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RESEARCH PAPER

Vaccination induced complacency in adherence to COVID-19 precautionary measures among oral health care professionals in India and the United States: a retrospective pretest-posttest design

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ABSTRACT

In the context of the COVID-19 pandemic, vaccination-induced behavioral complacency in adherence to COVID-19 appropriate behavior emerged as a significant concern. This study was conducted among a convenience sample of 540 oral health care professionals in India and the United States. This was a retrospective pretest-post-test design, a choice to eliminate response-shift bias, where the participants responded online on their adherence or otherwise to COVID-19 precautionary measures before and after vaccination. The difference between post-test and retrospective pretest scores was used in assessing the magnitude of complacency demonstrated by the individual as a function of getting vaccinated, and the process was validated using exploratory factor analysis (EFA) with principal axis factoring and confirmatory factor analysis (CFA) on two randomly split subsets of the overall sample. It was observed that there had been a decline in the adherence to all the considered COVID-19 precautionary measures from the time before vaccination to the time of achievement of the fully vaccinated status. EFA performed on the randomly split sub sample of 240 subjects returned a two factor solution with five items in factor 1 and seven items in factor 2. Items in both the factors demonstrated adequate internal consistency in reliability analysis (Cronbach's alpha 0.84 and 0.82, respectively). The two factor solution obtained in EFA demonstrated good model fit in CFA [RMSEA (90%CI) – 0.077 (0.063–0.092); TLI – 0.872; CFI – 0.897; SRMR – 0.056]. These results highlight the vaccination-induced complacency in observing COVID-19 appropriate behavior among oral health professionals in India and the United States.

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Introduction

Since the initial reports of novel human pneumonia outbreak in Wuhan, China in December 2019, which was termed as Wuhan pneumonia,[1] basing on the symptomatology and the place of outbreak, the world has witnessed 190.16 million confirmed COVID-19 cases as of 20th July 2021.[2] Though the 7-day moving average time series forecasting models predict a downward trend in daily incidence of COVID-19 cases in India and the United States, the magnitude of daily incidence remains an area of significant concern.[3] Under these circumstances of increasing transmission and also in light of the possible difficulties for many nations worldwide, on the financial front, to continue implementing non-pharmaceutical interventions such as strict lockdown, vaccination against COVID-19 appears to be quintessential in controlling the infection by generating vaccinal herd immunity.[4] Few vaccines have been approved worldwide and a few are under development.[5] In the United States, three vaccines have been authorized as on April 7, 2021: Pfizer-BioNTech [BNT162b2/COMIRNATY Tozinameran (INN)]; Moderna [mRNA-1273]; Johnson & Johnson/Janssen [Ad26.COV2.S].[6] In India, the Central Drugs Standard Control Organization (CDSCO) authorized Serum Institute of India's Covishield (ChAdOx1_nCoV19) and Bharat Biotech Limited's Covaxin for emergency use.[7] As of July 27, 2021, 163.2 million people (49.1% of the US population) got fully vaccinated in the United States compared to 94.66 million (6.49% of the Indian population) who completed receiving the second dose of the vaccine.[8,9]

Despite the assurance on the safety of COVID-19 vaccines being provided by the World Health Organization and various national authorities, vaccine hesitancy remains an area of concern amidst the uncertainties surrounding COVID-19 vaccination such as the possibility of a fully vaccinated individual communicating the infection and the duration for which the vaccine offers protection against SARS-CoV-2.[10] However, increasing number of people may get vaccinated in the days to come as suggested by the vaccination trends.[8,9] At this juncture, it is important to underscore the fact that the uncertainties regarding COVID-19 vaccination among general public may lead to complacency in the practice of precautionary measures post vaccination. There are various possible endpoints for an efficacious vaccine, which include the reduced likelihood of getting infected, increased chances of being asymptomatic, reduced probability of hospital admissions

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and subsequent need for intensive care, curtailed incidence of mortality, and downsized transmission rate. If people get too invested into the idea of vaccines being efficacious at any or all of the aforementioned endpoints, the likelihood of vaccinated people following suggested precautionary measures decreases as a function of their belief that the vaccine would offer protection even in case of SARS-CoV-2 exposure; such reduced adherence to COVID-19 precautionary measures among vaccinated people is referred to as vaccination-induced complacency in this paper. As suggested by Su Z et al., vaccine is not yet a silver bullet and safety measures must be followed with extreme caution so as to control COVID-19 transmission.[11] As to our knowledge, there were no previous reports on the behavioral changes with regard to COVID-19 precautionary measures among vaccinated people as a function of vaccination. Discerning vaccination-induced complacency at population level is very important in formulating directions for the vaccinated people that are empirically informed. With this background, the primary objective of this study was to document vaccination-induced complacency in adherence to COVID-19 precautionary measures among fully vaccinated oral health care professionals in India and the United States. A secondary objective was to perform initial validation of the COVID-19 vaccination-induced complacency scale.

Materials and methods

Study design

Unlike the conventional pretest and post-test designs, where the study participants are required to respond to a questionnaire before the administration of an intervention or prior to experiencing an event and respond to the same questionnaire after the intervention/experience, a retrospective pretest-post-test design was adopted in this study. In a retrospective pretest-post-test design, the pretest questionnaire is also administered at the same time as the post-test questionnaire. Here, the expression 'retrospective pretest' refers to the participants consciously reflecting back to their behavior/attitudes/opinions prior to the occurrence of the event or administration of an intervention. This choice was made to prevent the potential response-shift bias.[12,13] Response-shift bias has its roots in the ideological notion that the frame of reference from which the participants respond is dynamic and changes from pretest to post-test. This change in the internal axis of reference from pretest to post-test makes it inappropriate to compare the within subject self-reports in the conventional pretest and post-test designs.[14,15] To be more specific, the retrospective pretest questionnaires in this study were administered immediately after the post-test questionnaires, making this a 'retrospective post-then-pre design.'

Study sample and data collection

This study was conducted in the months of March and April 2021 on a convenience sample of 540 oral health care professionals in India and the United States. Only oral health care professionals who received the second dose of their vaccine for vaccines with two dose series or who received a single dose vaccine (Janssen) at least 2 weeks before participation in this study were included. Ethical approval for the study was obtained from the institutional review board of Sibar Institute of Dental Sciences. The participants' adherence to COVID-19 precautionary measures was assessed using a 12-item questionnaire administered online. Consent was obtained from the study participants before they could access the study survey form. This questionnaire was developed basing on the recommendations toward protection from COVID-19 made by the World Health Organization.[16] An initial set of 18 items was developed to be included in the questionnaire besides demographic data, which was reduced to 12 items after a two round Delphi iteration process with six experts from the disciplines of psychology and community medicine. All the items were administered on a five point semantic differential scale with few items having positive semantic differentials to the left and a few having negative semantic differentials to this end (Annexure 1). However, reverse coding was performed during analysis to transform the data in such a manner that all the positive semantics were to the left, indicating that higher scores represent better adherence.

Estimating behavioral complacency

For each individual, the difference between item-level scores in the post-test and retrospective pretest was identified as the item-level complacency in adherence of the subjects. The item-level complacency scores range from −4 to +4, with −4 indicating extreme complacency post vaccination, +4 indicating thorough caution post vaccination, and zero indicating no change in adherence to COVID-19 precautionary measures with vaccination. For example, a subject who reports that he/she is not at all reluctant to shake hands with others (score 1) post-vaccination, but was extremely reluctant (score 5) before the vaccination receives an item-level complacency score of −4 (post-test score – retrospective pretest score) indicating extreme complacency. Thus the subject-level complacency scores for the 12-item questionnaire ranging from −48 to +48, with 'extreme complacency' and 'thorough caution' on either ends of the negative to positive spectrum, respectively. Along with the 12-item questionnaire, a single self-rated COVID-19 safety behavior question was administered in both the post-test and retrospective pretest instances.

Study size and statistical analysis

The hypothesis (H_A) in this study was that the mean of difference between post-test scores and the retrospective pretest scores of the study participants would differ from zero. If the null hypothesis (H_0) was to be true, the mean of difference between individuals' post-test adherence scores and retrospective pretest adherence scores would be zero. The required sample size was estimated to be 449 using G*power 3.1.9.4 software with an estimated effect size of 0.2, at 1% significance level, and a power of 95%. The sample size of 540 considered in this study is also adequate to perform exploratory and

confirmatory factor analyses.[17] As suggested by MacCallum RC et al., the final sample was randomly divided into two unequal subsets of 240 and 300 for performing exploratory factor analysis (EFA) and confirmatory factor analysis (CFA), respectively.[18] For EFA and CFA, item level complacency scores of the corresponding sub sample of subjects were the input variables. Data were analyzed using IBM SPSS Version 20 software and free software program Classical and Bayesian Instrument Development (CBID) which utilizes the R package *lavaan*.[19] Descriptive statistics, one sample t test to check the null hypothesis that the mean complacency score of the study sample is zero, independent samples t tests for comparing the mean complacency scores based on background characteristics, dependent samples t tests for assessing the item level mean difference between post-test and the retrospective pretest, EFA with principal axis factoring for determining the factor structure, CFA using goodness of fit indices for assessing the construct validity of COVID-19 vaccination induced complacency scale, and multiple linear regression analysis to assess the amount of variance in vaccination-induced complacency scores explained by the participants' background characteristics were performed to analyze the study data.

Results

The mean age of the study sample was 37.02 ± 11.02 years and the sample consisted of nearly equal number of males (49.82%) and females (50.18%). While majority of the study subjects were oral health care professionals residing in India, nearly one-fifth were oral health care professionals residing in the United States of America. Table 1 presents the descriptive statistics of the responses provided by the study subjects in the post-test and the retrospective pretest questionnaires. It was observed that there had been a decline in the adherence to COVID-19 precautionary measures from the time before vaccination to the time of achievement of the fully vaccinated

Table 1. Descriptive statistics of the posttest and the retrospective pretest responses (n = 540).

Item		Extremely complacent behavior n(%)	Complacent behavior n(%)	Neutral n (%)	Cautionary behavior n(%)	Thoroughly cautionary behavior n(%)
Avoiding enclosed spaces	Posttest	58 (10.7)	92 (17)	176 (32.6)	110 (20.4)	104 (19.3)
	Retrospective pretest	63 (11.7)	52 (9.6)	95 (17.6)	98 (18.1)	232 (43)
Coming in close proximity with others	Posttest	78 (14.4)	100 (18.5)	211 (39.1)	84 (15.6)	67 (12.4)
	Retrospective pretest	35 (6.5)	36 (6.7)	107 (19.8)	143 (26.5)	219 (40.6)
Carrying a sanitizer	Posttest	51 (9.4)	86 (15.9)	107 (19.8)	77 (14.3)	219 (40.6)
	Retrospective pretest	27 (5)	29 (5.4)	66 (12.2)	80 (14.8)	338 (62.6)
Wearing a mask when going out	Posttest	24 (4.4)	41 (7.6)	47 (8.7)	87 (16.1)	341 (63.1)
	Retrospective pretest	25 (4.6)	11 (2)	22 (4.1)	62 (11.5)	420 (77.8)
Cleaning hands with alcohol based hand rub or washing with soap and water	Posttest	18 (3.3)	46 (8.5)	98 (18.1)	144 (26.7)	234 (43.3)
	Retrospective pretest	17 (3.1)	17 (3.1)	55 (10.2)	101 (18.7)	350 (64.8)
Touching of eyes, nose, and mouth	Posttest	43 (8)	82 (15.2)	127 (23.5)	142 (26.3)	146 (27)
	Retrospective pretest	27 (5)	37 (6.9)	86 (15.9)	119 (22)	271 (50.2)
Shaking hands with others	Posttest	67 (12.4)	92 (17)	145 (26.9)	125 (23.1)	111 (20.6)
	Retrospective pretest	38 (7)	42 (7.8)	101 (18.7)	137 (25.4)	222 (41.1)
Ensuring good ventilation at home and workplace	Posttest	30 (5.6)	49 (9.1)	121 (22.4)	127 (23.5)	213 (39.4)
	Retrospective pretest	26 (4.8)	28 (5.2)	92 (17)	130 (24.1)	264 (48.9)
Maintaining mask hygiene	Posttest	20 (3.7)	41 (7.6)	85 (15.7)	132 (24.4)	262 (48.5)
	Retrospective pretest	20 (3.7)	15 (2.8)	54 (10)	100 (18.5)	351 (65)
Touching masks only by straps	Posttest	31 (5.7)	75 (13.9)	115 (21.3)	123 (22.8)	196 (36.3)
	Retrospective pretest	26 (4.8)	43 (8)	81 (15)	120 (22.2)	270 (50)
Washing hands after removing the masks	Posttest	45 (8.3)	73 (13.5)	115 (21.3)	123 (22.8)	196 (36.3)
	Retrospective pretest	32 (5.9)	38 (7)	89 (16.5)	129 (23.9)	252 (46.7)
Cleaning or disinfecting frequently touched surfaces like handles, screens	Posttest	46 (8.5)	64 (11.9)	114 (21.1)	135 (25)	181 (33.5)
	Retrospective pretest	44 (8.1)	30 (5.6)	78 (14.4)	85 (15.7)	303 (56.1)
Single self-rated COVID-19 behavior question	Posttest	27 (5)	56 (10.4)	184 (34.1)	175 (32.4)	98 (18.1)
	Retrospective pretest	63 (11.7)	47 (8.7)	108 (20)	146 (27)	176 (32.6)

Table 2. Item level complacence scores (n = 540).

Item	Posttest Mean ±SD	Retrospective pretest Mean±SD	Complacence Mean ±SD	95% CI	*P* value
Avoiding enclosed spaces	3.2 ± 1.23	3.71 ± 1.4	−0.5 ± 1.25	−0.61 – −0.4	<.001*
Coming in close proximity with others	2.92 ± 1.18	3.87 ± 1.2	−0.95 ± 1.17	−1.05 – −0.85	<.001*
Carrying a sanitizer	3.6 ± 1.39	4.24 ± 1.16	−0.64 ± 1.25	−0.74 – −0.53	<.001*
Wearing a mask when going out	4.25 ± 1.16	4.55 ± 1	−0.29 ± 0.93	−0.37 – −0.21	<.001*
Cleaning hands with alcohol based hand rub or washing with soap and water	3.98 ± 1.12	4.38 ± 1	−0.4 ± 0.96	−0.48 – −0.32	<.001*
Touching of eyes, nose, and mouth	3.49 ± 1.25	4.05 ± 1.17	−0.56 ± 1.13	−0.65 – −0.46	<.001*
Shaking hands with others	3.22 ± 1.29	3.85 ± 1.23	−0.63 ± 1.2	−0.73 – −0.53	<.001*
Ensuring good ventilation at home and workplace	3.82 ± 1.2	4.07 ± 1.13	−0.24 ± 0.95	−0.32 – −0.16	<.001*
Maintaining mask hygiene	4.06 ± 1.1	4.38 ± 1.02	−0.31 ± 0.92	−0.39 – −0.24	<.001*
Touching masks only by straps	3.7 ± 1.24	4.04 ± 1.18	−0.34 ± 0.98	−0.43 – −0.26	<.001*
Washing hands after removing the masks	3.53 ± 1.27	3.98 ± 1.2	−0.44 ± 1	−0.53 – −0.36	<.001*
Cleaning or disinfecting frequently touched surfaces like handles, screens	3.63 ± 1.28	4.06 ± 1.28	−0.42 ± 1.14	−0.52 – −0.33	<.001*

Dependent samples t test; p ≤ .05 considered statistically significant; * denotes statistical significance.

status. Table 2 shows the item level mean complacency scores of the study subjects. The item level mean complacency score was highest for the item 'coming in close proximity with others.' The 12-item scale level mean complacency score was −5.79 ± 8.11 (95% CI −6.48 – −5.1; $p < .001$ one sample t test).

In the exploratory factor analysis (EFA) performed on the randomly split sub sample of 240 subjects, the Kaiser-Meyer-Olkin measure of sampling adequacy was 0.894 suggestive of sampling adequacy. Significant results were obtained from the Bartlett's test of sphericity underscoring the correlation between items included in EFA. Figure 1 shows the screen plot with factors having eigen values >1. Given the cross-loadings demonstrated by few items, promax rotation was employed to delineate the items in a manner that the factors are easily interpreted. Table 3 presents the pattern matrix of the two factor solution obtained from exploratory factor analysis using promax rotation with Kiaser normalization. All the items demonstrated factor loadings >0.4 (Table 3). The two factors were labeled as: 'Maintenance of and hygiene related to consumable resources'; 'Interpersonal communication, personal & surface hygiene, and environmental considerations.' Items loaded into each of the two factors demonstrated good

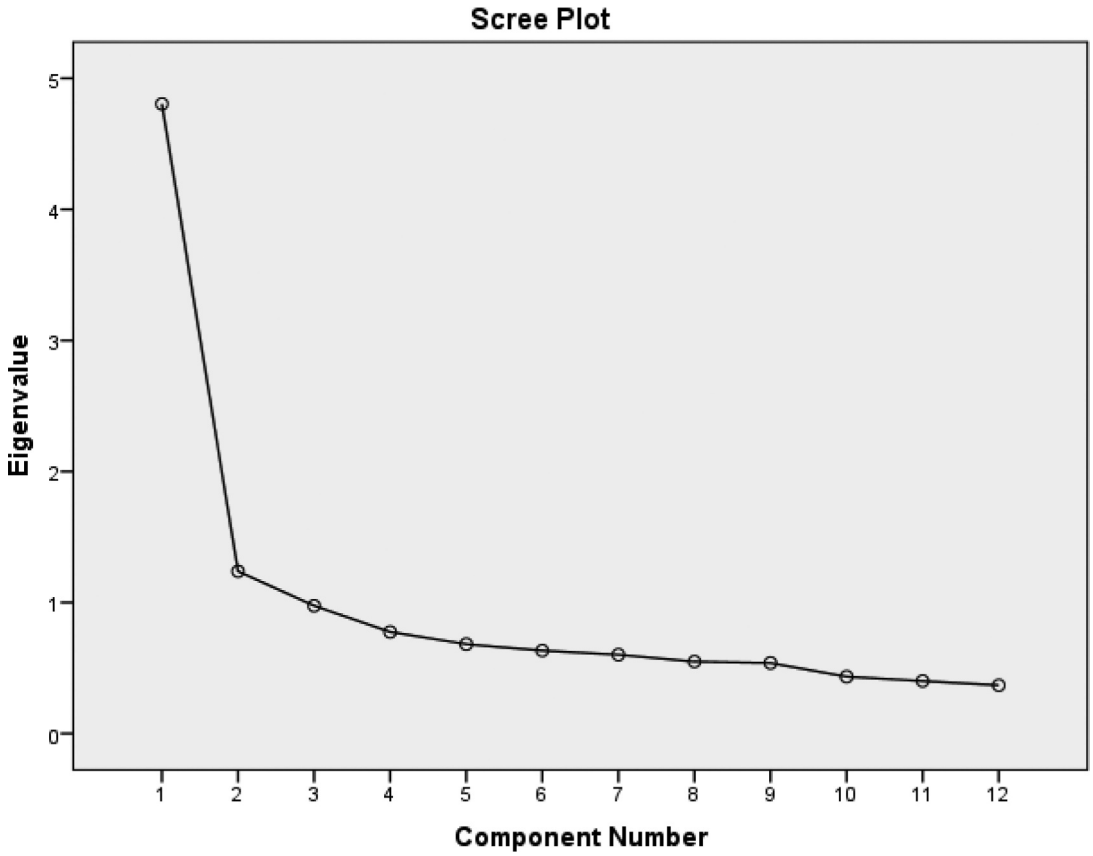

Figure 1. Scree plot showing two factors with Eigen values >1.

Table 3. Pattern matrix of the exploratory factor analysis with item-level complacence scores as the items (n = 240).

	Factor	
Item	1	2
Avoiding enclosed spaces		0.55
Coming in close proximity with others		0.731
Carrying a sanitizer	0.725	
Wearing a mask when going out	0.493	
Cleaning hands with alcohol based hand rub or washing with soap and water		0.729
Touching of eyes, nose, and mouth		0.739
Shaking hands with others		0.806
Ensuring good ventilation at home and workplace		0.47
Maintaining mask hygiene	0.905	
Touching masks only by straps	0.865	
Washing hands after removing the masks	0.883	
Cleaning or disinfecting frequently touched surfaces like handles, screens		0.588

Exploratory factor analysis with principal axis factoring as the extraction method; promax rotation with Kaiser normalization.

inter-item correlations, which were evident from the Cronbach's alpha values of 0.849 and 0.82 for factors 1 and 2, respectively. Table 4 shows the corrected item-total correlations and the internal consistency reliability values for both the factors extracted in EFA. In confirmatory factor analysis (CFA), the factor loadings of the scale items ranged between 0.41 and 0.78. Table 5 presents the factor loadings of the items in CFA performed using CBID that utilizes the R package *lavaan*. Table 6 shows the model fit indices of the CFA model tested. The two factor solution obtained in EFA demonstrated good model fit in CFA performed on a randomly split sub sample of 300 subjects with good internal consistency reliability (Cronbach's alpha: overall 0.832; factor-1 0.745; factor-2 0.744). The overall scale scores were obtained for all the 540 study participants and differences in scale scores based on gender, previous COVID-19 infection, and country of

Table 4. Factor-wise reliability analysis showing corrected item-total correlations and internal consistency reliability values (n = 240).

Factor	Item	Corrected item-total correlation	Cronbach's alpha if item deleted	Cronbach's alpha
Maintenance of and hygiene related to consumable resources	Carrying a hand sanitizer	0.579	0.829	0.849
	Maintaining mask hygiene	0.722	0.793	
	Touching masks only by straps	0.736	0.782	
	Washing hands after removing the masks	0.708	0.79	
	Wearing a mask when going out	0.527	0.841	
Interpersonal communication, personal & surface hygiene, and environmental considerations	Avoiding enclosed spaces	0.43	0.811	0.82
	Coming in close proximity with others	0.472	0.802	
	Cleaning or disinfecting frequently touched surfaces like handles, screens	0.598	0.781	
	Cleaning hands with alcohol based hand rub or washing with soap and water	0.616	0.77	
	Touching of eyes, nose, and mouth	0.679	0.763	
	Shaking hands with others	0.564	0.785	
	Ensuring good ventilation at home and workplace	0.543	0.789	

Table 5. Standardized estimates from classic confirmatory factor analysis (n = 300).

Factor	Item	Standardized estimate	Standard error	Z value
Maintenance of and hygiene related to consumable resources	Carrying a sanitizer	0.788	0.07	11.22
	Maintaining mask hygiene	0.593	0.051	11.55
	Touching masks only by straps	0.506	0.051	9.93
	Washing hands after removing the masks	0.641	0.052	12.38
	Wearing a mask when going out	0.539	0.064	8.43
Interpersonal communication, personal & surface hygiene, and environmental considerations	Avoiding enclosed spaces	0.422	0.075	5.59
	Coming in close proximity with others	0.511	0.066	7.77
	Cleaning or disinfecting frequently touched surfaces like handles, screens	0.454	0.055	8.32
	Cleaning hands frequently with alcohol based hand rub or washing with soap and water	0.545	0.052	10.51
	Touching of eyes, nose, and mouth	0.772	0.061	12.62
	Shaking hands with others	0.787	0.063	12.54
	Ensuring good ventilation at home and workplace	0.441	0.054	8.18

Table 6. Model fit indices of confirmatory factor analysis (n = 300).

Model fit index	Value
Root mean square error of approximation (RMSEA) [90% CI]	0.077 [0.063–0.092]
Tucker-Lewis Index (TLI)	0.872
Comparative Fit Index (CFI)	0.897
Model fit test statistic (*p* value)	148.36 (<0.001)
Standardized Root Mean square Residual (SRMR)	0.056

residence were examined. While there were no significant differences based on gender and previous exposure to COVID-19, subjects living in the United States had a significantly higher complacency score compared to those residing in India (Table 7). However, the difference in the complacency scores between oral health care professionals from India and the United States was only marginally significant in multiple linear regression analysis after adjusting for participants' gender and previous history of COVID-19 infection (Table 8). The overall scale score showed significant moderately strong positive correlation with the single self-rated question on COVID-19-related safety behavior (r = 0.506; $p < .001$).

Discussion

The present study demonstrates the emergence of behavioral complacency in adherence to COVID-19 precautionary measures among oral health care professionals in India and the United States from the time prior to vaccination to the time of achievement of fully vaccinated status. The mean complacency score of the study sample was −5.79 ± 8.11 (95% CI −6.48 – −5.1), and hence the null hypothesis can be rejected in favor of H_A. Given the uncertain nature of the disease and the equivocal nature of results on vaccine effectiveness,[20] it is imperative that all the WHO suggested precautionary measures be followed religiously in order to contain the COVID-19 transmission. Previously, vaccination complacency was studied on numerous occasions; however, the expression referred to complacency in not getting vaccinated and as one of the fundamental reasons for stagnation in global vaccination rates.[21–24] On the contrary, the present study documented behavioral complacency which is supposedly induced by vaccination against COVID-19. Such use of the expression complacency with regard to vaccination was made in the editorial 'COVID-19 vaccines: no time for complacency' published by The Lancet in late 2020.[25] To our knowledge, this is the first time behavioral complacency has been studied as a function of vaccination. However, it is important to underscore the fact that there could be other factors which are influential on the level of adherence to COVID-19 precautionary measures such as trends in daily incidence of COVID-19 confirmed cases in the corresponding geographies and previous history of successful recovery from COVID-19 which may affect the subject's fear of the infection and consequently his/her compliance with COVID-19 appropriate behavior. Though the shorter duration of this study does not allow us to account for trends in daily incidence of COVID-19 cases while studying vaccination-induced complacency, the previous history of COVID-19 infection was considered in this study so as to verify the differences in adherence to COVID-19 appropriate behavior between those with and without the previous history of COVID-19 infection. Furthermore, epidemiological data suggest that the daily incidence of COVID-19 cases was on a rise during the study period which rules out the attribution of reduced complacency with precautionary measures to trends in daily incidence. Unlike the previous reports which emphasized on lower compliance with precautionary measures among males,[26] the present study showed no differences based on gender in the overall complacency scores. The possible reason for this observation could be that all the participants in the present study are working professionals which necessitates the female participants to assume similar professional roles as males, whereas in the study conducted by Nivette A et al., the participants were only 22 years old with potential gender wise differences in social roles that need to be assumed. However, it is imperative to highlight at

Table 7. Differences in overall scale scores based on gender, previous COVID-19 infection, and country of residence (n = 540).

Variable	Category	*n*	Mean change	95% CI	*P* value
Gender	Female	271	−5.74 ± 7.94	6.99–8.88	.942
	Male	269	−5.84 ± 8.29	7.29–9.28	
Previous COVID-19 infection	No/Not aware	470	−5.74 ± 7.81	7.1–8.51	.868
	Yes	70	−6.11 ± 9.94	7.61–12.26	
Country of residence	United States of America	97	−7.15 ± 8.42	6.74–10.09	.008*
	India	443	−5.49 ± 8.02	7.27–8.76	

Independent samples t test; CI – confidence interval; p ≤ .05 considered statistically significant; * denotes statistical significance.

Table 8. Multiple linear regression analysis with COVICD-19 vaccination-induced complacency scale score as the dependent variable.

Variable	Category	Regression coefficient (95% CI)	*P* value
Gender	Female	reference	.865
	Male	−0.119 (−1.48–1.25)	
Previous COVID-19 infection	No/Not aware	reference	.697
	Yes	−0.405 (−2.44–0.63)	
Country of residence	United States of America	reference	.066
	India	1.674 (−0.1–3.45)	

Multiple linear regression; Coefficient of determination (R^2) = 0.007.

this juncture the fact that compliance with suggested precautionary measures and complacency demonstrated over time studied as a function of vaccination are not equivalent constructs. It is also important to discuss the vaccination distrust prevalent in the USA and the anti-vaccine movement being studied.[27] Amidst these observations, those people who got vaccinated are more likely to endorse the pro-vaccine attitudes and believe in the effectiveness of vaccines more thoroughly. This partly explains the reason why overall complacency scores were higher among participants from USA compared to those from India where people are relatively less choosy about getting vaccinated or otherwise. While this study includes oral health professionals residing in India and the United States who were fully vaccinated by the time they took part, it would have been more interesting had the professionals who rejected vaccination been included in the study too for comparative evaluation. Considerable level of vaccine hesitancy and rejection among dentists is the reason why such comparison would add more value to the proposed hypothesis of behavioral complacency being induced by vaccination.[28,29]

The 12-item scale evaluated in this study showed adequate psychometric properties. It is to be underscored here that each of these items is an outcome of the difference between post-test and the retrospective pretest scores of the participants, which was termed as item-level complacency. The two factors extracted from EFA were labeled as 'Maintenance of and hygiene related to consumable resources' (5 items), 'Interpersonal communication, personal & surface hygiene, and environmental considerations' (7 items). Conduct of CFA with this predetermined factor structure showed good model fit indices. Noar SM[30] suggested 2-index fit strategy to be reflective of a good model, nevertheless, all the five model fit indices (model chi square, CFI, TLI, RMSEA, SRMR) evaluated in this study suggested a good model fit, which is reflective of the construct validity of the COVID-19 vaccination-induced complacency scale. These model fit indices were reported in accordance with the recommendations made by Kline RB in reporting CFA.[31] The overall scale and the individual factors also demonstrated good internal consistency reliability in both the sub samples. Moderately strong positive correlation demonstrated by the scale scores obtained by the individuals with single self-rated COVID-19 safety behavior question is also an indication for the construct validity of the scale. Regardless of the vaccination status, adherence to precautionary measures is quintessential in containing the COVID-19 pandemic. It is time that policy makers and professional bodies underscore the imminent danger that could potentially be posed by the vaccine availability with which COVID-19 susceptibility may get ignored by the virtue of the oversize exuberance surrounding COVID-19 vaccines.

This study indicates the potential for vaccination-induced complacency in compliance to COVID-19 appropriate safety behavior, which gives a heads up on the need to articulate health education materials addressing this issue and the strategic dissemination of the same. The 12-item COVID-19 vaccination-induced complacency scale validated in this study forms an effective tool in the identification of the vaccination-induced complacency, and the use of this scale among communities in order to identify safety measures that are more vulnerable to neglect post vaccination helps the administrators in drafting custom-made educational programs aimed at dismantling the emergence of complacency.

The retrospective pretest – post-test design adopted in this study is postulated to be meritorious over the conventional pretest and post-test designs in preventing response shift bias and obtaining responses from the participants on both the occasions without a shift in the internal axis of reference.[14,15] However, this design is not without limitations; memory distortion and social desirability have been discussed to be the limitations associated with response style in retrospective pretest designs.[12] Another limitation of this study is that a convenience sample was considered. This may limit the generalizability of the study findings to all the oral health care professionals in India and the United States. Also, the response rate and reasons for nonparticipation could not be elicited owing to the online administration of the survey form among this convenience sample. Nevertheless, in view of the study objectives, we opine that the nature of sampling should not pose a significant threat to the validity of the results. Furthermore, the convenience sample considered in this study could more specifically be termed as a homogenous convenience sample, where, unlike the conventional convenience sample, the sampling was restrained to oral health care professionals with an additional condition of fully vaccinated status with regard to COVID-19.[32]

Conclusion

Within the limitations of this study, we conclude that behavioral complacency in adhering to COVID-19 precautionary measures as a function of vaccination against COVID-19 has been emerging as a significant concern among oral health care professionals in India and United States. Though these results could not be extrapolated to the general public, there lies a possibility for the manifestation of behavioral complacency post-vaccination among general public as well. This requires immediate attention from the policy makers and the professional bodies and measures should be taken to indoctrinate among oral health care professionals the necessity to carefully adhere to COVID-19 appropriate behavior in spite of vaccination against COVID-19.

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Annexure 1.

COVID-19 Vaccination Induced Complacency Scale

1) Avoiding enclosed spaces
   Extremely likely to avoid ○ ○ ○ ○ ○ Not at all likely to avoid

2) Coming in close proximity to others
   Not at all hesitant ○ ○ ○ ○ ○ Extremely hesitant

3) Carrying a hand sanitizer
   Carried almost always ○ ○ ○ ○ ○ Never carried

4) Wearing a mask when going out
   Worn almost always ○ ○ ○ ○ ○ Never worn

5) Cleaning hands with alcohol based hand rub or washing with soap and water
   Never ○ ○ ○ ○ ○ Very frequently

6) Touching of eyes, nose, and mouth
   Extremely conscious not to ○ ○ ○ ○ ○ Not at all conscious

7) Shaking hands
   Not at all reluctant ○ ○ ○ ○ ○ Extremely reluctant

8) Ensuring good ventilation at workplace and home
   Not at all concerned ○ ○ ○ ○ ○ Extremely particular

9) Maintenance of mask hygiene
   Extremely concerned about ○ ○ ○ ○ ○ Not at all concerned

10) Touching masks only be straps
   Not at all concerned ○ ○ ○ ○ ○ Extremely particular

11) Washing hands after removing the masks
   Almost always ○ ○ ○ ○ ○ Never

12) Cleaning or disinfecting frequently touched surfaces like handles, screens
   Never ○ ○ ○ ○ ○ Almost always

*The scale has to be administered on two occasions: post-vaccination test; retrospective pre-vaccination test with appropriate instructions. The difference between post-vaccination and retrospective pre-vaccination scores gives the complacency scores induced by vaccination.