

# INTENTION OF COVID-19 VACCINATION IN THE SRI LANKAN CONTEXT: A STRUCTURAL EQUATION MODEL APPROACH

Ahamed Rifath M.R., Fathima Jemziya M.B.

Department of Biosystems Technology, Faculty of Technology, South Eastern University of Sri Lanka, Oluvil, Sri Lanka

Correspondence: ahamedrifath@seu.ac.lk

## ABSTRACT

### INTRODUCTION:

The intention on vaccination of COVID-19 is influenced by demographic and psychological factors. An understanding of the factors that influence the intention of COVID-19 vaccination is important to achieve the successful vaccination programs.

### OBJECTIVE:

The objective of this study is to determine the critical factors affecting the intention of COVID-19 vaccination in Sri Lanka.

### METHODOLOGY:

An online questionnaire was implemented amongst Sri Lankans to acquire the primary data. The questionnaire assessed the social demographic features, vaccination details, perception and intention about the vaccination, social norm, media exposure, and trust towards vaccines. Descriptive analysis was used to analyse the demographic characters and vaccination details. The structural equation model was used to analyse the relationship between the intention of COVID-19 vaccination and other relevant factors.

### RESULTS:

The results showed that the perception of vaccine, social norms and trust were significantly related with people's intention towards vaccination, whereas media exposure showed an insignificant relationship with the intention towards vaccination. Meanwhile, perception about vaccine and media exposure had significant relationships between trust of the vaccines.

### CONCLUSION:

It was conclusive that the intention of the COVID-19 vaccination was greatly influenced by the perception of vaccine, social norms and trust besides media exposure, which had an indirect effect on intention towards vaccination of COVID-19.

### KEYWORDS

COVID-19, Perception, Sri Lanka, Structure equation model, Vaccination

## INTRODUCTION

Since the onset of COVID-19 pandemic, several nations have been fighting to control the community spread of COVID-19 virus. The World Health Organization (WHO) has provided several health guidelines as preventative measures to minimize the incidence of the COVID-19 virus such as hand hygiene, social distancing, and quarantine [1]. Since vaccination is one of the most efficient and cost-effective preventive measure to control the infectious diseases [2]. COVID-19 vaccines are considered critical for preventing and controlling the corona infections [3]. The Government provides the vaccines free of charge to the public, however, these vaccinations against COVID-19 are still challenged. The uncertainty on the acceptance of COVID-19 vaccines is considerable. Anti-immunization attitude has risen with vaccination reluctance resulting [4]. Anti-vaccination initiative comments, conspiracy theories, misconceptions and misperceptions, doubt about the speed of vaccine development, chronic side effects, and professionals' opinion about vaccines were the major concerns in vaccine hesitancy [5]. The intention to take the COVID-19 vaccinations are influenced by certain variables such as attitude, trust, risk perception, perceived benefits and social norms [6].

With reported variation in the COVID-19 vaccination intentions, it is critical to understand the human behaviours to develop health campaigns and educational initiatives targeted at fostering greater adoption of the Covid-19 vaccinations. To assess the public interest on getting vaccinated against COVID-19, the structural equation model is widely used by many researchers [6,7,8]. Structural equation modeling is the useful statistical method for dealing with causal relationships between latent variables and observable variables [9]. Structural equation modeling offers a particular advantage over traditional multiple regression analyses in that it has more statistical power in terms of rejecting a false null hypothesis than the other approaches. Furthermore, it outperforms other correlational approaches such as regression since it analyses several variables concurrently, and latent components minimize measurement error [10].

In the context of vaccinations, risk of perception may be described as concerns about vaccine efficacy and insecurity of concerns about vaccine adverse effects [11]. Intentions to be vaccinated are strongly influenced by risk of perception [12]. Individuals' perspectives and decisions

making are impacted by such external factors, which are referred to as social norms [13]. According to Graupensperger et al. [14], social norms are positively associated with the intentions of participants towards the vaccination. People are utilising a variety of sources including mass media and social media to acquire the information and updates about the degree of infections during the COVID-19 pandemic, and these sources also might influence on people's acceptance or refusal of COVID-19 vaccinations [15]. In relation to this, acceptance of vaccines is heavily influenced by trust towards the vaccines [16]. Planning awareness programs and health campaigns to promote the vaccination rate in the society are important to understand the variables and how they are affecting the acceptance of COVID-19 vaccinations. The objective of this study is to investigate, the media exposure, perception about the vaccination, trust and social norms influence on the intention of COVID-19 vaccination.

## LITERATURE REVIEW

Previous research has revealed that vaccination hesitancy is a common occurrence across the world, with varying causes for refusal of vaccine adoption [17,18]. The most common reasons included were trust, social norms, media exposure and perception [7]. Recent research has discovered a substantial link between the intention to receive COVID-19 vaccinations and perceived safety. An association between a negative attitude toward COVID-19 vaccines and hesitation to obtain the vaccines, connection between religiosity and reluctance to obtain COVID-19 vaccines may contribute to COVID-19 vaccine hesitancy [7,17,18].

## TRUST

The public are cognitive misers, and they may lack the time or cognitive skills to comprehend a complicated and evolving pandemic situation like the coronavirus, which continues to confound the researchers [19]. Many researchers have discovered that, using information from a reliable source reduces cognitive process and gives a shortcut for making decisions about a situation [20,21]. Further, several studies have found that trust in scientists, the government, and the media are all key drivers of vaccination intentions and behaviour [22,23]. According to the study of Liu and Yang [24], trust was found to be a substantial predictor of vaccination intention and was positively related to it. Krishna [25] discovered that trust in the health sector regarding the vaccination were linked to

fewer negative thoughts against vaccinations, which were linked to vaccination intention.

## SOCIAL NORMS

Normative social behavior theory states that, individuals' activities are influenced by their perceptions of how others in their social group act (descriptive norms) and perceived social pressure to adopt similar behaviors (injunctive norms) [26]. According to a number of researchers, both descriptive and injunctive social norms have an influence on a range of behaviors, including vaccination intentions for a variety of diseases [22,27,28]. An individuals' drive for group membership is activated by injunctive norms, which change their behaviour through perceptions of social incentives and consequences [29]. Many studies have discovered a positive association between social norms and health behaviours, such as vaccination intentions [14,30]. Bish et al. [31] discovered that relatives and friends had been vaccinated and that others close to them to be vaccinated, were linked to the vaccination intention of individuals. Because COVID-19 is a novel pandemic and the science behind it is changing, and many behavioral judgments are undertaken with ambiguity, which enhances the significance of normative impact [32].

## MEDIA EXPOSURE

Social media platforms are the most popular places to find and discuss COVID-19 information [33, 34]. COVID-19 vaccination-related news on media has the ability to influence the public's intention to vaccinate [35]. Previous researches have demonstrated that internet information influences people's views, attitudes, and vaccination intentions [36,37,38]. People frequently use social media to obtain expert knowledge on the safety and efficacy of vaccines [39]. Accurate vaccination facts can boost their confidence and faith in vaccinations [40]. Previous research on influenza and HPV vaccinations found that the exposure to vaccination-related information on a regular basis via social media was favorably connected with positive perceptions and use of such vaccines [41,42]. However, false information and anti-vaccination views are occasionally spread on the social media, such as conspiracy theories, overstated side effects, and lowered vaccine efficacy, which may promote the vaccine reluctance [43,44]. Many worldwide health organizations have joined forces with social media behemoths to tackle COVID-19 and encourage COVID-19 immunization. For example, when users search for information on COVID-19 vaccines on Facebook, they are directed to WHO webpages in order to offer correct and trustworthy facts

and to eliminate misleading allegation regarding vaccines [35].

## PERCEPTION

In the context of vaccinations, the risk of perception may be described as concerns about vaccine efficacy and insecurity of concerns about vaccine adverse effects [11]. Previous studies have found that vaccination acceptance is low among women, the unemployed, and those with a lower level of education, and that they have a favorable relationship with risk perceptions [45,46]. Concerns about the vaccine's effectiveness or safety were cited as justifications for refusing to be immunized against COVID-19 [47,48]. Uncertainty about vaccine development or testing procedures, as well as scientific investigation, was discovered to be prevalent among vaccine-hesitant responders in the United States and Italy [49,50]. False information or acceptance of conspiracy theories, on the other hand, was found to be adversely linked with vaccination intentions [51].

## METHODOLOGY

### CONCEPTUAL FRAMEWORK

The proposed conceptual framework was developed with a detailed literature review, using five constructs including perception of COVID-19 vaccination (P), social norms (SN), perceived media exposure on COVID-19 vaccines (M), trust towards COVID-19 vaccines (T), and intention on the COVID-19 vaccination (I) (Figure 1).

The following hypotheses were developed using the proposed conceptual framework,

H1: Perceived media exposure about COVID-19 vaccine influence the intention of obtaining COVID-19 vaccination

H2: Social norms are affecting the intention of obtaining COVID-19 vaccination

H3: Perception on COVID-19 vaccination is influenced by the trust of participants towards COVID-19 vaccinations

H4: Perception about the COVID-19 vaccination is influenced by the intention of obtaining COVID-19 vaccination

H5: Perceived media exposure about COVID-19 vaccines is influenced by the trust of participants towards COVID-19 vaccinations

H6: The intention of obtaining COVID-19 vaccination is affected by the participants trust towards COVID-19 vaccinations

## DATA COLLECTION

A structured questionnaire was developed and administered through the internet during the period May to July 2021 among the adult population of Sri Lanka. The questionnaire was pretested with 20 participants to ensure the questions were understandable and adequate. It was administered to obtain participant's socio-demographic data and Likert scale questions related to COVID-19 vaccination. The Likert scale varying from the 1 to 5, where 1 denoted strongly disagree and 5 denoted strongly agree. There were 300 participant responses that were registered.

## STATISTICAL ANALYSIS

The collected socio-demographic data were analysed using the descriptive analysis with the SPSS 25.0. The Likert scale data were analysed using structural equation model (SEM) with SPSS AMOS 23.0. SEM consists of two models; measurement and structural models. Proposed model consisted of four constructs namely perception, media exposure, social norms and trust which were considered as independent variable and intention towards COVID-19 considered as a dependent variable. Prior to structural modelling, the study was evaluated the latent constructs of measurement model for dimensionality, validity, and reliability using a procedure known as confirmatory factor analysis (CFA) as suggested by Byrne [52]. CFA is carried out to determine whether all observed variables (indicator variables) appropriately reflected their underlying

constructs (latent variables) and whether the measurement model had acceptably fit to the data. Twenty-one items were used to assess these four constructs other than demographic details of respondents. Two indicators which were less contributed to the construct (less than 0.4 factor loading) were removed and model was re-estimated. The Cronbach alpha was used to determine the internal accuracy of survey items. The measurement model was evaluated to verify a sufficient model fitness level and constructed validity and reliability. Afterwards, path analysis was used to examine the predicted causal relationship among the latent constructs [52].

## RESULTS AND DISCUSSION

### DESCRIPTIVE ANALYSIS

The demographic data of the participants were collected in order to understand the structure of the sample population. According to the results, most of the respondents were women, with equal proportion of lactating women (2.1 %) and pregnant women (2.1 %). The sample population were mostly aged between 18-29 (67.6 %). Among the sample population, most of them were obtained tertiary education (90.3 %) and majority of them were unmarried (69.1 %) (Table 1). Among the sample population, the individuals with 37.6 % were vaccinated with at least one dosage (79.4 %). The Sinopharm vaccine has been become mostly obtained vaccine type by the respondents. After the vaccination, most (61.4 %) answered as not experienced any discomforts. Fever, pain in the body, headache, and tiredness were the main discomforts experienced after the vaccination (Table 2).

TABLE 1. SOCIO-DEMOGRAPHIC CHARACTERISTICS OF THE RESPONDENTS

Features	Category	Percentage (%)
Gender	Male	42.4
	Female	57.6
Age	18-29	67.6
	30-59	21.8
	60 & over	10.6
Female	Ordinary	95.8
	Pregnant	2.1
	Lactating	2.1
Employment status	Unemployed	50.3
	Employed	49.7
Educational Level	Primary	1.8
	Secondary	7.9
	Tertiary	90.3
Civil status	Married	30.9

	Unmarried	69.1
--	-----------	------

**TABLE 2. STATUS OF VACCINATIONS**

Parameter	Category	Percentage (%)
Already vaccinated	Yes	37.6
	No	62.4
Type of vaccine	Sinopharm	71.6
	Pfizer	5.9
	AstraZeneca	18.6
	Moderna	3.9
Number of doses	1	79.4
	2	20.6
Felt discomfort after vaccination	Yes	38.6
	No	61.4
Type of discomfort	Fever	21.8
	Pain	35.6
	Headache	3.4
	Tiredness	27.6
	Other	11.5

### RELIABILITY AND VALIDITY ANALYSIS

Initially, the 21 question statements were used as indicators in the testing of the model fit of measurement model (Appendix 1). Thus, some indicator questions were excluded (I5 and P3) due to the low factor loading (less than 0.4) and insignificant at 0.05 probability. Afterwards, revised model was established and indicated in Figure 2. To test the internal consistency of each construct of the questionnaire, a reliability test was performed. The Cronbach's alphas of constructs were evaluated to assess the internal consistency which are higher than 0.7 and indicating good reliability for all indicator variables (Table 03).

Three indices were employed to assess convergent validity: factor loading values must be more than 0.7, average variance extracted (AVE) values must be greater than 0.5, and composite reliability (CR) values must be greater than 0.7 [53]. The composite reliability of all constructs was higher than suggested value 0.7 except perception construct. The

CR of the perception construct was marginally less than 0.7, even though other constructs had higher CR value than threshold value indicating that model has a good convergent validity. The AVE of the constructs were higher than the threshold value 0.5 which indicating that model has strong convergent validity. The factor loading values are more than 0.7 which indicating a strong convergent validity (Table 04). Further, square root AVE of each construct must be greater than the correlation coefficient among sub constructs to achieve discriminant validity. Discriminant validity describes the degree to which one construct differs from another. Other than the correlation coefficient of intention and trust, rest of the values are following the condition which indicating good discriminant validity for all constructs (Table 05). In the context of divergent and convergent validity, the adequate degree of construct validity is shown by testing findings indicating that, for a structural model evaluation, research constructs are appropriately fitted.

**TABLE 3. RESULTS OF RELIABILITY TEST**

Construct	Items	Cronbach's alpha
Trust	T1, T2, T3, T4, T5, T6, T7	0.922
Media exposure	M1, M2, M3	0.768
Social norms	SN1, SN2, SN3	0.757

Perception	P1, P2	0.709
Intention	I1, I2, I3, I4	0.849

TABLE 4. RESULTS OF CONVERGENT VALIDITY TEST

Construct	Variable	Factor Loading	CR	AVE
Trust	T1	0.80	0.923	0.633
	T2	0.84		
	T3	0.84		
	T4	0.83		
	T5	0.75		
	T6	0.85		
	T7	0.74		
Media exposure	M1	0.76	0.781	0.544
	M2	0.76		
	M3	0.78		
Social norms	SN1	0.8	0.785	0.565
	SN2	0.92		
	SN3	0.72		
Perception	P1	0.83	0.675	0.517
	P2	0.69		
Intention	I1	0.74	0.880	0.648
	I2	0.75		
	I3	0.90		
	I4	0.82		

CR = Composite reliability; AVE = average variance extracted

TABLE 5. RESULTS OF DISCRIMINANT VALIDITY TEST

	AVE	MSV	MaxR(H)	Trust	Media	Social Norm	Perception	Intention
<b>Trust</b>	0.633	0.654	0.930	<b>0.796*</b>				
<b>Media</b>	0.544	0.241	0.789	0.491	<b>0.737*</b>			
<b>Social Norm</b>	0.565	0.162	0.880	0.335	0.402	<b>0.752*</b>		
<b>Perception</b>	0.517	0.323	0.729	-0.490	0.008	0.041	<b>0.719*</b>	
<b>Intention</b>	0.648	0.654	0.899	0.809	0.398	0.363	-0.568	<b>0.805*</b>

AVE = average variance extracted; MSV = maximum shared variance; MaxR(H) = maximum reliability; (\*) = square root of AVE.

**TABLE 5. HYPOTHESIS TESTING**

Hypothesis	Constructs	Estimate	S.E.	C.R.	P
H1	Trust <--- Media exposure	.506	.117	4.336	***
H2	Trust <--- Perception	-.629	.145	-4.333	***
H3	Intention <--- Social norm	.205	.076	2.683	**
H4	Intention <--- Trust	.655	.156	4.199	***
H5	Intention <--- Perception	-.518	.174	-2.972	**
H6	Intention <--- Media exposure	.023	.131	.180	.857

\*\*\* (p<0.001), \*\* (p<0.01); CR=Critical ratio, SE= Standard error, P= Probability

**MEASUREMENT MODEL**

The CFA was tested for the adequate model fitness level. Maximum Likelihood method was used to estimate the measurement model and model fit was assessed by using Multiple Fit Indices. The model fit was good as chi-square value ( $\chi^2$ ) 194.77, degree of freedom (df) 138, probability less than 0.01;  $\chi^2/df$  is 1.411, comparative fit index (CFI) 0.959, Tucker-Lewis Index (TLI) 0.95, Root Mean-Square Error of Approximation (RMSEA) 0.057, Goodness of fit index (GFI) 0.864, and Adjusted goodness of fit index (AGFI) 0.813. The threshold values of the model fit were " $\chi^2/df < 3.0$ , with the values of CFI, TLI  $\geq 0.90$ , RMSEA  $\leq 0.08$ , and AGFI  $\geq 0.80$  [7]. According to Hair et al. [53], the fit indices indicate a good model fit is obtained. It means COVID-19 vaccination intention can be assessed through these indicators and also public behaviour towards COVID-19 vaccination can be moderated through the measurements driven by these indicators.

According to the measurement model (Figure 2) SN2 indicator showed the highest factor loading (0.92) towards social norms which indicated that people who very close to the individual had an impact on decision to get the COVID-19 vaccination (by 92 %) the underlying construct of social norm. Based on this finding, the researcher can argue that influence of close relatives and friends' decision can greatly affect the someone's decision on taking COVID-19 vaccination. The thinking of COVID-19 vaccination is a viable option for treating and preventing the COVID-19 pandemic (T6) highly reflect the factor trust by 85 %. As a result, the researcher can recommend government-led awareness campaigns to boost trust in COVID-19 vaccinations.

The M3 observed variable showed a higher estimate (0.78) towards media coverage which showed the belief on

information on COVID-19 vaccinations found on media was beneficial had highly reflect media coverage of the respondent by 78 %. It means, people have a believe that information revealed in the media has a significant impact on decision-making. Therefore, the researcher can suggest that promotional campaign through the media would reach the population effectively. The negative perception like COVID-19 vaccinations is produce negative side effects (P1) highly reflects the underlying construct perception by 83 %. Therefore, relevant bodies should take necessary actions to remove such negative thought among the population as it is greatly affecting the construct perception. The I3 indicator showed the highest factor loading (0.9) towards intention which indicated that thought of vaccines strengthen the immune system of respondents highly reflects (by 90 %) the underlying construct of intention.

**STRUCTURAL MODEL**

The structural model was used to test the research hypotheses between proposed conceptual framework (Figure 3). The fitness of the structural model was tested using multiple fit indices. The model fit was good as chi-square value ( $\chi^2$ ) 204.73, degree of freedom (df) 141, probability less than 0.01;  $\chi^2/df$  was 1.452, comparative fit index (CFI) 0.954, Root Mean-Square Error of Approximation (RMSEA) 0.060, Goodness of fit index (GFI) 0.862, Adjusted goodness of fit index (AGFI) 0.814, and Normal fit index (NFI) 0.825. Despite the fact that the GFI and AGFI values did not surpass 0.9 (the threshold value) and satisfied with the criteria proposed by Baumgartner and Homburg [54] and Doll et al. [55]. Therefore, the researcher can argue that intention towards COVID-19 vaccination in Sri Lanka can be enhanced by promoting through these indicators (Figure 3) included under each Construct.

FIGURE 1: CONCEPTUAL FRAMEWORK

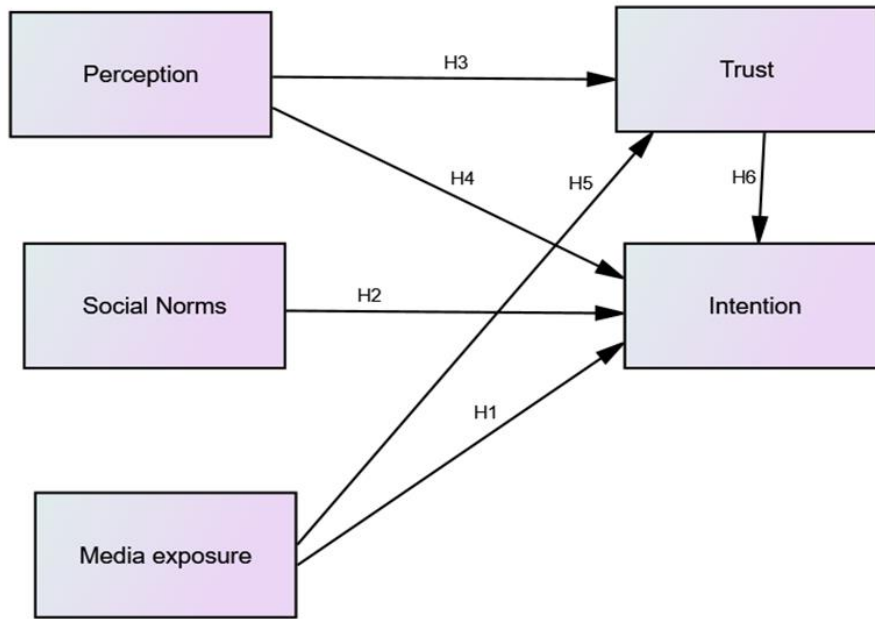


FIGURE 2: MEASUREMENT MODEL

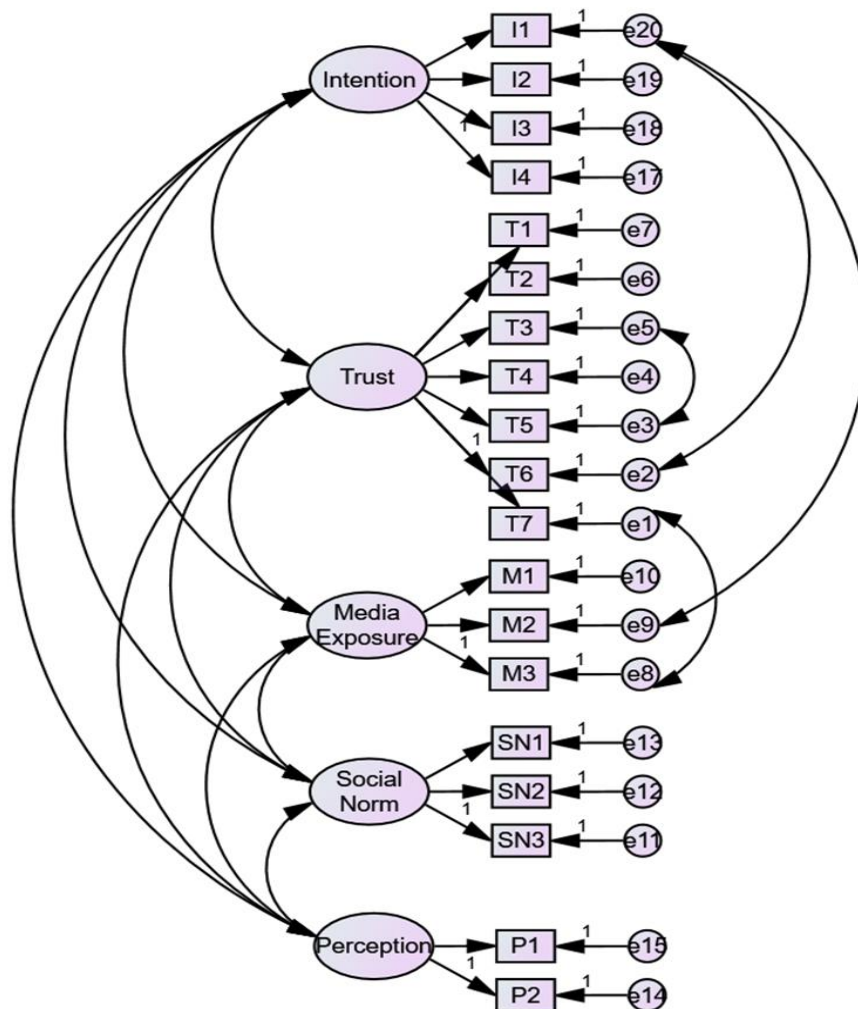
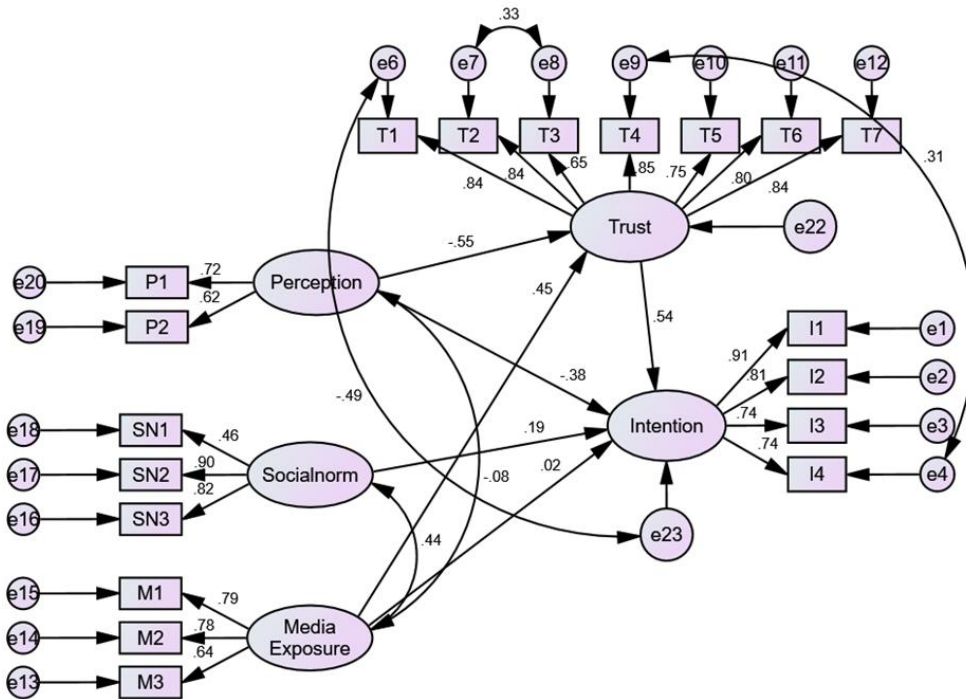




FIGURE 3: STRUCTURAL MODEL



Path analysis was used to perform hypothesis testing. The hypothesis results revealed that, the media exposure ( $\beta=0.506$ ,  $t=4.366$ ,  $p<0.001$ ) and perception ( $\beta= -0.629$ ,  $t=4.333$ ,  $p<0.001$ ) on COVID-19 vaccination on trust towards vaccination, the social norms SN1 on intention of getting COVID-19 vaccination ( $\beta=0.205$ ,  $t=2.683$ ,  $p<0.01$ ), the trust towards the COVID-19 vaccination on intention of getting COVID-19 vaccination ( $\beta=0.655$ ,  $t=4.199$ ,  $p<0.001$ ), and the perception on COVID-19 vaccination on intention of getting COVID-19 vaccination ( $\beta= -0.518$ ,  $t= -2.972$ ,  $p<0.01$ ) were significant. Therefore, the hypothesis H1, H2, H3, H4 and H5 were well supported. However, the media exposure about the COVID-19 vaccination on intention of getting COVID-19 vaccination ( $\beta= 0.023$ ,  $t= 0.180$ ,  $p>0.05$ ) were not significant, therefore, hypothesis H6 was not supported and expressed in Table 05. According to Hair et al. [53], the fit indices indicate a good model fit. Therefore, the researcher can argue that intention toward COVID-19 vaccination of Sri Lankan population can be enhanced by promoting through these indicators (Table 5) included under each Construct.

According to these research findings social norms had a significant impact on the intention towards the COVID-19 vaccine acceptance. The social norm was measured by using two indicator statements that asked about family and the important people to the respondent influencing in the decision making, have an effect on the intention on

COVID-19 vaccine acceptance. Further, literature review also revealed that the social norms have an influence on the intention on the COVID-19 vaccine uptake [56]. The participants are willing to receive the COVID-19 vaccines when the trust towards the vaccine had higher. The trust was measured with seven indicator statements regarding the trust towards the vaccines. Latkin et al. [57] also found that trust had a significant effect on the COVID-19 intention of vaccination.

The perception on the COVID-19 vaccination had negative impact on the intention of vaccinations. The perception was assessed by the indicator statements such as COVID-19 vaccines had side effects and insufficient trials. Zeballos et al. [58] also found that risk perception had a significant effect on the COVID-19 vaccination. The media exposure about COVID-19 vaccine had insignificant relationship with intention of the COVID-19 vaccination. The media exposure was studied using indicator statements which were influences on provision of information by the government and the received information from social and mass media. The literature study also revealed the same result obtained by Mir et al. [5]. The perception and the media exposure had substantial link with the trust towards the COVID-19 vaccines. Szilagy et al. [59] also reported that trust towards the COVID-19 vaccines had a relationship with the source of information.

## CONCLUSION

Against the backdrop of this project, it is possible to conclude that relevant government bodies can develop action plans and campaigns to promote the vaccine acceptance among the people by considering variables such as trust, social norms, media exposure and perception.

Providing reliable information regarding the vaccines, implementing awareness programmes among the public, utilization of media to disseminate the information regarding the vaccine and providing information about the importance of herd immunity could be tackle the hesitancy towards the COVID-19 vaccinations by considering these factors to develop the action plans.

This research had certain limitations including constraints in the theoretical model and limited number of constructs to explain the vaccine uptake behavior of Sri Lankan people. Despite the limitations, the findings of this research study had a number of significances for the human health-related campaigns and informative initiatives targeted at increasing the intention of COVID-19 vaccination.

## References

1. World Health Organization. Global patient safety action plan 2021–2030: towards eliminating avoidable harm in health care.
2. Lurie N, Saville M, Hatchett R, Halton J. Developing Covid-19 vaccines at pandemic speed. *New England Journal of Medicine*. 2020 May 21;382(21):1969-73.
3. Wang J, Jing R, Lai X, Zhang H, Lyu Y, Knoll MD, Fang H. Acceptance of COVID-19 Vaccination during the COVID-19 Pandemic in China. *Vaccines*. 2020 Sep;8(3):482.
4. Machingaidze S, Wiysonge CS. Understanding COVID-19 vaccine hesitancy. *Nature Medicine*. 2021 Aug;27(8):1338-9.
5. Khubchandani J, Sharma S, Price JH, Wiblehauser MJ, Sharma M, Webb FJ. COVID-19 vaccination hesitancy in the United States: a rapid national assessment. *Journal of Community Health*. 2021 Apr;46(2):270-7.
6. Ansari-Moghaddam A, Seraji M, Sharafi Z, Mohammadi M, Okati-Aliabad H. The protection motivation theory for predict intention of COVID-19 vaccination in Iran: a structural equation modeling approach. *BMC Public Health*. 2021 Dec;21(1):1-9.
7. Mir HH, Parveen S, Mullick NH, Nabi S. Using structural equation modeling to predict Indian people's attitudes and intentions towards COVID-19 vaccination. *Diabetes & Metabolic Syndrome: Clinical Research & Reviews*. 2021 May 1;15(3):1017-22.
8. Erawan MA, Zaid Z, Pratondo K, Lestari AY. Predicting Covid-19 vaccination intention: The role of health belief model of muslim societies in Yogyakarta. *Al-Sihah: The Public Health Science Journal*. 2021 Jun 30;13(1):36-50.
9. Wu, M. L. Structural equation modeling—operation and application (2nd ed.) Chongqing Publishing House. 2010.
10. Beran TN, Violato C. Structural equation modeling in medical research: a primer. *BMC research notes*. 2010 Dec;3(1):1-0.
11. Lehmann BA, Ruiter RA, Chapman G, Kok G. The intention to get vaccinated against influenza and actual vaccination uptake of Dutch healthcare personnel. *Vaccine*. 2014 Dec 5;32(51):6986-91.
12. Caserotti M, Gavaruzzi T, Girardi P, Tasso A, Buizza C, Candini V, Zarbo C, Chiarotti F, Brescianini S, Calamandrei G, Starace F. Who is likely to vacillate in their COVID-19 vaccination decision? Free-riding intention and post-positive reluctance. *Preventive medicine*. 2022 Jan 1; 154:106885.
13. Chu H, Liu S. Integrating health behavior theories to predict American's intention to receive a COVID-19 vaccine. *Patient Education and Counseling*. 2021 Aug 1;104(8):1878-86.
14. Graupensperger S, Abdallah DA, Lee CM. Social norms and vaccine uptake: College students' COVID vaccination intentions, attitudes, and estimated peer norms and comparisons with influenza vaccine. *Vaccine*. 2021 Apr;39(15):2060-7.
15. Mannan DK, Farhana KM. Knowledge, attitude and acceptance of a COVID-19 vaccine: a global cross-sectional study. *International Research Journal of Business and Social Science*. 2020 Dec 7;6(4).
16. Majid U, Ahmad M. The factors that promote vaccine hesitancy, rejection, or delay in parents. *Qualitative Health Research*. 2020 Sep;30(11):1762-76.
17. Lane, S., MacDonald, N. E., Marti, M., & Dumolard, L. (2018). Vaccine hesitancy around the globe: Analysis of three years of WHO/UNICEF Joint Reporting Form data-2015–2017. *Vaccine*, 36(26), 3861-3867.
18. Wagner AL, Masters NB, Domek GJ, Mathew JL, Sun X, Asturias EJ, Ren J, Huang Z, Contreras-Roldan IL, Gebremeskel B, Boulton ML. Comparisons of vaccine

- hesitancy across five low-and middle-income countries. *Vaccines*. 2019 Dec;7(4):155.
19. Thaker J. Planning for a COVID-19 Vaccination Campaign: The Role of Social Norms, Trust, Knowledge, and Vaccine Attitudes. 2020;10.
  20. Poortinga W, Pidgeon NF. Exploring the dimensionality of trust in risk regulation. *Risk Analysis: An International Journal*. 2003 Oct;23(5):961-72.
  21. Siegrist M, Gutscher H, Earle TC. Perception of risk: the influence of general trust, and general confidence. *Journal of risk research*. 2005 Mar 1;8(2):145-56.
  22. Bradshaw AS, Shelton SS, Wollney E, Treise D, Auguste K. Pro-vaxxers get out: Anti-vaccination advocates influence undecided first-time, pregnant, and new mothers on Facebook. *Health Communication*. 2021 May 12;36(6):693-702.
  23. Cadeddu C, Daugbjerg S, Ricciardi W, Rosano A. Beliefs towards vaccination and trust in the scientific community in Italy. *Vaccine*. 2020 Sep 29;38(42):6609-17.
  24. Liu Z, Yang JZ. In the wake of scandals: how media use and social trust influence risk perception and vaccination intention among Chinese parents. *Health Communication*. 2021 Aug 24;36(10):1188-99.
  25. Krishna A. Poison or prevention? Understanding the linkages between vaccine-negative individuals' knowledge deficiency, motivations, and active communication behaviors. *Health Communication*. 2018 Sep 2;33(9):1088-96.
  26. Rimal RN, Real K. How behaviors are influenced by perceived norms: A test of the theory of normative social behavior. *Communication research*. 2005 Jun;32(3):389-414.
  27. Chen L, Zhang Y, Young R, Wu X, Zhu G. Effects of vaccine-related conspiracy theories on Chinese young adults' perceptions of the HPV vaccine: An experimental study. *Health Communication*. 2021 Sep 19;36(11):1343-53.
  28. Xiao X, Borah P. Do norms matter? Examining norm-based messages in HPV vaccination promotion. *Health communication*. 2021 Oct 15;36(12):1476-84.
  29. Cialdini RB, Kallgren CA, Reno RR. A focus theory of normative conduct: A theoretical refinement and reevaluation of the role of norms in human behavior. In *Advances in experimental social psychology* 1991 Jan 1 (Vol. 24, pp. 201-234). Academic Press.
  30. Quinn SC, Hilyard KM, Jamison AM, An J, Hancock GR, Musa D, Freimuth VS. The influence of social norms on flu vaccination among African American and White adults. *Health education research*. 2017 Dec 1;32(6):473-86.
  31. Bish A, Yardley L, Nicoll A, Michie S. Factors associated with uptake of vaccination against pandemic influenza: a systematic review. *Vaccine*. 2011 Sep 2;29(38):6472-84.
  32. Young SD, Goldstein NJ. Applying social norms interventions to increase adherence to COVID-19 prevention and control guidelines. *Preventive Medicine*. 2021 Apr 1; 145:106424.
  33. Saud M, Mashud MI, Ida R. Usage of social media during the pandemic: Seeking support and awareness about COVID-19 through social media platforms. *Journal of Public Affairs*. 2020 Nov;20(4): e2417.
  34. Lin Y, Hu Z, Alias H, Wong LP. Influence of mass and social media on psychobehavioral responses among medical students during the downward trend of COVID-19 in Fujian, China: cross-sectional study. *Journal of medical Internet research*. 2020 Jul 20;22(7): e19982.
  35. Luo S, Xin M, Wang S, Zhao J, Zhang G, Li L, Li L, Lau JT. Behavioural intention of receiving COVID-19 vaccination, social media exposures and peer discussions in China. *Epidemiology & Infection*. 2021;149.
  36. Betsch C, Renkewitz F, Betsch T, Ulshöfer C. The influence of vaccine-critical websites on perceiving vaccination risks. *Journal of health psychology*. 2010 Apr;15(3):446-55.
  37. Nan X, Madden K. HPV vaccine information in the blogosphere: how positive and negative blogs influence vaccine-related risk perceptions, attitudes, and behavioral intentions. *Health communication*. 2012 Nov 1;27(8):829-36.
  38. Yang G, Myrick JG. Online media use and HPV vaccination intentions in mainland China: integrating marketing and communication perspectives to improve public health. *Health education research*. 2020 Apr 1;35(2):110-22.
  39. Yin F, Wu Z, Xia X, Ji M, Wang Y, Hu Z. Unfolding the determinants of COVID-19 vaccine acceptance in China. *Journal of medical Internet research*. 2021 Jan 15;23(1): e26089.
  40. Zhang J, Featherstone JD, Calabrese C, Wojcieszak M. Effects of fact-checking social media vaccine misinformation on attitudes toward vaccines. *Preventive Medicine*. 2021 Apr 1; 145:106408.
  41. Ortiz RR, Smith A, Coyne-Beasley T. A systematic literature review to examine the potential for social media to impact HPV vaccine uptake and awareness,

- knowledge, and attitudes about HPV and HPV vaccination. *Human vaccines & immunotherapeutics*. 2019 Aug 3;15(7-8):1465-75.
42. Ahmed N, Quinn SC, Hancock GR, Freimuth VS, Jamison A. Social media use and influenza vaccine uptake among White and African American adults. *Vaccine*. 2018 Nov 26;36(49):7556-61.
  43. Johnson NF, Velásquez N, Restrepo NJ, Leahy R, Gabriel N, El Oud S, Zheng M, Manrique P, Wuchty S, Lupu Y. The online competition between pro-and anti-vaccination views. *Nature*. 2020 Jun;582(7811):230-3.
  44. Puri N, Coomes EA, Haghbayan H, Gunaratne K. Social media and vaccine hesitancy: new updates for the era of COVID-19 and globalized infectious diseases. *Human vaccines & immunotherapeutics*. 2020 Nov 1;16(11):2586-93.
  45. Dror AA, Eisenbach N, Taiber S, Morozov NG, Mizrahi M, Zigran A, Srouji S, Sela E. Vaccine hesitancy: the next challenge in the fight against COVID-19. *European journal of epidemiology*. 2020 Aug;35(8):775-9.
  46. Williams L, Gallant AJ, Rasmussen S, Brown Nicholls LA, Cogan N, Deakin K, Young D, Flowers P. Towards intervention development to increase the uptake of COVID-19 vaccination among those at high risk: Outlining evidence-based and theoretically informed future intervention content. *British Journal of Health Psychology*. 2020 Nov;25(4):1039-54.
  47. Sherman SM, Smith LE, Sim J, Amlôt R, Cutts M, Dasch H, Rubin GJ, Sevdalis N. COVID-19 vaccination intention in the UK: results from the COVID-19 vaccination acceptability study (CoVAccS), a nationally representative cross-sectional survey. *Human vaccines & immunotherapeutics*. 2021 Jun 3;17(6):1612-21.
  48. Paul E, Steptoe A, Fancourt D. Attitudes towards vaccines and intention to vaccinate against COVID-19: Implications for public health communications. *The Lancet Regional Health-Europe*. 2021 Feb 1; 1:100012.
  49. Fisher KA, Bloomstone SJ, Walder J, Crawford S, Fouayzi H, Mazor KM. Attitudes toward a potential SARS-CoV-2 vaccine: a survey of US adults. *Annals of internal medicine*. 2020 Dec 15;173(12):964-73.
  50. Palamenghi L, Barello S, Boccia S, Graffigna G. Mistrust in biomedical research and vaccine hesitancy: the forefront challenge in the battle against COVID-19 in Italy. *European journal of epidemiology*. 2020 Aug;35(8):785-8.
  51. Ruiz JB, Bell RA. Predictors of intention to vaccinate against COVID-19: Results of a nationwide survey. *Vaccine*. 2021 Feb 12;39(7):1080-6.
  52. Byrne BM. *Structural equation modeling with Mplus: Basic concepts, applications, and programming*. routledge; 2013 Jun 17.
  53. Hair JF, Anderson RE, Tatham RL, Black WC. *Factorial analysis. Multivariate Data Analysis*. Fifth edition. New Jersey: Prentice Hall. 1998.
  54. Baumgartner H, Homburg C. Applications of structural equation modeling in marketing and consumer research: A review. *International journal of Research in Marketing*. 1996 Apr 1;13(2):139-61.
  55. Doll WJ, Xia W, Torkzadeh G. A confirmatory factor analysis of the end-user computing satisfaction instrument. *MIS quarterly*. 1994 Dec 1:453-61.
  56. Agranov M, Elliott M, Ortoleva P. The importance of Social Norms against Strategic Effects: The case of COVID-19 vaccine uptake. *Economics Letters*. 2021 Sep 1; 206:109979.
  57. Latkin CA, Dayton L, Yi G, Konstantopoulos A, Boodram B. Trust in a COVID-19 vaccine in the US: A social-ecological perspective. *Social science & medicine* (1982). 2021 Feb; 270:113684.
  58. Zeballos Rivas DR, Lopez Jaldin ML, Nina Canaviri B, Portugal Escalante LF, Alanes Fernández AM, Aguilar Ticona JP. Social media exposure, risk perception, preventive behaviors and attitudes during the COVID-19 epidemic in La Paz, Bolivia: A cross sectional study. *PLoS one*. 2021 Jan 22;16(1): e0245859.
  59. Szilagyi PG, Thomas K, Shah MD, Vizueta N, Cui Y, Vangala S, Fox C, Kapteyn A. The role of trust in the likelihood of receiving a COVID-19 vaccine: Results from a national survey. *Preventive Medicine*. 2021 Dec 1; 153:106727.

## APPENDIX 1

Construct	Variable name	Items
Trust	T1	I believe that vaccination is a successful strategy to reduce COVID-19 spread
	T2	I trust that vaccines for COVID-19 will reduce likelihood of getting the infection.
	T3	I believe that COVID-19 vaccination will be successful in COVID-19 disease prevention
	T4	I trust that vaccines for COVID-19 will aid our community to controlling the COVID-19 disease.
	T5	I have faith that COVID-19 vaccines are effective against the COVID-19 virus.
	T6	I believe that COVID-19 vaccines are a viable option for treating and preventing the COVID-19 pandemic..
	T7	I trust COVID-19 vaccines as medical specialists and government agencies have recommended and authorized it. .
Media exposure	M1	I believe the government makes pertinent information regarding COVID-19 vaccines available.
	M2	I believe that social media has influenced my decision to get the COVID-19 vaccination.
	M3	I believe that the detailed information on COVID-19 vaccinations that I found on media was beneficial.
Social norms	SN1	My family advises that I get the COVID-19 vaccination.
	SN2	People who matter to me have an impact on my decision to get the COVID-19 vaccination.
	SN3	My decision to get COVID-19 vaccinations was influenced by my friends and coworkers.
Perception	P1	I feel that COVID-19 vaccinations are likely to produce negative side effects
	P2	I'm concerned that after receiving COVID-19 vaccinations, I'll be vulnerable to infectious illnesses.
	P3	I'm hesitant to use COVID-19 vaccinations since they haven't gone through enough testing.
Intention	I1	I have positive mind in relation to receiving COVID-19 vaccines.
	I2	I believe that COVID-19 vaccinations should be given to all members of my family.
	I3	I plan to get the COVID-19 vaccination since it strengthens my immune system.
	I4	I feel that COVID-19 vaccines are a mandatory to everyone.
	I5	I will recommend COVID-19 vaccine to everyone