# Motivation for COVID-19 Vaccination: Applying a Self-Determination Theory Perspective to a Global Health Crisis

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## ARTICLE INFO

## ABSTRACT

Examining the spectrum of vaccine attitudes within the general public, spanning from hesitancy to confidence, is pivotal in addressing the challenges posed by the COVID-19 pandemic. Despite widespread campaigns advocating for vaccine uptake, a proportion of the population harbour reservations about the safety and efficacy of vaccines. This study seeks to explore the determinants of vaccine attitudes in Canada, leveraging key concepts from the well-established Self-Determination Theory (SDT), including basic psychological needs and the quality of an individual's motivation. During a crucial juncture in the COVID-19 pandemic (December 2021), 292 participants were recruited and completed an online survey assessing levels of satisfaction/frustration of basic psychological needs (sense of autonomy, relatedness, and competence), vaccine attitudes (confidence and hesitancy), and motivation towards vaccination (controlled and autonomous). Two mediation models were employed to examine whether autonomous-controlled motivation mediated the relationship between need satisfaction-frustration and vaccine attitudes. Model 1 revealed a full mediating effect, indicating that need satisfaction influenced vaccine confidence only through autonomous motivation ($ab_1 = 0.09$, $SE = 0.04$, $z = 2.19$, 95 % CI [0.01, 0.18]). Meanwhile, Model 2 demonstrated that need frustration was associated with vaccine hesitancy partially through controlled motivation ($ab_2 = 0.05$, $SE = 0.02$, $z = 2.54$, 95 % CI [0.02, 0.10]). These findings underscore the applicability of SDT in investigating the motivational mechanisms that shape vaccine attitudes. Recognizing psychosocial factors, including the balance of basic needs and quality of motivations, may be integral to informing effective public health strategies.

## 1. Background

The COVID-19 pandemic represents an alarming global health crisis that has and continues to place significant hardships on both individuals and healthcare systems [15,30]. The discovery of new variants contributing to the pandemic has prompted health authorities and experts to prioritize the development of effective and safe vaccination as a crucial step in ending the pandemic [32]. Since the COVID-19 outbreak, mass vaccination campaigns have been implemented across Canada. Despite COVID-19 vaccines demonstrating safe and protective outcomes against the virus, there is variance among vaccine acceptance worldwide [19]. In Canada, the rate of COVID-19 vaccine acceptance (e.g., willingness to take the vaccine, trust in pandemic information and sources regarding vaccine guidelines) among the general population ranges from 69 to 80 % [11,26]. This suggests that the utility of vaccine campaigns and education programs as a means to attain herd immunity may not solely be dependent on vaccine efficacy and safety. As Canada

continues to battle multiple waves of COVID-19 cases, these findings indicate a potential health disparity that may have major public health implications, calling for research to better understand and optimize trust in vaccination efforts.

Research exploring antecedent factors influencing individuals' attitudes and engagement in health-related behavior has been investigated from various theoretical frameworks [1,7,11]. Prominent among these theories is Self-Determination Theory (SDT) [4], which posits that there are contextual contingencies that influence motivation and behavior initiation and maintenance. Central to SDT is the well-established relation between need satisfaction (or frustration) and autonomous (or controlled) motivation. Individuals who are autonomously motivated feel they have a sense of personal choice and freedom and that their actions result from personal intentions, values, and beliefs. Conversely, individuals whose motivation is controlled behave based on external forces, such as societal pressures. SDT posits that motivation to engage in health-related behaviors, based on autonomous or controlled reasons,

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predisposes individuals to develop beliefs that are in alignment with these motives. According to SDT, the degree of autonomous (or controlled) motivation is influenced by the satisfaction or frustration of three basic psychological needs, which include the need for autonomy, competence, and relatedness. Here, autonomy refers to feeling free to behave and act in accordance with one's goals and values, competence refers to feeling capable, able, and a sense of mastery in one's abilities, and relatedness refers to feeling close and connected to others. Research suggests that when these needs are satisfied, it results in more autonomous motivation which thereby impacts affect, attitudes, and behaviors (e.g., [3,9]). Conversely, thwarted needs are associated with controlled motivation.

### 1.1. The Present Study

Although an array of research has shown that basic psychological needs predict psychosocial and behavioral outcomes in several settings through motivational mechanisms [10,16,21], this relational model has yet to be applied in the context of COVID-19 vaccine attitudes, which have provoked polarizing reactions ranging from strong opposition from anti-vaccination movements to unwavering trust in vaccines. As such, the present study seeks to understand the continual variability in vaccine attitudes by applying the well-established and empirically supported SDT. To this end, the present study does the following: (1) examine the associations between global need satisfaction (and frustration), autonomous (and controlled) motivation, and vaccine confidence (and hesitancy), (2) assess whether autonomous motivation mediates the relation between global need satisfaction and vaccine confidence, and (3) assess whether controlled motivation mediates the relation between global need frustration and vaccine hesitancy. Accordingly, we hypothesized that (1) global need satisfaction would be directly associated with vaccine confidence, and that (2) autonomous motivation would mediate the relation between global need satisfaction and vaccine confidence. On the other end of the spectrum, we also hypothesized that (1) global need frustration would be directly associated with vaccine hesitancy, and that (2) controlled motivation would mediate the relation between global need frustration and vaccine hesitancy.

## 2. Methods

### 2.1. Participants and Procedure

Participant recruitment was completed through the survey company Leger during the COVID-19 pandemic in December 2021. Leger Company holds the largest propriety survey panel in Canada, which is representative of Canadians in terms of geography, age, gender, socioeconomic status, and racial/ethnic make-up. Eligibility criteria included individuals at least 18 years of age residing in either Ontario or Quebec. This study was done as part of a larger ongoing project that focused on vaccination among Black Canadian adults.[1]

Participants received an email with an enclosed link to a 30 to 45-minute survey taken through a secured online platform (Qualtrics); there was no face-to-face contact between participants and experimenters. All participants provided informed consent. Data were anonymized and did not include any identifying information to ensure confidentiality. Participants were compensated for completing the survey.[2] This study was approved by the University Research and Ethics Board.

### 2.2. Measures

The online survey included a short sociodemographic section, which included self-reported age (in years), gender (female, male, other), and racial ethnicity (Black, White, Latinx, Asian, Middle Eastern, Indigenous, other). Participants also indicated their vaccination status, which included not vaccinated (0 dose), partially vaccinated (1 dose), or fully vaccinated (≥2 doses).

#### 2.2.1. Need Satisfaction Balance (Frustration and Satisfaction)

The Balanced Measure of Psychological Needs scale (BMPNS) was used to assess basic psychological need satisfaction and frustration related to an individual's sense of autonomy, relatedness, and competence over the past two weeks [23]. Responses to the 12-item scale were made on a 7-point Likert scale ranging from 1 ("not at all true") to 7 ("very true"). Global need satisfaction was calculated by averaging three 2-item subscales, such as "I was free to do things my own way" (autonomy), "I felt a sense of contact with people who care for me, and whom I care for" (relatedness), and "I took on and mastered hard challenges" (competence). Similarly, global need frustration was calculated by averaging three 2-item subscales, such as "There were people telling me what I had to do" (autonomy), "I was lonelier than I'd like to be" (relatedness), and "I did something stupid that made me feel incompetent" (competence). Cronbach's alphas were 0.82 and 0.86 for global need satisfaction and frustration respectively.

#### 2.2.2. Vaccine Attitudes (Hesitancy and Controlled)

To assess attitudes regarding the COVID-19 vaccine, participants were asked to respond to nine items related to vaccine hesitancy and vaccine confidence using a 5-point Likert scale ranging from 1 ("strongly disagree") to 5 ("strongly agree"). The vaccine hesitancy subscale was calculated by averaging three items related to vaccine mistrust (e.g., "I am concerned about serious adverse effects of new vaccines"). The same procedure was done to calculate vaccine confidence using six items related to vaccine trust (e.g., "Getting vaccines is a good way to protect myself from disease"). Cronbach's alphas were 0.95 and 0.75 for vaccine confidence and hesitancy, respectively.

#### 2.2.3. Motivation Towards Vaccination (Controlled and Autonomous)

Participants were asked to rate the quality of their motivation using eight items that were abbreviated to assess external, introjected, identified, and integrated reasons for getting vaccinated [22]. Responses for each reason were made on a 7-point Likert scale ranging from 1 ("strongly disagree") to 7 ("strongly agree"). Examples of reasons included "because somebody else wants you to" (external), "because you would feel ashamed, guilty, or anxious if you didn't" (introjected), "because you believe that it is really important to get vaccinated" (identified), and "because getting vaccinated is in line with your values" (integrated). Autonomous motivation was calculated by averaging integrated and identified ratings, whereas controlled motivation was calculated by averaging external and introjected ratings. Our abbreviated items yielded Cronbach's alphas were 0.66 and 0.63 for autonomous motivation and controlled motivation respectively. Although these internal consistency coefficients were lower than what is typically found with the full scale, we considered these coefficients acceptable given the reduced number of items in each subscale as Cronbach alphas are positively related to number of items [8].

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[1] An a priori decision was made to analyze English-speaking individuals only in the present study. We have published separate studies looking at the impact of language on healthcare attitudes and disparities: Fang, X., Davids, J., & Koestner, R. (2023). Disparities in Healthcare Accessibility and Discrimination Faced by Black Quebecers: a Race and Language Perspective. *J Racial Ethn Health Disparities.* https://doi.org/10.1007/s40615-023–01724-0, Nweze, N., Davids, J., Fang, X., Holding, A., & Koestner, R. Ibid.The Impact of Language on the Mental Health of Black Quebecers. *10*(5), 2327–2337. https://doi.org/10.1007/s40615-022–01412-5.

[2] Participant compensation was managed by Leger Company.

### 2.3. Analytic Plan

Preliminary analyses were conducted including descriptive statistics and Pearson's partial correlation. Given the large body of evidence in SDT that demonstrates the mediating role of autonomous-controlled motivation in the relation between need satisfaction-frustration and psychosocial and behavioral outcomes (e.g., [10,16,21]), mediation models within this context were employed using cross-sectional data. In Model 1, we tested whether there was a mediation of the effect of need satisfaction on vaccine confidence via autonomous motivation; the indirect effect was denoted by $ab_1$, the direct effect of need satisfaction was denoted by $c_1$, and the direct effect of need satisfaction controlling for autonomous motivation denoted by $c_1'$. In Model 2, we tested whether there was a mediation of the effect of need frustration on vaccine hesitancy via controlled motivation; the indirect effect was denoted by $ab_2$ paths, the direct effect of need frustration was denoted by $c_2$, and the direct effect of need frustration controlling for controlled motivation denoted by $c_2'$. The mediation analyses categorized results into three distinct types: full, partial, or no mediation effect. Full mediation was operationally defined as the scenario in which the influence of the independent variable (i.e., basic psychological need satisfaction or frustration) on the dependent variable (i.e., vaccine confidence or hesitancy) achieved statistical significance solely upon the inclusion of the mediator (i.e., autonomous or controlled motivation) in the model. Partial mediation, on the other hand, was characterized by the continued statistical significance of the effect of the independent variable on the dependent variable, even after accounting for the mediator within the model. Conversely, the absence of mediation, or no mediation, signified that the mediator failed to exert a statistically significant influence on the relationship between the independent and dependent variables. Mediation analyses were performed with R Studio Build 372 using the RMediation and Lavaan packages [17,29] with 1,000 bootstrap samples [24]. An α value set at 0.05 was used to determine significance.

### 3. Results

#### 3.1. Participant Characteristics and Descriptive Statistics

Participant characteristics ($N = 292$; $M_{age} = 43.97$, $SD = 17.73$) are summarized in Table 1. Participants with missing data across the key variables of this study were removed from the following analyses ($n = 10$). Correlations between key variables are reported in Table 2.

**Table 1**
Participant characteristics.

| Characteristic | n | % |
|---|---|---|
| **Gender** | | |
| Female | 165 | 57 % |
| Male | 120 | 41 % |
| Other | 7 | 2 % |
| | | |
| **Racial ethnicity** | | |
| Black | 100 | 34 % |
| White | 83 | 28 % |
| Asian | 68 | 23 % |
| Middle Eastern | 21 | 7 % |
| Latinx | 4 | 2 % |
| Indigenous | 2 | 1 % |
| Other | 13 | 5 % |
| | | |
| **Vaccination status** | | |
| Unvaccinated (0 doses) | 28 | 10 % |
| Partially vaccinated (1 dose) | 7 | 2 % |
| Fully vaccinated (2 doses) | 57 | 20 % |
| Fully vaccinated with booster (3 doses) | 200 | 68 % |

*Note.* $N = 292$. Participants were on average 43.97 years ($SD = 17.73$).

Consistent with previous SDT research [12], overall basic need satisfaction was positively associated with autonomous motivation, $r(266) = 0.15$, $p = .013$, and overall basic need frustration was positively associated with controlled motivation, $r(266) = 0.30$, $p < .001$. As expected, autonomous motivation was positively associated with vaccine confidence, $r(266) = 0.70$, $p < .001$, and negatively associated with vaccine hesitancy, $r(266) = -0.51$, $p < .001$. Additionally, controlled motivation was positively associated with vaccine hesitancy, $r(266) = 0.33$, $p < .001$, and was not associated with vaccine confidence, $r(266) = -0.04$, $p = .52$.

#### 3.2. Main Analyses

##### 3.2.1. Mediation Model 1: Vaccine Confidence

To determine whether there was a mediation of the effect of global need satisfaction on vaccine confidence via autonomous motivation (Model 1),[3] we conducted a mediation analysis using 95 % confidence intervals of the indirect effect and bootstrap resampling procedures. Results from the mediation analysis showed that mean global need satisfaction was significantly associated with autonomous motivation for vaccination, $a_1 = 0.22$, $SE = 0.09$, $z = 2.32$, $p = .02$, 95 % CI [0.02, 0.40]. Autonomous motivation for vaccination was significantly associated with vaccine confidence, $b_1 = 0.42$, $SE = 0.03$, $z = 12.69$, $p < .001$, 95 % CI [0.35, 0.48], such that participants who were more autonomously motivated to get vaccinated also had greater confidence in the vaccine. Next, we examined the total, indirect, and direct effects. The total effect of global need satisfaction on vaccine confidence was not statistically significant, $c_1 = 0.09$, $SE = 0.06$, $z = 1.51$, $p = .13$, 95 % CI [−0.02, 0.21]. The indirect effect of global need satisfaction on vaccine confidence through autonomous motivation was estimated to be $ab_1 = 0.09$, $SE = 0.04$, $z = 2.19$, 95 % CI [0.01, 0.18]. This is considered significant as the confidence interval does not straddle zero. The direct effect of global need satisfaction on vaccine confidence was not statistically significant, $c_1' = 0.00$, $SE = 0.05$, $z = -0.04$, $p = .97$, 95 % CI [-0.09, 0.08]. Together, results suggest that there was no direct association between global need satisfaction and vaccine confidence, however there was an indirect association when considering autonomous motivation as a mediator, thus supporting full mediation (see Fig. 1).

##### 3.2.2. Mediation Model 2: Vaccine Hesitancy

Next, using the same procedure, we sought to determine whether there was a mediation of the effect of global need frustration on vaccine hesitancy via controlled motivation (Model 2).[1] Results of the mediation analysis showed that mean global need frustration was significantly associated with controlled motivation for vaccination, $a_2 = 0.23$, $SE = 0.06$, $z = 4.11$, $p < .001$, 95 % CI [0.12, 0.33], and controlled motivation for vaccination was significantly associated with vaccine hesitancy, $b_2 = 0.24$, $SE = 0.06$, $z = 3.87$, $p < .001$, 95 % CI [0.11, 0.35], such that participants who had higher controlled motivation to get vaccinated also had greater vaccine hesitancy. Next, we examined the total, indirect, and direct effects. The total effect of global need frustration on vaccine hesitancy was statistically significant, $c_2 = 0.22$, $SE = 0.04$, $z = 4.97$, $p < .001$, 95 % CI [0.13, 0.30]. The indirect effect of global need frustration on vaccine hesitancy through controlled motivation was estimated to be $ab_2 = 0.05$, $SE = 0.02$, $z = 2.54$, 95 % CI [0.02, 0.10]. This is considered significant as the confidence interval does not straddle zero. The direct effect of global need frustration on vaccine hesitancy was also statistically significant, $c_2' = 0.16$, $SE = 0.04$, $z = 3.91$, $p < .001$, 95 % CI [0.08, 0.25]. Together, results suggest full mediation and support the hypothesis that controlled motivation for vaccination mediates the relation between global need frustration and vaccine hesitancy (see

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[3] Mediation model using 95% confidence internals and bootstrap resampling ($k = 1,000$). Analyses without bootstrapping yielded the same results. Standardized coefficients are reported.

**Table 2**

Descriptive statistics and pearson's partial correlations for key variables.

| Variable | M | SD | 1 | 2 | 3 | 4 | 5 | 6 |
|---|---|---|---|---|---|---|---|---|
| 1. Global Need Satisfaction | 4.61 | 1.15 | – | | | | | |
| 2. Global Need Frustration | 3.34 | 1.45 | 0.11 | – | | | | |
| 3. Autonomous Motivation | 5.66 | 1.61 | 0.12* | −0.04 | – | | | |
| 4. Controlled Motivation | 3.67 | 1.10 | 0.15* | 0.26*** | 0.02 | – | | |
| 5. Vaccine Confidence | 3.92 | 1.12 | 0.07 | −0.04 | 0.66*** | 0.03 | – | |
| 6. Vaccine Hesitancy | 2.77 | 1.03 | 0.06 | 0.25*** | −0.46*** | 0.28*** | −0.36*** | – |

*Note.* Means *(M)* based on Likert-type scales (see Measures section); Pearson's correlation *(r)* controlling for demographic variables (age, gender, ethnicity); *$p <.05$, **$p <.01$, ***$p <.001$.
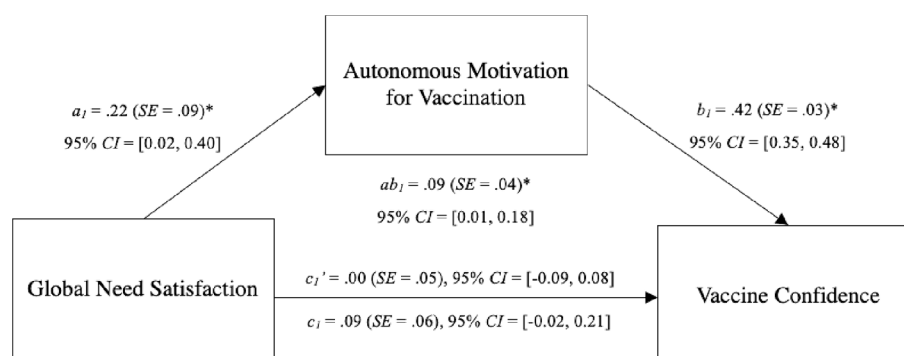


**Fig. 1.** *Mediation Model 1. Note. *$p <.05$. Model representing mediation of the effect of global need satisfaction on vaccine confidence via autonomous motivation for vaccination. $a_1$ and $b_1$ represent the two steps of the indirect path ($ab_1$), $c_1$ represents the total effect of global need satisfaction, and $c_1'$ represents the direct effect of global need satisfaction controlling for autonomous motivation for vaccination.
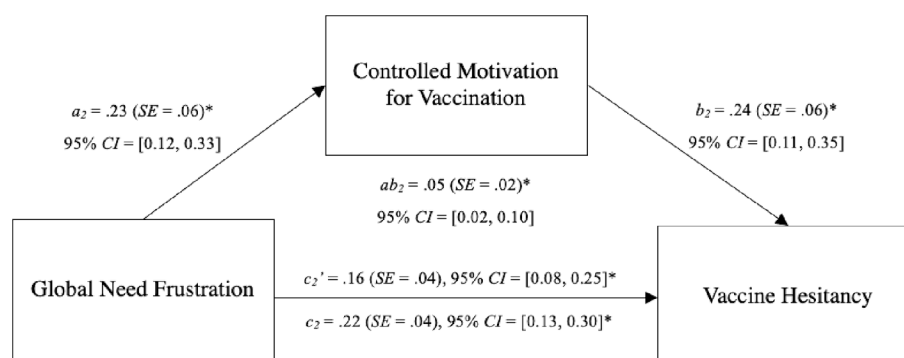


**Fig. 2.** *Mediation Model 2. Note. *$p <.05$. Model representing mediation of the effect of global need frustration on vaccine hesitancy via controlled motivation for vaccination. $a_2$ and $b_2$ represent the two steps of the indirect path ($ab_2$), $c_2$ represents the total effect of global need frustration, and $c_2'$ represents the direct effect of global need frustration controlling for controlled motivation for vaccination.

Fig. 2).

### 4. Discussion

The primary objective of our study was to empirically test cross-sectional mediation models that explore the distinct roles of global need satisfaction and frustration in shaping vaccine confidence and hesitancy through the mediating factors of autonomous and controlled motivation. Overall, our results broadly support the hypotheses outlined in Model 1 and Model 2. Both models, rooted in SDT, contribute theoretical insights into understanding vaccine attitudes. Our findings illuminate the relationship between the satisfaction/frustration of basic psychological needs and vaccine attitudes, specifically hesitancy and confidence, mediated by motivational mechanisms.

In Model 1, autonomous motivation fully mediated the relationship between basic psychological need satisfaction and vaccine confidence. This may suggest that individuals who experience satisfaction of their

basic psychological needs tend to exhibit higher levels of autonomous motivation for the COVID-19 vaccine. This autonomous motivation, in turn, may result in greater vaccine confidence. This mediation pattern indicates that the effect of basic psychological need satisfaction on vaccine confidence may operate entirely through the pathway of autonomous motivation. In other words, when individuals feel that their psychological needs for autonomy, competence, and relatedness are satisfied, they are more likely to internalize their motivations for vaccination, leading to increased confidence in vaccines. This aligns with SDT's core tenet that when basic psychological needs are met, individuals are more motivated to get vaccinated for internalized reasons reflecting personal values and beliefs, fostering vaccine trust and confidence [18].

In Model 2, controlled motivation partially mediated the relationship between basic psychological need frustration and vaccine hesitancy. This may suggest a more nuanced relationship than the one observed between basic psychological need satisfaction and vaccine confidence.

Here, basic psychological need frustration may lead individuals to experience feelings of coercion, pressure, or external regulation regarding vaccination decisions, resulting in higher levels of controlled motivation. However, this controlled motivation, while attenuating the direct negative impact of basic psychological need frustration on vaccine hesitancy, does not fully account for it. Thus, while controlled motivation plays a role in explaining the relationship between basic psychological need frustration and vaccine hesitancy, there are likely other factors contributing to vaccine hesitancy beyond external regulation. Research suggests that individuals who live in a geographic area with control measures (e.g., vaccine passports) reported greater autonomy frustration and decreased motivation and willingness to get vaccinated than those who live in an area without such control measures [14], providing context to our finding, however other factors that may contribute to vaccine hesitancy that were not considered in our study may include access barriers [6], negative experiences with healthcare providers [5], or prior adverse reactions to vaccines [25].

Expanding on the growing literature applying SDT to vaccine-related attitudes during the COVID-19 era, our study aligns with recent findings. Studies, such as Schmitz et al. [20] and Van Oost et al. [31], emphasize the varying outcomes associated with different motivations toward vaccination. Schmitz et al.'s [20] two-part study demonstrated that not all types of motivation toward vaccination are equal in outcome. In their study, participants who saw the benefit and necessity of vaccination were more likely to express stronger intentions to be vaccinated (autonomous motivation), have greater vaccine uptake, or take proactive steps to get vaccinated earlier. On the other hand, participants who felt externally pressured to get vaccinated (controlled motivation) had less uptake. Recognizing influential factors that may drive vaccine attitudes and uptake, another study found that greater government trust and lower endorsement of conspiracism predicted COVID-19 vaccine intention [31]. However, these associations were fully mediated by motivational factors, whereby autonomous motivation yielded more positive vaccine outcomes. Combined with our findings, this collective body of studies underscores how influential variables (e.g., trust in authorities, basic psychological needs) can materialize into latent motivations that then impact vaccine attitudes and uptake.

Our findings carry potentially significant implications for health policy. In addition to emphasizing the efficacy and safety of vaccines, addressing psychosocial factors, such as need balance and motivation, emerges as critical in promoting vaccine acceptance and addressing hesitancy. Accordingly, we highlight three potential avenues for consideration within health policy frameworks. First, the language used in vaccine campaigns serves not only to convey information but also to evoke affective responses. Words that might be perceived as threatening an individual's sense of autonomy, competence, and relatedness could contribute to vaccine hesitancy. Linguistic guidelines developed by the Royal Society of Canada provide valuable insights for those devising communication strategies [28]. Second, collaborating with communities to understand collective goals may foster a sense of relatedness and cohesion, thereby addressing reluctance towards vaccination in a supportive manner. This approach may be particularly effective during mass vaccination campaigns when concerns about vaccine effectiveness arise due to the rapid pace of rollout. Finally, our previous research [5,13] has illuminated health disparities as a barrier to vaccine acceptance. This underscores the notion that optimizing vaccine confidence is not solely reliant on individual factors but also on environmental and healthcare experiences. Therefore, addressing systemic inequities and enhancing healthcare accessibility and experiences are integral components in fostering vaccine acceptance across diverse populations.

### 4.1. Limitations

Although the present study provides novel contributions to the understanding of factors influencing vaccine hesitancy and confidence, some limitations must be considered when interpreting the results. First,

all key variables were collected at the same time point (in December 2021). Apart from the methodological limitations and recall bias associated with this procedure, the use of cross-sectional data at best can only hint towards a potential causality, however, we acknowledge that it greatly limits our ability to infer interpretations of causality or temporal sequencing of relationships from the yielded results. Identified pathways should therefore be confirmed by future studies using longitudinal designs. Second, our study targeted a sample of participants residing exclusively in Ontario or Quebec, as the primary study involved broader investigation centred on Black Canadian adults. Consequently, the generalizability of our results may be limited by our sample's characteristics, however may be particularly relevant to a demographic that has received less attention in Canadian health research [2]. Therefore, to bolster the broader applicability of our findings, we suggest future research to apply SDT principles comprehending vaccine hesitancy and confidence across diverse populations. Nevertheless, the geographic and ethnic focus of our study may offer valuable insights into a community that has been understudied.

### 4.2. Conclusions

In conclusion, our study sheds light on the complexity of vaccine attitudes and the multifaceted factors contributing to vaccine confidence and hesitancy. Understanding the motivational mechanisms behind these attitudes is crucial for developing effective strategies to combat the COVID-19 pandemic. Two key findings emerged in our study: the importance of global psychological need satisfaction as a precursor to vaccine confidence through autonomous motivation and the influence of global psychological need frustration on vaccine hesitancy partially through controlled motivation. Our results suggest that fostering autonomy, relatedness, and competence in individuals may lead to greater autonomous motivation toward vaccination and, consequently, greater confidence in its effectiveness. Autonomy-supportive vaccine campaigns and regulations may prove instrumental in building trust and confidence, whereas campaigns that emphasize mandates, regulations, or societal expectations may induce controlled motivation among individuals who feel that their autonomy is compromised.

## 5. Ethics approval

This study was performed in line with the principles of the Declaration of Helsinki. Approval was granted by the Ethics Committee of McGill University.

## 6. Consent to participate

Informed consent was obtained from all individual participants included in the study.

## Author contributions

All authors contributed to the study conception and design. Material preparation and data collection were performed by HT, ÉCA, and RK. Statistical analyses were conducted by HT. The first draft of the manuscript was written by HT and all authors commented on versions of the manuscript. All authors read and approved the final manuscript.

## Funding

## CRediT authorship contribution statement

**Helen Thai:** Conceptualization, Data curation, Formal analysis,

Investigation, Methodology, Project administration, Validation, Writing
– original draft, Writing – review & editing. **Élodie C. Audet:** Concep-
tualization, Data curation, Validation, Writing – review & editing.
**Richard Koestner:** Conceptualization, Data curation, Funding acquisi-
tion, Investigation, Methodology, Project administration, Resources,
Supervision, Validation, Writing – review & editing.

## Declaration of Competing Interest

The authors declare that they have no known competing financial
interests or personal relationships that could have appeared to influence
the work reported in this paper.

## Data Availability

The data that has been used is confidential.

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