Determinants of COVID-19 vaccine intention in a University population: a serial mediation approach

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1. Introduction & Objective

The Health Belief Model (HBM) [1] is one of the most often used conceptual models to identify determinants associated with vaccine intention:

- It has been used in many studies during previous pandemics and during COVID-19 pandemic
- **Relationships between the HBM dimensions seem to be undefined** [1] :
  - ➤ In most studies, each of the major dimensions were considered as independent of each other
  - ➤ Some studies have used the HBM model while applying analytical approaches such as mediation analysis [2] but not serial mediation for COVID-19 vaccine intention. However, in Jones et al., the authors pointed out that the differential effects of the HBM dimensions could be symptomatic of an underlying causal chain [3]

Objective of our study : To develop a serial mediation model dealing with latent variables to assess direct and indirect effects of the six HBM dimensions; perceived susceptibility, severity, benefits, barriers, self-efficacy and cues to action; on COVID-19 vaccine intention.

2. Materials and methods

A questionnaire on vaccine intention against COVID-19 was administered to staff and students at the University of Liège (Belgium) from April to June 2021. To evaluate direct and indirect effects of the HBM dimensions on vaccine intention (score 0-100), serial mediation models for each latent variable permutation were assessed with Partial Least Squares Path Modeling (PLS-PM):

- Bayesian information criterion (BIC) was used to compare models
- Internal consistency reliability and convergent and discriminant validity were evaluated
- Covariates: Sociodemographic variables, health literacy, psychological profile, body mass index, chronic disease and previous COVID-19 infection
- The "do not know" answers for items of the HBM dimensions were replaced by a score of 50% → sensitivity analysis

All statistical analyses were performed globally and by institutional status (staff and students). The statistical analyses were carried out using SAS (version 9.4 for Windows) statistical package and R (version 4.0) with particular packages seminR.

3. Description of the data

- Sample: 1256 participants (804 staff (64.0%) and 452 students (36.0%)); 60.3% females; median age 34.5 years.
- Vaccine intention score (P50 (P25-P75)): 100 (78.0-100); 100 (80.0-100) for staff and 98.5 (75.0-100) for students
- HBM dimensions with items significantly associated* with the vaccine intention (p<0.01): Perceived susceptibility, severity, benefits, barriers, self-efficacy
- No significant association was found for the item of the dimension Cues to action (p<0.05)
- Covariates were also significantly associated with vaccine intention (p<0.05)

Spearman correlation coefficients ranging, in absolute value, from 0.085 to 0.63

5. Conclusions

- **Serial mediations allow a better understanding of how a vaccine intention works**
- **Perceived barriers, the first HBM dimension of the causal chain, are a key determinant of COVID-19 vaccine intention**
- **Vaccination-related perceived barriers must be taken into account as a priority in communication strategies to enable individuals to make an informed choice**

6. References

[1] Champion, V.; Skinner, CS. The Health Belief Model. In: Glanz, K.; Rimer, B.; Viswanath, K., editors. Health behavior and health education. 4. San Francisco, CA: Jossey-Bass; 2008. p. 45-65.
[2] Berni I, Menouni A, Filali Zegzouti Y, Kestemont M-P, Godderis L, El Jaafari S. Factors associated with COVID-19 vaccine acceptance in Morocco: Applying the health belief model. Vaccines. 2022;10(5):784. doi:10.3390/vaccines10050784
[3] Jones CL, Jensen JD, Scherr CL, Brown NR, Christy K, Weaver J. The health belief model as an explanatory framework in communication research: Exploring Parallel, serial, and moderated mediation. Health Communication. 2015;30(6):566–76. doi:10.1080/10410236.2013.873363

4. Serial mediation model

The final serial mediation model with the lower BIC and better R^2, for the whole population and by institutional status:
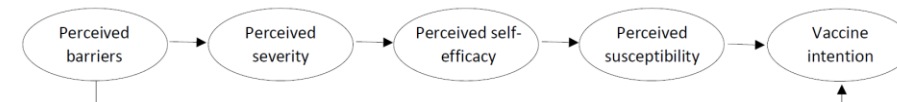
→ This Figure highlights a **significant indirect and direct effect between barriers and vaccine intention**.

- The Table below presents the strength of indirect effects of each dimension on the vaccine intention presented in the Figure, namely the serial mediation effects, globally and by institutional status
- The Table also shows that there are direct associations between two HBM dimensions and vaccine intention
- The sensitivity analysis conducted on a final sample reduced to 167 subjects led to the same conclusions

	Globally Estimation (CI95%)[1]	Staff Estimation (CI95%)[2]	Student Estimation (CI95%)[3]
Serial mediation effect			
Perceived barriers → Perceived severity	-0.092	-0.074	-0.13
	(-0.15 – -0.027)	(-0.17 – 0.002)	(-0.21 – -0.062)
Perceived severity → Perceived (low) self-efficacy	-0.13	-0.16	-0.085
	(-0.20 – -0.072)	(-0.25 – -0.080)	(-0.18 – -0.016)
Perceived (low) self-efficacy → Perceived (low) susceptibility	0.20	0.18	0.21
	(0.15 – 0.25)	(0.096 – 0.24)	(0.13 – 0.31)
Direct effect			
Perceived barriers → Vaccine intention	-0.20	-0.21	-0.20
	(-0.25 – -0.15)	(-0.26 – -0.14)	(-0.28 – -0.13)
Perceived (low) susceptibility → Vaccine intention	-0.55	-0.56	-0.51
	(-0.60 – -0.51)	(-0.64 – -0.50)	(-0.61 – -0.44)
Total effect			
Perceived barriers → Vaccine intention	-0.20	-0.21	-0.20
	(-0.25 – -0.15)	(-0.27 – -0.14)	(-0.28 – -0.13)
Perceived severity → Vaccine intention	0.015	0.017	0.009
	(0.008 – 0.025)	(0.005 – 0.028)	(0.002 – 0.024)
Perceived low self-efficacy → Vaccine intention	-0.11	-0.10	-0.11
	(-0.14 – -0.078)	(-0.14 – -0.06)	(-0.17 – -0.061)
Perceived low susceptibility → Vaccine intention	-0.55	-0.57	-0.51
	(-0.60 – -0.51)	(-0.64 – -0.50)	(-0.61 – -0.44)
	BIC = -592.65	BIC = -394.10	BIC = -177.69
	R^2 = 0.40	R^2 = 0.42	R^2 = 0.39

[1] Adjusted by gender, highest level of education, faculty and health literacy
[2] Adjusted by gender, faculty and health literacy
[3] Adjusted by gender, health literacy, perceived socio-economic status and faculty

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