



Psychological factors associated with the intention of getting vaccinated against COVID-19 in Mexico

Factores psicológicos asociados a la intención de vacunarse contra COVID-19 en México

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ABSTRACT. Introduction: Intention of getting vaccinated are governed by positive beliefs and attitudes towards the vaccine and vaccination, as well as others' opinion about the immunization. **Objective:** Identify the psychological factors associated with the intention to vaccinated against COVID-19 in Mexico, through the evaluation of a theory of planned behavior-based model. **Material and methods:** A sample of 729 adults from different states of the Mexican Republic participated, who were between 18 and 77 years old (mean = 33.57, SD = 14.28). The participants answered an evaluation battery disseminated by social networks. A path analysis was carried out on which absolute and comparative adjustment indices are reported. **Results:** It was identified that 87.2% of the participants reported intentions of getting vaccinated and the best perceived vaccine was the Pfizer-BioNTech. The model showed a good statistical fit and explains 62% of the variance for the intentions to vaccinated against COVID-19. **Conclusion:** Evidence is shown of the importance of beliefs and attitudes about vaccines, vaccination behavior and the opinion of the social group in the intention of getting vaccinated against COVID-19 in Mexican population.

Keywords: Attitude, intention, COVID-19 vaccines, social norms, health behavior.

RESUMEN. Introducción: Las intenciones de vacunarse están reguladas por las creencias y actitudes positivas hacia la vacuna y la vacunación, así como, la opinión de otros sobre la inmunización. **Objetivo:** Identificar los factores psicológicos asociados con la intención de vacunarse contra la COVID-19 en México, a través de la evaluación de un modelo basado en la teoría de la conducta planeada. **Material y métodos:** Participaron 729 adultos de diferentes estados de la República Mexicana, quienes se encontraban entre 18 y 77 años (media = 33.57, DE = 14.28). Los participantes respondieron una batería de evaluación diseminada por redes sociales. Se realizó un análisis de senderos sobre el cual se reportan índices de ajuste absoluto y comparativo. **Resultados:** Se identificó que el 87.2% de los participantes reportó intenciones de vacunarse y la vacuna mejor percibida fue la Pfizer-BioNTech. El modelo mostró un buen ajuste estadísticos y explica el 62% de la varianza de intenciones de vacunarse contra la COVID-19, siendo la norma subjetiva la variable que más aporta al modelo. **Conclusión:** Se muestra evidencia de la importancia de las creencias y actitudes sobre las vacunas, la conducta de vacunarse y la opinión del grupo social en las intenciones de vacunarse contra la COVID-19 en población mexicana.

Palabras clave: Actitudes, intención, vacunas para COVID-19, normas sociales, conducta de salud.

INTRODUCTION

Since the outset of the COVID-19 pandemic, behavioral preventive and social containment measures have been adopted to prevent transmission,¹⁻³ however, the first

measures have been implemented in an inconsistent manner throughout the pandemic (due to different factors) and the second measures have had a social, psychological and economic impact.³ Notwithstanding this, vaccination as a strategy to immunize the population has been

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indicated as the main form to approach management of the pandemic.⁴

On December 24, 2020, Mexico was the first Latin American country to start vaccination against COVID-19 with the Pfizer-BioNTech vaccine. Having an element to prevent and improve control of COVID-19 has raised positive expectations in the population.⁵ Nevertheless, despite effectiveness of the COVID-19 prevention measures, problems of misinformation have been identified among the population.⁶⁻⁸

Reports indicate a 95% efficacy of the Pfizer-BioNTech vaccine after the second dose,⁹ however, this fact has not stopped the population's concern caused by information given in traditional and digital media, which may give rise to speculation regarding its emergency use, leading to an excessive concern about the vaccine's negative effects, fear of same, doubts about its efficacy and non-vaccination.^{7,10-12}

Susceptibility, exposure and absorption rates in the population are among the factors conducive to the success of the vaccination programs around the world,¹⁰⁻¹³ as well as, trust and acceptance of the vaccine by the population, understanding of false beliefs about same and the intentions of getting vaccinated.¹³⁻¹⁶

As far as this last aspect is concerned, research worldwide has explored this phenomenon,¹⁷⁻¹⁹ some based on health behavior explanatory models such as the theory of planned behavior (TPB),²⁰ which claims that the intentions to engage in a behavior are the best predictor for the presence of same.²⁰

In the context of vaccination in the face of COVID-19, intentions would be based, on one hand, on people's attitudes towards being vaccinated, in which opinions that encourage or discourage a perceived behavioral control on getting vaccinated are involved and on the other hand, by the perception that an individual has regarding others' opinions (important to him/her) could be related to his/her getting vaccinated or not (subjective norm).²⁰

Predictive evidence on the intention to vaccinate shows that positive beliefs and attitudes towards the vaccine and vaccination, as well others' opinion on the immunization, would be some of the most relevant psychosocial factors to take into account, on the grounds that such factors are modifiable determinants which could be useful to develop behavioral interventions in the healthcare context.^{13,17,21-23}

Objective. The aim of this research study was to identify the psychosocial factors related to the intention to vaccinate against COVID-19 in Mexico through the evaluation of a TPB-based model.

MATERIAL AND METHODS

Participants

The initial sample of 869 participants obtained through chain or network non-representative sampling,²⁴ answered

an evaluation form on psychosocial factors related to being vaccinated against COVID-19. The form was designed based on the TPB^{13,20} and created on the Google Forms online platform and was disseminated by email and social networks such as Facebook and WhatsApp between February 1st and March 30th, 2021 (at the beginning of the 2nd vaccination stage for senior citizens aged 60 years or more in Mexico).

The participants answered the form with their prior informed consent and Privacy Notice. The project was evaluated and accepted by the Research Ethics Committee of the *Instituto Nacional de Enfermedades Respiratorias* (INER), registration number: S01-21.

A validation procedure was conducted with the participants' data to identify atypical cases with response trend, duplicated cases and inconsistency in the answers to similar items which resulted in the elimination of 73 cases. In addition, the cases of individuals who reported already having received the vaccine against COVID-19 ($n = 67$) were excluded, finally counting on a sample of 729 participants between 18 and 77 years of age (mean = 33.57, SD = 14.28).

Instruments

Sociodemographic data card: set of 10 questions to collect information on place of residence, family, education, occupation, opinion on some vaccine brands (Pfizer-BioNTech, AstraZeneca, Sputnik V, Moderna and CanSino), to name a few.

Evaluation of the intention of being vaccinated against COVID-19: item that evaluates the likelihood to get the vaccine against COVID-19 once the vaccine is available for the person. The item was answered using a Likert-type scale from 1 (totally disagree) to 5 (totally agree).

Beliefs and attitudes towards the COVID-19 (BAV-COVID-19) vaccine: instrument with 15 items that evaluates beliefs (8 items) and attitudes (7 items) regarding the vaccine against COVID-19. The scale of beliefs refers to the efficacy, logistics of vaccination, population at risk, side effects and individual and social benefits ($\alpha = 0.779$, $\Omega = 0.792$). The scale of attitudes includes opinions on safety, effectiveness, quality, benefits, negative effects, concern and need for the vaccine ($\alpha = 0.877$, $\Omega = 0.901$). Both instruments were answered using a Likert-type scale, the first one with 5 points from 1 (totally disagree) to 5 (totally agree) and the second one with 7 points from 1 (very negative) to 7 (very positive).

Attitudes regarding being vaccinated against COVID-19 (AV-COVID-19): instrument with 17 items that evaluate the perception on the opinion of significant people to get vaccinated or not (9 items, $\alpha = 0.929$, $\Omega = 0.934$), on the facility-difficulty dealing with possible negative

effects of the vaccine and perform preventive behaviors before getting vaccinated and after that, feeling prepared to receive it (4 items; perceived behavioral control, $\alpha = 0.704$, $\Omega = 0.677$) and attitudes on getting vaccinated (4 items, $\alpha = 0.837$, $\Omega = 0.868$), including assessments concerning getting vaccinated as something necessary, favorable, good and pleasant. The first two scales are Likert-type from 1 (totally disagree) to 5 (totally agree) and the last one with 7 points from 1 (very negative) to 7 (very positive).

Statistical analysis

Data were analyzed with the IBM SPSS Statistics 24 and AMOS 25 for Windows statistics software. Descriptive statistics were used to summarize the participants' characteristics and study variables. Normality of the data distribution was evaluated according to the asymmetry coefficients (value < 1.5) and kurtosis (value < 1.5), and the critical ratio of multivariate kurtosis (value < 7.00).²⁵

First, the measurement models of each scale were estimated through the confirmatory factor analysis (CFA), based on the standardized regression weighting criterion (factorial loads) and the following fit indices: the chi-square statistic (χ^2 , $p > 0.05$), the quotient resulting from χ^2/gf ($DF < 3$), the root mean square error of approximation ($RMSEA < 0.08$, 90% CI), the comparative fit index ($CFI > 0.90$) and the Tucker-Lewis index ($TLI > 0.90$).²⁶ The internal reliability of the scales was examined using Cronbach's alpha coefficient (α) and omega (Ω) coefficient.

Finally, a path analysis was used with the purpose of predicting the intention to vaccinate, considering the process and the theoretical structure of the TPB. For this, the maximum likelihood estimation procedure with a 95% bias-corrected bootstrapping (BC) was used with 1,000 samples,²⁶ in addition to considering the aforementioned fit indices and criteria in the evaluation of the measurement model.

RESULTS

Table 1 shows the sociodemographic characteristics of the participants, where it is observed that they were mostly women (68%), most of them from Mexico City and metropolitan area (84.6%) and the rest from the states of Baja California, Colima, Michoacán, Guanajuato, Hidalgo, Jalisco, Morelos, Puebla, Oaxaca, Querétaro, San Luis Potosí, Sonora, Tamaulipas, Veracruz, Tlaxcala and Yucatán (14.9%). Finally, most of the participants were students ($n = 281$, 38.5%), professionals ($n = 204$, 28%) or employees ($n = 126$, 16.5%).

It was identified that 87.2% ($n = 636$) of the participants reported their intention to vaccinate once they are eligible for the vaccination plan. With reference to the opinion on the vaccines it is observed that the most well-known and best perceived («as good») by the participants is the one

Table 1: Sociodemographic characteristics of participants.

Variables	n	%
Sex		
Female	496	68.0
Male	233	32.0
Place of residence		
Mexico City	325	44.6
State of Mexico	295	40.5
Other states	109	14.9
Marital status		
Single	455	62.4
Married	136	18.7
Partnered	83	11.4
Other	55	7.5
Educational level		
Bachelor's degree	506	69.4
High school	103	14.1
Graduate	73	10.0
Other	47	6.5

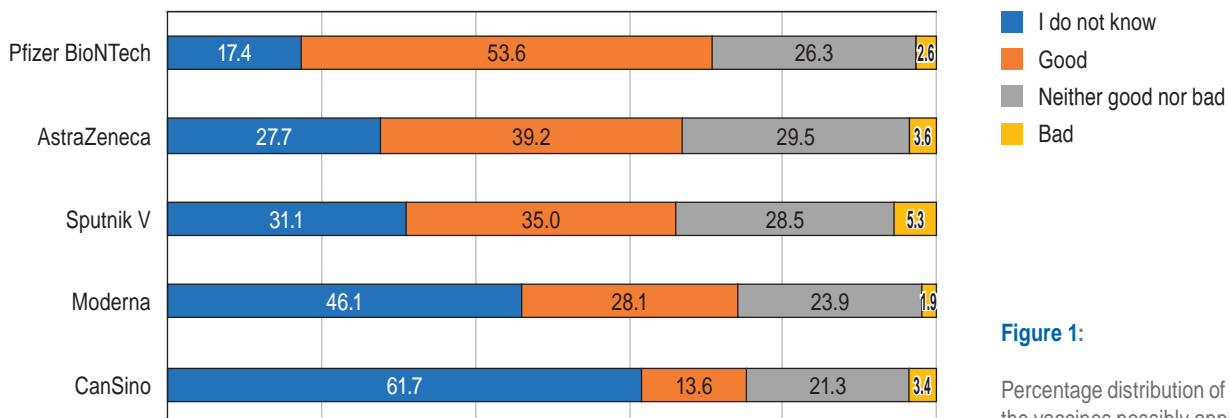


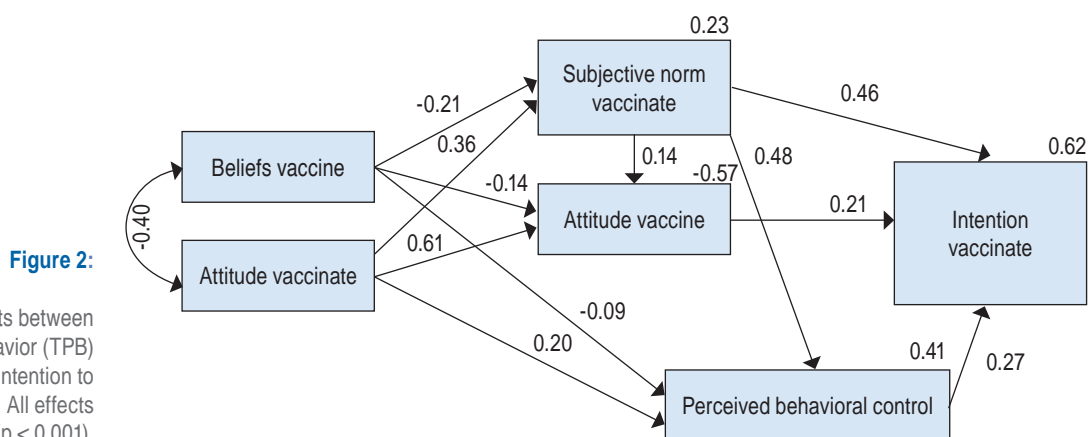
Figure 1:

Percentage distribution of the opinion on the vaccines possibly applied in Mexico.

Table 2: Description of theory of planned behavior (TPB) variables.

Scales	Variables	Min	Max	Mean	SD
BAV-COVID-19	Beliefs about the COVID-19 vaccine	8	40	12.98	4.56*
	Attitude about the COVID-19 vaccine	7	49	39.53	6.81
AV-COVID-19	Subjective norm	9	45	35.94	7.81
	Attitude towards getting vaccinated	4	28	24.80	3.40
	Perceived behavioral control	4	20	16.04	3.01
	Intentions of getting vaccinated	1	5	4.45	0.97

* The items describe negative ratings for the vaccine and therefore scores close to 8 mean favorable beliefs about same.



developed by Pfizer-BioNTech, followed by AstraZeneca, Sputnik V and Moderna. On the other hand, the least known and considered the least good is the CanSino vaccine. It is worth mentioning that the Sputnik V vaccine was the one perceived as the worst («bad») (Figure 1).

In addition to the foregoing, it is observed that the participants have positive beliefs and attitudes towards the vaccine against COVID-19 and intend to get vaccinated.

Likewise, the opinion of other people important to them is relevant when deciding whether to get vaccinated or not and finally, they feel confident in their knowledge of the vaccine, their capacity to deal with negative effects of the vaccine and continue behaving in a preventive manner until they get vaccinated and after doing so (perceived behavioral control) (Table 2).

Path analysis

In the model proposed (Figure 2) it is observed that, according to the analyzed sample, the variable that has the greatest influence on the intention to vaccinate against COVID-19 among the Mexican population is the subjective norm, in other words, people will have a higher intention to vaccinate if they believe that it is something beneficial for their social circle,

if they intend to get vaccinated and if they deem it is important for others to protect themselves with the vaccination too.

Along with this, a positive attitude towards getting vaccinated, knowledge on the vaccine, the perceived capacity to deal with the negative effects of the vaccine and the perceived capacity to engage in preventive behaviors before, during and after getting vaccinated perceived behavioral control, also contribute to the intention to vaccinate. Despite this, the subjective norm has substantial contributions to these two variables.

Lastly, people will have a higher intention to vaccinate if they have positive attitudes and beliefs about the vaccine against COVID-19, since these variables represent a relevant contribution to the attitude of getting vaccinated, the subjective norm and the perceived behavioral control.

As can be seen, the model explains the 62% of the variance of the intention to vaccinate against COVID-19, being a model that shows a very good fit considering the absolute and comparative fit indexes (Table 3).

DISCUSSION

Analyzing the results, a first aspect to discuss are the high scores in beliefs, attitudes (on the vaccine and getting

Table 3: Global fit indicators of the measurement models and path analysis.

Models	χ^2	DF	p	CFI	TLI	RMSEA	RMSEA CI 90%	
BAV-COVID-19	258.587	89	0.000	0.964	0.958	0.051	0.044	0.058
AV-COVID-19	410.739	113	0.000	0.962	0.955	0.060	0.054	0.066
Model	14.953	3	0.002	0.994	0.970	0.074	0.040	0.113

DF = difference; CFI = comparative fit index; TLI = Tucker-Lewis index; RMSEA = root mean square error of approximation.

vaccinated) and the subjective norm, factor which will result in Mexican people getting vaccinated. This is to be expected considering since historically, vaccination programs in Mexico have been successful due to the fact that they guarantee open access, gratuitousness and a comprehensive coverage,²⁷ an element to consider since in other countries the cost of the vaccine against COVID-19 has limited its affordability.²⁸

A high percentage of intention to vaccinate (87.2%) was reported in this study, which is higher compared to other countries, for example, 67%²⁹ reported in the United States, 64%¹³ in the United Kingdom and 52.2%²⁸ in China.

Regarding this aspect it is worthwhile mentioning that in most of the vaccine brands evaluated there was no negative opinion about same, it should be noted that, two of the five brands evaluated belong to renowned pharmaceutical companies which distribute other commercial medicines, a fact which may be creating a connection with the supplier.²¹

This fact is deemed relevant given that, by the time when the data were collected, some negative or undesirable effects allegedly attributable to vaccination or immunization had already been recorded and disclosed, aside from the suspension of the AstraZeneca vaccine in some European countries in mild March.

This study is based on the TPB model which has been used to evaluate the intention to vaccinate in different countries^{13,22,23} which explains 62% of the variance, whereas, in countries such as the United Kingdom, the evaluated variables in this research only explain 34%.¹³

As described in the results, the most important variable to predict the intention to vaccinate is the subjective norm, an expected result since Mexico has a collective culture that revolves around family and society³⁰ and considering that the development of the vaccine is a new and unknown event, decision making is governed by the social context and reference group.²²

The results contrast with those reported in the Chinese population, where attitudes and the subjective norm are of little relevance to the intention to vaccinate, whilst the perception of risk and awareness are the most important elements to consider before getting vaccinated,³¹ results also observed in the United States.¹⁸ Meanwhile, another study

in China²³ reports that attitudes play the most important role, similarly to countries such as New Zealand²² and the United Kingdom.¹³

The main limitations of the study were the self-report evaluation by digital means and the type of dissemination, as they can be considered inaccurate, however, there is evidence of their usefulness and equivalence with traditional evaluation,³² not to mention the validation procedure which was implemented between answers.

Another aspect to be considered is the distribution of the sample, given that most of the participants were women from the center of the country and with a high level of education. Nonetheless, this information is consistent with psychological research on COVID-19 worldwide.³³

CONCLUSIONS

Mexican population has positive beliefs and attitudes towards vaccines in general, and particularly there are high hopes and positive expectancy for the COVID-19 vaccine, which derives into a wide acceptance of the vaccine, contrary to what is observed in other countries, where anti-vaccine movements are present.⁷

In addition to the above, the behavior of getting vaccinated is valued positively, even more so when the assessment or approval of said behavior is made from the family or reference group of individuals (subjective norm), central elements that impact the intention to be vaccinated against the COVID-19.

However, the present study was carried out when vaccination began, a time of low availability, high demand and in which news about adverse events associated with vaccines emerged, which shows the importance of social acceptance of a behavior so that this is carried out.

Finally, it is important to consider that other studies that have evaluated the intention to be vaccinated, report that vaccine absorption is not uniform among different populations²¹ hence it is necessary to perform analyses based on sociodemographic factors such as the level of education, region, race, age and vaccination history, concluding that these are the main intention to vaccinate predictors,^{18,19,21,29} however, these factors are not distal, insofar as the psychological variables are proximal and

therefore it is possible to propose interventions to bring about changes.

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