman, Y. S., & Bodner, E. (2020). Age is not just a number: Age awareness, subjective nearness-to-death, self-esteem, and depressive symptoms among older adults. *Aging & Mental Health*, *24*(6), 906–913. https://doi.org/10.1080/13607863.2019.1566815

Bergman, Y. S., Bodner, E., & Haber, Y. (2018). The connection between subjective nearness-to-death and depressive symptoms: The mediating role of meaning in life. *Psychiatry Research*, *261*, 269–273. https://doi.org/10.1016/j.psychres.2017.12.078

Bergman, Y. S., Bodner, E., & Shrira, A. (2018). Subjective nearness to death and end-of-life anxieties: The moderating role of ageism. *Aging & Mental Health*, *22*(5), 678–685. https://doi.org/10.1080/13607863.2017.1286459

Bergman, Y. S., Cohen-Fridel, S., Shrira, A., Bodner, E., & Palgi, Y. (2020). COVID-19 health worries and anxiety symptoms among older adults: The moderating role of ageism. *International Psychogeriatrics*, *32*(11), 1371–1375. https://doi.org/10.1017/S1041610220001258

Bergman, Y. S., Shrira, A., Palgi, Y., & Shmotkin, D. (2021). The moderating role of the Hostile-World Scenario in the connections between COVID-19 worries, loneliness, and anxiety. *Frontiers in Psychology*, *12*, 645655. https://doi.org/10.3389/fpsyg.2021.645655

Bultmann, M. N., & Arndt, J. (2019). Physical health under the shadow of mortality: The Terror Management Health Model. In C. Routledge & M. Vess (Eds.), *Handbook of terror management theory* (pp. 369–390). Elsevier.

Carmel, S., & Mutran, E. (1997). Wishes regarding the use of life-sustaining treatments among elderly persons in Israel: An explanatory model. *Social Science & Medicine*, *45*(11), 1715–1727. https://doi.org/10.1016/S0277-9536(97)00104-4

Champion, V. L., & Skinner, C. S. (2008). The health belief model. In K. Glantz, B. K. Rimer, & K. Viswanath (Eds.), *Health behavior and health education: Theory, research, and practice* (pp. 45–65). Wiley.

Cooper, D. P., Goldenberg, J. L., & Arndt, J. (2010). Examining the terror management health model: The interactive effect of conscious death thought and health-coping variables on decisions in potentially fatal

health domains. *Personality and Social Psychology Bulletin*, *36*(7), 937–946. https://doi.org/10.1177/0146167210370694

Courtney, E. P., Goldenberg, J. L., & Boyd, P. (2020). The contagion of mortality: A terror management health model for pandemics. *British Journal of Social Psychology*, *59*(3), 607–617. https://doi.org/10.1111/bjso.12392

Dodd, R. H., Pickles, K., Nickel, B., Cvejic, E., Ayre, J., Batcup, C., Bonner, C., Copp, T., Cornell, S., Dakin, T., Isautier, J., & McCaffery, K. J. (2021). Concerns and motivations about COVID-19 vaccination. *The Lancet Infectious Diseases*, *21*(2), 161–163. https://doi.org/10.1016/S1473-3099(20)30926-9

Dubé, E., Laberge, C., Guay, M., Bramadat, P., Roy, R., & Bettinger, J. A. (2013). Vaccine hesitancy: An overview. *Human Vaccines & Immunotherapeutics*, *9*(8), 1763–1773. https://doi.org/10.4161/hv.24657

Giambi, C., Fabiani, M., D'Ancona, F., Ferrara, L., Fiacchini, D., Gallo, T., Martinelli, D., Pascucci, M. G., Prato, R., Filia, A., Bella, A., Del Manso, M., Rizzo, C., & Rota, M. C. (2018). Parental vaccine hesitancy in Italy–results from a national survey. *Vaccine*, *36*(6), 779–787. https://doi.org/10.1016/j.vaccine.2017.12.074

Greenberg, J., Pyszczynski, T., & Solomon, S. (1986). The causes and consequences of a need for self-esteem: A terror management theory. In R. F. Baumeister (Ed.), *Public self and private self* (pp. 189–212). Springer.

Hayes, A. F. (2018). *An introduction to mediation, moderation, and conditional process analysis: A regression-based approach*. Guilford Press.

Hornsey, M. J., Finlayson, M., Chatwood, G., & Begeny, C. T. (2020). Donald Trump and vaccination: The effect of political identity, conspiracist ideation and presidential tweets on vaccine hesitancy. *Journal of Experimental Social Psychology*, *88*, 103947. https://doi.org/10.1016/j.jesp.2019.103947

Kanadiya, M. K., & Sallar, A. M. (2011). Preventive behaviors, beliefs, and anxieties in relation to the swine flu outbreak among college students aged 18–24 years. *Journal of Public Health*, *19*(2), 139–145. https://doi.org/10.1007/s10389-010-0373-3

Khaled, S. M., Petcu, C., Bader, L., Amro, I., Al-Hamadi, A. M. H., Al Assi, M., Ali, A. A. M., Le Trung, K., Diop, A., Bellaj, T., Al-Thani, M. H., Woodruff, P. W., Alabdulla, M., & Haddad, P. M. (2021). Prevalence and potential determinants of COVID-19 vaccine hesitancy and resistance in Qatar: Results from a nationally representative survey of Qatari nationals and migrants between December 2020 and January 2021. *Vaccines*, *9*(5), 471. https://doi.org/10.3390/vaccines9050471

Kosloff, S., Anderson, G., Nottbohm, A., & Hoshiko, B. (2019). Proximal and distal terror management defenses: A systematic review and analysis. In C. Routledge & M. Vess (Eds.), *Handbook of terror management theory* (pp. 31–63). Elsevier.

Kotter-Grühn, D., Grühn, D., & Smith, J. (2010). Predicting one's own death: The relationship between subjective and objective nearness to death in very old age. *European Journal of Ageing*, *7*(4), 293–300. https://doi.org/10.1007/s10433-010-0165-1

Leask, J., Kinnersley, P., Jackson, C., Cheater, F., Bedford, H., & Rowles, G. (2012). Communicating with parents about vaccination: A framework for health professionals. *BMC Pediatrics*, *12*(1), 1–11. https://doi.org/10.1186/1471-2431-12-154

Lehmann, B. A., Ruiter, R. A., Wicker, S., Van Dam, D., & Kok, G. (2014). "I don't see an added value for myself": A qualitative study exploring the social cognitive variables associated with influenza vaccination of Belgian, Dutch and German healthcare personnel. *BMC Public Health*, *14*(1), 1–11. https://doi.org/10.1186/1471-2458-14-407

Menzies, R. E., & Menzies, R. G. (2020). Death anxiety in the time of COVID-19: Theoretical explanations and clinical implications. *The Cognitive Behaviour Therapist*, *13*, E19. https://doi.org/10.1017/S1754470x20000215

Ministry of Health. (2021). *COVID-19 in Israel*. https://datadashboard.health.gov.il/COVID-19/general?utm_source=go.gov.il&utm_medium=referral

Murphy, J., Vallières, F., Bentall, R. P., Shevlin, M., McBride, O., Hartman, T. K., McKay, P., Bennett, K., Mason, L., Gibson-Miller, J., Levita, L., Martinez, A. P., Stocks, T. V. A., Karatzias, T., & Hyland, P. (2021). Psychological characteristics associated with COVID-19 vaccine hesitancy and resistance in Ireland and the United Kingdom. *Nature Communications*, *12*(1), 1–15. https://doi.org/10.1038/s41467-020-20226-9

O'Brien, R. M. (2007). A caution regarding rules of thumb for variance inflation factors. *Quality and Quantity*, *41*(5), 673–690. https://doi.org/10.1007/s11135-006-9018-6

Palamenghi, L., Barello, S., Boccia, S., & Graffigna, G. (2020). Mistrust in biomedical research and vaccine hesitancy: The forefront challenge in the battle against COVID-19 in Italy. *European Journal of Epidemiology*, *35*(8), 785–788. https://doi.org/10.1007/s10654-020-00675-8

Palgi, Y., Bergman, Y. S., Ben-David, B., & Bodner, E. (2021). No psychological vaccination: Vaccine hesitancy is associated with negative psychiatric outcomes among Israelis who received COVID-19 vaccination. *Journal of Affective Disorders*, *287*, 352–353. https://doi.org/10.1016/j.jad.2021.03.064

Prentice-Dunn, S., & Rogers, R. W. (1986). Protection motivation theory and preventive health: Beyond the health belief model. *Health Education Research*, *1*(3), 153–161. https://doi.org/10.1093/her/1.3.153

Pyszczynski, T., Greenberg, J., & Solomon, S. (1999). A dual-process model of defense against conscious and unconscious death-related thoughts: An extension of terror management theory. *Psychological Review*, *106*(4), 835–845. https://doi.org/10.1037/0033-295X.106.4.835

Pyszczynski, T., Lockett, M., Greenberg, J., & Solomon, S. (2020). Terror management theory and the COVID-19 pandemic. *Journal of Humanistic Psychology*, *61*(2), 173–189. https://doi.org/10.1177/0022167820959488

Randolph, H. E., & Barreiro, L. B. (2020). Herd immunity: Understanding COVID-19. *Immunity*, *52*(5), 737–741. https://doi.org/10.1016/j.immuni.2020.04.012

Rogers, R., Sanders, C. S., & Vess, M. (2019). The terror management of meaning and growth. In C. Routledge & M. Vess (Eds.), *Handbook of terror management theory* (pp. 325–345). Elsevier.

Savas, E., & Tanriverdi, D. (2010). Knowledge, attitudes and anxiety towards influenza A/H1N1 vaccination of healthcare workers in Turkey. *BMC Infectious Diseases*, *10*, 281. https://doi.org/10.1186/1471-2334-10-281

Shrira, A., Hoffman, Y., Bodner, E., & Palgi, Y. (2020). COVID-19-related loneliness and psychiatric symptoms among older adults: The buffering role of subjective age. *The American Journal of Geriatric Psychiatry*, *28*(11), 1200–1204. https://doi.org/10.1016/j.jagp.2020.05.018

Steele, H. (2020). COVID-19, fear and the future: An attachment perspective. *Clinical Neuropsychiatry*, *17*(2), 97–99. https://doi.org/10.36131/CN20200213

Van Tongeren, D. R., Hook, J. N., Davis, D. E., Aten, J., & Davis, E. B. (2016). Ebola as an existential threat? Experimentally-primed Ebola reminders intensify national-security concerns among extrinsically religious individuals. *Journal of Psychology & Theology*, *44*(2), 133–141. https://doi.org/10.1177/009164711604400204

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