ORIGINAL ARTICLE

PREPARATION AND VALIDATION OF AN INSTRUMENT CONCERNING CONFORMITY OF MEASURES FOR COPING WITH COVID-19 IN ORAL HEALTH SERVICES IN BRAZIL

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Highlights:

1. The validated tool was elaborated according to the guidelines of ANVISA.
2. Target to dental staff (dentists, hygienists or assistants).
3. It can be used in other situations to control infectious diseases.

http://dx.doi.org/10.21527/2176-7114.2024.48.14627

How to cite:
Silva Júnior MF, Palma LZ, Warmling CM, Spiger V, Ditterich RG, Pecharki GD. et al. Preparation and validation of an instrument concerning conformity of measures for coping with Covid-19 in oral health services ln Brazil. Rev. Contexto & Saúde, 2024;24(48): e14627

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ABSTRACT

The aim of this study was to validate an instrument designed for oral health professionals (dentists, hygienists or assistants) on compliance with measures to combat Covid-19 in dental services according to the guidelines of the Brazilian National Health Surveillance Agency. The methodological study was divided into five stages: 1) face and content validity: carried out by eight experts in the field followed by a pilot study with 35 oral health professionals; and, 2) validation of the psychometric properties measured among oral health professionals working in the states of the Southern Region of Brazil, who answered 37 questions of the instrument (n=1824), with assessment of: a) internal consistency using the Cronbach's Alpha coefficient and the item-total correlation; b) reproducibility measured by test-retest among 52 participants; and, c) construct validity by b means of divergent and convergent correlation analysis and exploratory factor analysis. In terms of face and content validity, questions were reduced, regrouped and divided, in addition to adaptations of form and content in items and answers. On 34 items, agreement was substantial/almost complete *(intraclass correlation coefficient>0.60)* Reproducibility was adequate *(p=0,45).* Reliability analysis indicated exclusion of six items due to item-total correlation <0.20 and one item due to factor loading <0.30. The instrument with 30 items showed good internal consistency *(Cronbach's alpha=0.86).* Analysis of the main components showed five dimensions that explained 51.1% of the variance *(p<0.001).* The convergent criterion validity had a moderate positive correlation *(p<0,001).* The instrument developed was validated by presenting adequate psychometric properties. In this sense, the instrument can be used for oral health professionals in other locations or at other times of the Covid-19 syndemic in Brazil.

Keywords: Corona Virus Oral health services Validation study

INTRODUCTION

The Covid-19 syndemic, a situation in which interaction with other diseases of an epidemic nature determines an increased effect on the health of the world population, and has had a negative impact on social, environmental and economic contexts[1]. This emerging global health problem emanated unprecedented joint efforts between researchers from different areas and regions, so that it was possible, in just over two years, to expand knowledge about the

disease, improve mitigation and control measures, develop effective vaccines and achieve important advancement in combating the syndemic. During this period of confrontation and resistance, health workers have remained on the front line to ensure care and support for the health of populations.

Therefore, the nature of health work involves being in close proximity to others. In the syndemic scenario, this connection also represents a greater propensity for contamination and taking ill[2-4]. In the same sense, given the particular characteristics of the work process, professionals who work in oral health care are at high risk of infection by the Sars-CoV-2 virus[5-8]. Dentists, hygienists or assistants are frequently exposed to saliva, blood, and other body fluids – dental care can generate a large production and dispersion of aerosols, arising from the use of working instruments such as high and low rotation pens, triple syringes and ultrasonic debridement equipment[6].

The context also reinforces the fundamental role played by biosafety, understood as an interdisciplinary and multilateral approach to the protection of human beings and their environments, with their efforts to make it feasible to contain and reduce the risks of contamination, frequently expressed in protocols and standards that regulate professional practice and work processes[9,10].

On March 31, 2020, in Brazil, the National Health Surveillance Agency (ANVISA) published the Technical Note GVIMS/GGTES/ANVISA N° 04/2020 (NT 04/2020)[11], a document that established protocols to be adopted for reducing the risk of contamination by Sars-CoV-2, in dental offices as well, with a central role as a reference to the reorganization of health services in syndemic times. In a systematic review that analyzed 27 documents from different countries, and identified low scientific quality among the different guidelines - due to the need for in-depth research at the time - the Brazilian recommendations were outstanding along with those from Germany and Spain precisely because they presented higher quality in comparison with the others[12].

For dental practice, the Covid-19 syndemic also represented the incorporation of new Personal Protective Equipment (PPE), in addition to organizational and structural changes in the work environment and professional routine[11]. It is important to understand whether the instructions that were established in government protocols were, in fact, incorporated by professionals in their different work scenarios.

Therefore, several studies have evaluated the knowledge and attitudes of oral health workers with regard to new biosafety protocols for combating Covid-19[5,8,13-20]. However, to

date, no instruments that have been submitted to validation processes have been described, to enable their potential for measurement and reproducibility to be assessed[17].

Likewise, the majority of studies have focused on evaluating the working conditions of Dentists, either in Brazil[16,18,20] or the world [5,13-15,17,19], without including other oral health workers, such as hygienists or assistants [8]. In view of the needs observed in this scenario, the aim of this study was to validate an instrument designed for oral health professionals (dentists, hygienists or assistants) in compliance with the measures to combat Covid-19 in oral health services, in accordance with the guidelines of the Brazilian National Health Surveillance Agency.

METHODOLOGY

Study Design and Ethical Aspects

This was a methodological study of instrument elaboration and validation, developed from May to October 2020, as part of the project "Biosecurity in Dentistry for combating Covid-19: analysis of practices and formulation of strategies", a multicentric research with the aim of focused on oral health personnel working in states of the southern region of Brazil during the first year of the syndemic. The study was conducted by the Collective Oral Health Network of the Southern Region (Rede SBCSul), composed of 45 researchers from four Higher Education Institutions in southern Brazil and one from Argentina[21].

The research project was approved by the Research Ethics Committees (REC) of the educational institutions involved: State University of Ponta Grossa (CAAE: 31720920.5.1001.0105, opinion 4.024.593), Federal University of Paraná (CAAE: 31720920.5.3001.0102, opinion 4.312.933), Federal University of Santa (CAAE: 31720920.5.2001.0121, opinion 4.226.476) Federal University of Rio Grande do Sul (CAAE: 31720920,5,2002,5530, appear 4,071,063). All participants included in the study agreed to the Term of Free and Informed Consent Form (TFIC), made available prior to completing the questionnaire.

Considering the theoretical and empirical poles that are the bases of development of instruments and scales in psychometric investigations[22,23] this research was structured in the following stages: (1) definition of the theoretical framework; (2) initial development of the instrument; (3) face and content validation; (4) application of the questionnaire; (5) analysis of psychometric properties. The procedures adopted in each of these stages are described below.

Definition of the theoretical framework

Definition of the theoretical framework was based on two elements that were central to the research problem: (1) general aspects related to the Covid-19 syndemic and characterization of working conditions; (2) local and regulatory aspects of the national context. Therefore, theoretical clarification considered both scientific publications existent on the topic investigated to date, and official documents and guidelines published in the national territory. Among these, NT 04/2020 was outstanding since it dealt with protocols to be adopted in the dental care environment to reduce the risk of contamination. Initially published on January 30, 2020, and has undergone several updates resulting from the dynamics of the syndemic[11]. During the preparation period of the instrument, the fourth update of NT 04/2020, published on May 8, was used as a basis. Among other measures, the aforementioned note defines that dental care should be restricted to urgent and/or emergency services, to reduce the number of aerosol-generating procedures and, therefore, reduce the risks of contamination and transmission of Covid-19[11]. The choice of this document was based on the importance of ANVISA as a regulatory body connected to the Ministry of Health and responsible for health care of these services, and recognition of the scientific quality of its recommendations at the time [12].

After clarification and establishment of the theoretical pole and its reference, the instrument was developed in consensus with researchers of the Network

Validation of the face and content

Face and content validation can be understood as the first step in the process of associating abstract concepts with observable indicators; that is, in the act of seeking to identify the representativeness of one or more items in relation to the phenomenon studied [24,25]. One of the most commonly used strategies in the health sector is peer review.

With the aim of qualifying the research instrument, the initial questionnaire was sent to a group of 10 reviewers, who were intentionally selected, based on the following criteria: a) have a degree in Dentistry; b) be a teacher with at least 10 years of experience; c) have a doctorate degree in the field of Dentistry, Dental Clinic, Public Health, Public Health or Epidemiology. The referees were professors identified by recognition in the area, and the requirements were verified by means of the Lattes Curriculum.

The instrument was made available on the Google Forms® platform, and the time for response was 7 days. The Professors were requested to classify each of the questions relative to their relevance to the research context, according to the scale: (0) “of no importance”; (1)

"not very important"; (2) "reasonably important"; (3) "important"; and, (4) "extremely important". They also had the opportunity to describe their perceptions and recommendations with regard to the evaluation of grammar, syntax, organization and logical adequacy of structuring for each of the questions.

The data were tabulated and analyzed using the Content Validity Index (CVI), a method that allows the measurement of relevance of an item to the object studied by the degree of agreement of reviewers. To maintain the question, 75% of the reviewers should indicate the option (3) "important" or (4) "extremely important", a value considered satisfactory for the development of new instruments2 [27].

In the face and content validation process, the pre-test represented the stage in which the instrument for its target population was investigated. This new version was made available to 50 oral health professionals (dentists, hygienists or assistants) working in other regions of the country, except the southern region, for seven days.

Application of the Questionnaire

After final adjustments in the face and content validation phase, the instrument moved to the questionnaire application phase. The people who participated in this study were oral health professionals (dentists, hygienists or assistants) from the states of Paraná, Santa Catarina and Rio Grande do Sul, listed based on records of the Regional Dental Councils (RDCs)

Data collection occurred in the period of August through to October 2020, by means of an electronic form on the Google Forms®, platform, with invitations to participants by *e-mail* by the respective RDCs.

The invitation strategy was conducted in three different periods, with intervals of 15 and 45 days, with the aim of providing all registered professionals with access to information and voluntary participation. In a complementary manner, the SBCSul Network used a broad dissemination strategy in partnership with the Health Departments, educational institutions and professional associations, reports on social networks (WhatsApp®, Instagram® Facebook®) and dissemination events on *Lives Streaming*, by Youtube®.

On conclusion of filling out the electronic form, all participants were able to provide their contact e-mail for participation in subsequent stages.

Analysis of psychometric properties

Exploratory data analyses were performed using the Statistical Package for the Social Sciences (SPSS) for Windows® version 21.0 ($p \leq 0.05$).

To analyze the psychometric properties, only the 37 objective questions prepared in accordance with NT 04/2020 were extracted[11]. This data set received this type of analysis with the aim of creating a scaled instrument to verify the compliance with measures to combat Covid-19 adopted in dental services for oral health professionals.

These questions had an option to answer on a 5-point frequency Likert scale: (1) "never;" (2) "rarely"; (3) "sometimes"; (4) In the majority of times" (5) "always". Furthermore, there was an option (6) "I don't know".

For the validation process, the following exclusion criteria were defined: (1) respondents who did not receive clinical care during the Covid-19 syndemic period at the time; (2) those with the answer "I don't know" to one or more questions under analysis.

In the present study, the steps sought to measure reliability, representation and the hypothesis[22,28].

Reliability?/trustworthiness expresses the concept that is intended to be represented, that is, that the same subjects on different occasions or in equivalent tests will produce the same results In the absence of instruments previously validated for comparison in the same period, the test-retest technique can be used, which consists of applying the same instrument to the same population at two different times, and investigating whether there is a positive correlation between the responses, indicating the reliability of the instrument

The selection of respondents for the retest occurred in a staggered manner, among those who agreed to participate in future stages. The data were reorganized and the identification code, generated from the order of the response date, was used both to identify non-response and to perform matching in the retest.

To guarantee that the sample characteristics would be maintained, we sought to maintain the proportionality of respondents in the 3 professional categories and in the 3 states, thus establishing a minimum of 50 participants. The retest collection took place between 7 and 10 days after the first participation, in a single attempt.

Analysis of agreement between pairs of responses was obtained by using the intraclass correlation coefficient (ICC), which measures the correlation between two samples, in each question and in the total scale. Interpretation of the magnitude of the CCI estimators is classified as: no agreement (0.00), poor (0.01-0.19); weak (0.20-0.39); moderate (0.30-0.59); substantial (0.60-0.79); and almost complete ($\geq$0.80)[30].

Reproducibility was demonstrated using a Bland Altmann graph, considering the total value of the measure resulting from the sum of the question scores. Comparison between the Test-retest was made with the one-sample t-test. The reference value zero indicates good reproducibility *(p>0.05)*[31].

Representation analysis is a psychometric approach to ensure content validity, and involves two main techniques, internal consistency analysis and factor analysis. Internal consistency represents the correlation between each question and/or total of questions s[22] and was evaluated by Cronbach's Alpha Coefficient, total and after removing the question, and by Item-Total Correlation. The existence of a very low item-value for correlation indicates that the question does not belong to the domain studied and, therefore, its exclusion is recommended[29]

In this study, any question that presented: (1) Item-total correlation coefficient less than 0.20; and/or, (2) Cronbach's Alpha Coefficient less than 0.7 [32,33].

Factor analysis in validation consists of a set of techniques to verify the common constructs necessary for explaining the inter-correlations between the questions of the instrument. Covariance, or factor loading, of a variable indicates whether it is a good indicator of the phenomenon evaluated Exploratory factor analysis seeks to generate the indicator from exploration of the data itself, which is the case in the present study. Conventional principal component analysis (PCA) was used to reduce variables into a number of unrelated components[34]. We opted for the Direct Olkin rotation technique with Kaiser normalization, since the factors extracted were correlated [34,35].

Model fit was checked using the Kaiser-Meyer-Olkin (KMO) test, Bartlett's test of sphericity and analysis of factor loadings. The KMO test has values between 0 and 1, which are classified as: excellent (0.90-1.00); good (0.80-0.89); median (0.70-0.79); mediocre (0.60-0.69); poor (0.50-0.59); and inadequate (0.00-0.49) [35]. Bartlett's sphericity value, with a significance level closest to zero ($p<0.001$), demonstrates the adequacy of the factor analysis to the data set [36]. The analysis of factor loadings indicates the degree of correspondence between item and factor and representativeness. Items with factor loadings lower than 0.30 must be excluded from the analysis and the final instrument [36].

For factor analysis to be performed, the normality of the data must be guaranteed. For this purpose, the Shapiro-Wilk test ($p>0.05$) was applied and, since the data presented a non-parametric distribution, they were transformed. For this purpose, the logarithmic transformation was applied.

Hypothesis analysis is a construct validation method that seeks to verify whether the instrument is capable of predicting or discriminating a criterion external to itself, and its main technique is convergent-discriminant validation, which tests the correlation with variables to which the construct should relate[22].

At this stage, two questions about access to information, knowledge and confidence to act in care during that period were considered for the convergent validation process and one that addressed the feeling of insecurity and anxiety to act for divergent validation. This choice was made based on the construct, based on the possible correlation between these factors and the compliance of the professionals' working conditions, verified by Spearman's Correlation Coefficient ($p \leq 0.05$) between the total value of the measure and the score of each of the other variables.

RESULTS

The instrument initially prepared by the Network consisted of 65 questions, including: 14 related to sociodemographic, training and work profile; 43 with the availability of inputs and biosecurity measures; and 8 with professional practice, management, education and teamwork. Of these questions, 4 allowed open answers, and 61 were objective answers.

Validation of the face and content

Among the 10 reviewers, eight completed the initial instrument evaluation questionnaire. After analyzing the reviewers' suggestions, eight questions were no longer part of the questionnaire: four were combined into two, another five were unified, and two were definitively excluded because they had a CVI value <75%, which generated an average CVI for the instrument. 86%, a value considered satisfactory.

Two questions about the availability and use of conventional Personal Protective Equipment (PPE) (coverallt, surgical mask, procedure gloves, protective glasses), which were presented together as a block, were divided into 4, each with the aim of unifying and identifying variations for each item. In addition, changes were made to the wording of 15 questions, with the aim of improving alternative answers, and making it easier to understand each question in the instrument. Furthermore, for the questions referring to NT 04/2020, the recommendation was to replace the form of the 5-point Likert scale used from agreement to frequency[21].

The new version of the instrument consisted of 57 questions, 52 of an objective, and 5 of a subjective nature, and it was applied as a pre-test. The responses of 35 professionals were

analyzed. This allowed adjustments to be made to the final version. Some of the questions showed little or no variability in responses, indicating their exclusion. In the end, the instrument was submitted to reduction, regrouping and division of questions, in addition to modification of form (discursive question, open field for typing or use of the Likert-type Scale) and/or content (reformulation of the wording of the question or the options for answers). Details of the process of change at this stage, were described in a previously published document[21].

The final version of the instrument resulted in 50 questions, 47 of which were objective, ,and 3, subjective in nature. It is noteworthy, however, that for the psychometric analysis of the instrument, only 37 of the 47 questions were considered quantitative in nature, as they refer to NT 04/2020 since each `question` in the analysis was called an `item`.

Data collection

The final sample of the multicenter study had 2560 respondents, after excluding participants who did not fully respond to the 37 items directly related to NT 04/2020. The non-probabilistic sample, was made up of a total of 1824 professionals. This made it possible to conduct the validation process of the psychometric properties. The sample consisted predominantly of women (77.1%) and mean age was 39.8 years (±10.4). Relative to occupation, the majority declared themselves to be dentists (76.9%), and they worked in Primary Care in the Unified Health System (55.6%).

Reliability

For the retest stage, responses were obtained from 52 professionals, and of these the majority were women (80.8%), dentists (61.5%) with an average age of 36.1 years (± 9.6), enabling the reliability of the instrument to be assessed (Table 1)

Table 1 Analysis of reproducibility of the questionnaire on compliance with measures to combat Covid-19 in dental services for oral health professionals in Brazil, according to NT GVIMS/GGTES/ANVISA No. 04/2020.

	Item of the questionnaire [a]	Intraclass Correlation Coefficient	p-value
Q1	Elective dental procedures suspended	0.855	<0.001
Q2	Reduction in working hours or turnover of professionals	0.882	<0.001
Q3	Participated in decision making	0.883	<0.001
Q4	Patient asked about symptoms when scheduling appointments	0.870	<0.001
Q5	Works in reception/screening to detect patients with suspected infection	0.815	<0.001
Q6	Patients with symptoms are isolated from others	0.614	<0.001
Q7	Minimum distancing is respected in the waiting room	0.921	<0.001
Q8	Visual alerts are available	0.814	<0.001
Q9	Advises patients about Covid-19	0.766	<0.001
Q10	Dental emergency defined by clinical protocols	0.697	<0.001
Q11	Use digital tools for tele-orientation/tele-monitoring	0.807	<0.001
Q12	Interaction with other healthcare professionals during the pandemic	0.790	<0.001
Q13	Cleaning/disinfection of the environment by a trained professional, with appropriate PPE	0.858	<0.001
Q14	Cleaning/disinfecting suction hoses after each service	0.826	<0.001
Q15	Sterile and autoclaved handpieces at each dental appointment	0.926	<0.001
Q16	Head coveralls available	0.702	<0.001
Q17	Protective goggles available	0.650	<0.001
Q18	Surgical Mask available	0.877	<0.001
Q19	Procedure glove available	0.797	<0.001
Q20	Face shield available	0.600	0.001
Q21	N95/PFF2S/or equivalent mask available	0.699	<0.001
Q22	Waterproof apron available	0.719	<0.001
Q23	Use coverall	0.352	0.062
Q24	Use protective goggles	0.743	<0.001
Q25	Use surgical mask	0.787	<0.001
Q26	Use procedure glove	**	
Q27	Use face shield	0.862	<0.001
Q28	Use N95/PFF2S/ mask or equivalent	0.839	<0.001
Q29	Use waterproof apron	0.633	<0.001
Q30	Re-use N95/PFF2/ mask or equivalent	0.475	0.012
Q31	Cleaning and disinfecting the face shield at each service	0.809	<0.001
Q32	Appropriate sequence of undressing for each service	0.449	0.018
Q33	Avoid performing and/or requesting intra oral radiographic exams	0.889	<0.001
Q34	Dental procedures carried out with 4 (four) hands.	0.951	<0.001
Q35	Use a rubber dam when handling high-speed pens	0.859	<0.001
Q36	Avoid procedures that generate aerosols	0.898	<0.001
Q37	Uses high power suction system	0.923	<0.001
	Total (sum of scores	**0.945**	**<0.001**

[a] Response Options: 1 - never; 2 - rarely; 3 - sometimes; 4 - almost always; 5 - always.
* Not calculated, 100% of score 5 (always) in the test and retest.

It was observed that 34 of the 37 questions had an ICC ≥ 0.6, considered substantial to almost complete reproducibility. The remaining questions showed moderate agreement, with the lowest value being obtained for Q23 (wears coverall – CCI=0.35), Q32 (adequate sequence of donning and doffing – CCI=0.35) and Q30 (reuses N95 mask or equivalent; CCI= 0.,47)., However, the coefficient for the total sum of scores was high (0.94).

Therefore , the scale proved to be reliable, in which the Bland Atman graph indicated good reproducibility of the instrument as a whole (p>0.05).

Analysis of representation

Table 2 presents the measures of central tendency and dispersion of the responses obtained, as well as the percentage of 'always' responses, considered complete compliance with the measure. The instrument demonstrated good compliance of oral health services with the measures recommended by NT 04/2020, with the majority of item medians falling within scores 4 (almost always) and 5 (always). Lower compliance was observed for Q5 (acting in reception/screening to detect patients with suspected infection) and Q36 (use of rubber dam when using high rotation), followed by reduction in working hours or turnover of professionals (Q2), use digital tools for telemonitoring and tele-orientation (Q11), and avoid performing/requesting intra oral X-rays (Q34).

Table 2 also shows the internal consistency analysis measures. Relative to the item-total correlation, six items obtained values lower than 0.2 and were excluded from the final instrument (Q1, Q25, Q30, Q33, Q34 and Q37). After eliminating the items, the total value of Cronbach's Alpha coefficient was 0.857, indicating good/adequate internal consistency.

Table 2 Internal consistency analysis of the items in the questionnaire conforming to measures to combat Covid-19 in dental services in Brazil, according to NT GVIMS/GGTES/ANVISA No. 04/2020.

	Item of questionnaire [a]	Md*	IQR*	% score 5 always)	Correlation item-total Corrected	Cronbach's alpha if item is removed
Q1	Elective dental procedures suspended	4.0	2.0	37.9	---	---
Q2	Reduction in working hours or turnover of professionals	3.0	4.0	28.8	0.296	0.867
Q3	Participated in decision making	4.0	4.0	40.2	0.395	0.864
Q4	Patient asked about symptoms when scheduling appointments	5.0	1.0	70.3	0.521	0.860
Q5	Works in reception/screening to detect patients with suspected infection	2.0	3.0	20.5	0.232	0.869
Q6	Patients with symptoms are isolated from others	5.0	1.0	66.4	0.448	0.862
Q7	Minimum distancing is respected in the waiting room	5.0	1.0	69.0	0.478	0.862
Q8	Visual alerts are available	5.0	2.0	58.4	0.344	0.865
Q9	Advises patients about Covid-19	5.0	2.0	53.7	0.471	0.861
Q10	Dental emergency defined by clinical protocols	5.0	1.0	54.6	0.397	0.863
Q11	Use digital tools for tele-orientation/tele-monitoring	3.0	4.0	27.1	0.413	0.863
Q12	Interaction with other healthcare professionals during the pandemic	4.0	2.0	35.3	0.323	0.865
Q13	Cleaning/disinfection of the environment by a trained professional, with appropriate PPE	5.0	2.0	57.0	0.479	0.861
Q14	Cleaning/disinfecting suction hoses after each service	4.0	2.0	49.3	0.477	0.861

Q15	Sterile and autoclaved handpieces at each dental appointment	4.0	3.8	40.2	0.456	0.860
Q16	Head coveralls available	5.0	0.0	92.7	0.393	0.864
Q17	Protective goggles available	5.0	0.0	91.1	0.451	0.863
Q18	Surgical Mask available	5.0	0.0	86.5	0.412	0.863
Q19	Procedure glove available	5.0	0.0	94.6	0.312	0.866
Q20	Face shield available	5.0	0.0	88.8	0.438	0.863
Q21	N95/PFF2S/or equivalent mask available	5.0	1.0	69.2	0.515	0.860
Q22	Waterproof apron available	5.0	2.0	60.5	0.548	0.859
Q23	Use coverall	5.0	0.0	92.8	0.350	0.865
Q24	Use protective goggles	5.0	0.0	80.6	0.340	0.864
Q25	Use surgical mask	5.0	0.0	81.7	---	---
Q26	Use procedure glove	5.0	0.0	95.7	0.296	0.866
Q27	Use face shield	5.0	0.0	81.4	0.376	0.864
Q28	Use N95/PFF2S/ mask or equivalent	5.0	1.0	72.4	0.426	0.859
Q29	Use waterproof apron	5.0	2.0	61.0	0.522	0.859
Q30	Re-use N95/PFF2/ mask or equivalent	5.0	1.0	60.2	---	---
Q31	Cleaning and disinfecting the face shield at each service	5.0	0.0	89.7	0.341	0.865
Q32	Appropriate sequence of undressing for each service	5.0	1.0	54.5	0.462	0.861
Q33	Avoid performing and/or requesting intra oral radiographic exams	3.0	2.0	15.1	---	---
Q34	Dental procedures carried out with 4 (four) hands.	4.0	3.0	44.8	---	---
Q35	Use a rubber dam when handling high-speed pens	2.0	3.0	13.0	0.350	0.865
Q36	Avoid procedures that generate aerosols	3.0	2.0	19.4	0.201	0.868
Q37	Uses high power suction system	4.0	4.0	45.4	---	---
		Md*	**IQR***	**Mean**	**SD***	**Cronbach's Alpha**
	Total (sum of scores**	125.0	21.0	122.9	16.7	0.867
	Total (Mean of scores)**	4.2	0.7	4.1	0.5	

[a] Response Options: 1 - never; 2 - rarely; 3 - sometimes; 4 - almost always; 5 - always. --- Item excluded from the instrument due to item-total correlation < 0.2; * Md – median; IQR – interquartile range; sd – standard deviation; ** Only items that remained in the instrument are included in the calculation.

Table 3 shows the results of the exploratory factor analysis. One item (Q5) had an eigenvalue lower than 0.3 and was excluded from the analysis. The best adjustment was obtained by grouping the variables into five main components that together explained 51.1% of the variance in the responses. The block of questions related to the availability and use of conventional and face-shield PPE presented greater representation, alone explaining 23.8% of the total variance. The communalities had results between 0.741 and 0.307. The KMO test was 0.856 and Bartlett sphericity with $p<0.001$, indicating good fit of the model.

Table 3 Exploratory Factor Analysis of the database using Principal Component Analysis (n=1824).

Item of questionnaire [a]	Components (factor loadings)					Commonalities
	1	2	3	4	5	
Q19 Procedure glove available	0.872					0.741
Q26 Use procedure glove	0.847					0.716
Head coveralls available	0.829					0.694
Use coverall	0.775					0.634
Q17 Protective goggles available	0.692					0.552
Q18 Surgical Mask available	0.629					0.500
Q20 Face shield available	0.628					0.563
Q27 Use face shield	0.590					0.580
Q24 Use protective goggles	0.544					0.349
Q36 Avoid procedures that generate aerosols		0.676				0.493
Q10 Dental emergency defined by clinical protocols		0.674				0.498
Q6 Patients with symptoms are isolated from others		0.607				0.444
Q9 Advises patients about Covid-19		0.563				0.468
Q4 Patient asked about symptoms when scheduling appointments		0.500				0.447
Q12 Interaction with other healthcare professionals during the pandemic		0.445				0.336
Q8 Visual alerts are available		0.400				0.307
Q3 Participated in decision making			0.696			0.518
Q2 Reduction in working hours or turnover of professionals			0.662			0.443
Q35 Use a rubber dam when handling high-speed pens			0.485			0.342
Q11 Use digital tools for tele-orientation/tele-monitoring			0.472			0.347
Q7 Minimum distancing is respected in the waiting room			0.453			0.401
Q29 Use waterproof apron				-0.795		0.697
Q22 Waterproof apron available				-0.780		0.711
Q28 Use N95/PFF2S/ mask or equivalent				-0.650		0.615
Q21 N95/PFF2S/or equivalent mask available				-0.636		0.607
Q14 Cleaning/disinfecting suction hoses after each service					-0.628	0.533
Q31 Cleaning and disinfecting the face shield at each service					-0.621	0.442
Q32 Appropriate sequence of undressing for each service					-0.596	0.471
Q13 Cleaning/disinfection of the environment by a trained professional, with appropriate PPE					-0.492	0.479
Q15 Sterile and autoclaved handpieces at each dental appointment					-0.429	0.386
Eigenvalues	7.13	3.81	1.70	1.50	1.18	
Variance (%)	23.77	12.69	5.66	5.00	3.94	

[a] a Scores on a five-point frequency Likert scale (subjected to logarithmic transformation), Q5 excluded from analysis due to factor loading <0.3; * Direct On Rotation with Kaiser normalization; KMO test = 0.856/ Bartlett Hispanic (Chi-square) = 22464.542 (p<0.001); Convergent rotations in 18 iterations.

The final version of the instrument had 30 items, and can be seen in Chart 1.

Chart 1 Questionnaire on compliance with measures to combat Covid-19 in dental services for oral health professionals in Brazil, according to NT GVIMS/GGTES/ANVISA No. 04/2020.

Code	Item of questionnaire*#
Q1	**Excluded**
Q2	In my service, there was a reduction in the workload or rotation of professionals to minimize the risks of contamination
Q3	I participated in making decisions about changes to my work during the Covid-19 pandemic.
Q4	When scheduling outpatient appointments, at my place of work, patients are asked if they have symptoms of a respiratory infection (for example: fever, cough, runny nose, difficulty breathing, among others).
Q5	**Excluded**
Q6	At my workplace, patients who show up with symptoms of respiratory tract infection (cough, runny nose, fever, difficulty breathing, among others) are immediately isolated from the other patients (allocated to a separate room, preferably ventilated, with a surgical mask and with easy access to respiratory and hand hygiene supplies).
Q7	In the waiting room, a minimum distance of 1 meter between each person is respected.
Q8	At my workplace, to provide patients with guidance on the correct form of hand hygiene, respiratory hygiene/cough etiquette, among others, visual alerts are made available at the entrance to the health service and in other strategic locations (waiting areas , elevators, cafeterias, etc.).
Q9	At my workplace, I guide my patients about the signs and symptoms of Covid-19, means of contamination and spread of the disease, prevention and control measures, and what to do if you suspect you are sick.
Q10	At my workplace, I guide my patients about the signs and symptoms of Covid-19, means of contamination and spread of the disease, prevention and control measures, and what to do if you suspect you are sick.
Q11	At my workplace, oral health professionals use digital tools (cell phone paps, email) to tele-guide or tele-monitor patients.
Q12	During the pandemic, I interacted with other health professionals to discuss the work process in clinical practice.
Q13	At my workplace, the process of cleaning and disinfecting the environment is carried out by a trained professional, who has and uses the following Personal Protective Equipment (PPE): hat, protective glasses or face shield, surgical mask, waterproof apron, gloves rubber and waterproof shoes.
Q14	Cleaning and disinfection of the suction hoses is carried out with a chlorine-based disinfectant (concentration of 2,500 mg of chlorine per liter of water), or another disinfectant indicated for this purpose, at each service.
Q15	I use sterile and autoclaved handpieces (high and low rotation pens) at each dental appointment.
	At my place of work. the following PPE is available in sufficient quantity:
Q16	Cap/Helmet/Coverall
Q17	Protective Goggles
Q18	Surgical Mask
Q19	Procedure glove
Q20	Face shield
Q21	N95/PFF2S/or equivalent mask
Q22	Waterproof apron
	Considering Covid-19, when caring for patients I use the following PPE:
Q23	Cap/Helmet/Coverall
Q24	Protective Goggles
Q25	**Excluded**
Q26	Procedure glove
Q27	Face shield
Q28	N95/PFF2S/or equivalent mask
Q29	Waterproof apron
Q30	**Excluded**
Q31	At my place, of work I clean and disinfect the face shield with 70% liquid alcohol or another product recommended by the manufacturer at each service.
Q32	After each attendance, I perform the following undressing sequence: removing gloves, washing hands, removing face shield, removing cap, removing apron, washing hands, leaving the clinical environment, removing protective glasses, removing mask , handwashing.
Q33	**Excluded**
Q34	**Excluded**
Q35	At my place of work, due to the Covid-19 pandemic, the rubber dam is used during services that require the use of high-speed pens.

Q36	At my place of work, we avoid procedures that require the use of equipment that generates aerosols (triple syringe in the form of mist/spray, high and low rotation pens, bicarbonate jets or ultrasound) due to the Covid-19 pandemic.
Q37	**Excluded**

* Response Options: 1 - never; 2 - rarely; 3 - sometimes; 4 - almost always; 5 - always; 6 - I don't know.
# The questions are translated into English, but the questionnaire was only validated in Portuguese (Brazilian).

Analysis by hypothesis

These results of the analysis of convergence are presentation in Table 4. For the two convergent validity analysis questions there was a moderate positive correlation ($p<0.001$). For divergent construct analysis, there was a weak negative correlation ($p<0.001$).

Table 4. Spearman correlation (rho) between access to information, feeling of security at work, stress and compliance with best practice measures to control the spread of COVID-19 in the health service in Brazil, according to NT GVIMS/GGTES/ANVISA No. 04/2020 (n=1824).

	Adherence to good practice measures in health services/COVID-19	Received guidance at the place of work*	I feel well informed and safe*	I feel anxious and worrried*
Adherence to good practice measures in health services/COVID-19	1.00	---	---	---
Received guidance at the place of work*	0.425**	1,00	---	---
I feel well informed and safe*	0.400**	0.377**	1.00	---
I feel anxious and worrried*	- 0.128**	- 0.105**	- 0.308**	1.00

*Response Options: 1 - totally disagree; 2 - partially disagree; 3 - neither agree nor disagree; 4 - I partially agree; 5 - I completely agree ('I don't know' responses were considered 'missing').
**Significant Correlation at level of 0.01%.

DISCUSSION

The present study was conducted with the purpose of validating the first instrument designed to analyze the compliance with measures to combat Covid-19 in oral health services. The instrument was shown to be easy to interpret, apply and demonstrated reproducibility, since the questions in it were based on the representativity of subjects since the time of their conceptual definition. Furthermore, a methodological differential was envisaged, in which all professional categories in oral health were included; that is, dentists, hygienists or assistants. At this point, it contrasted with national and international literature, which has collected information about biosafety or work processes only among dentists[5,13-20].

The development of instruments benefits from the use of techniques that aim to ensure that the instrument actually represents the phenomenon it proposes to measure, in both content and construct. We emphasize that the problem of validity and the construction of instruments is a central aspect of the context of both psychosocial and health sciences as a whole, given the

need for congruence between these and the particularities of the properties that are studied.[22,28] In the present study, these techniques, in addition to the collaboration and sharing of experiences of researchers from the multicenter network, allowed an instrument to be developed, capable of investigating a broad scope of different aspects of working conditions in oral health, right away in the first year of the Covid-19 syndemic. Moreover it was possible to generate a scale capable of evaluating the compliance with measures to combat Covid-19 in oral health services in accordance with the Brazilian guidelines for prevention and control of the spread of CHARS-CoV-2 in these services. Furthermore, it was a scale that showed satisfactory psychometric characteristics according to the reliability and validity criteria of the construct[35-37].

Covid-19 had widespread impact on the environment and work context in oral health on a global scale. Several changes were recommended to guarantee fundamental oral health care safely for professionals and patients, starting with raising awareness of the danger arising from droplets and aerosols produced by work equipment, through to the use of items of PPE that were previously uncommon in the daily lives of many workers. Among the above-mentioned PPE were items such as N95/PFF-2 type face masks or face shields, and the recommendations to suspend elective dental care [38-40]. This was a context that recommended efforts to develop alternatives for scientific research into the context of the work of these professionals.

The validity of an instrument is included within a broad and divergent conceptual field, and it extends outwards beyond the classical foundation of sensitivity and specificity. Moreover, it seeks to assess the extent to which the results of measurement values all meaningful and interretable[41-43]. This research sought to respect the theoretical structuring and epistemic perspective, which are features that are central and primordial to the approach to the problem, in order to ensure that statistical analysis does not become outstanding out and determine the investigation, but rather that itis an instrument in favor of the investigation,2 [22,44] This is why the psychometric measurements were directed exclusively to that part of the instrument which, in fact, had the criteria required for this type of analysis. That is to say, in the same way as validation techniques adapt the instrument, the choice of these techniques must respect and be adapted to the theoretical purpose of the instrument.

The use of a validated instrument can allow the comparison of compliance with the measures to combat Covid-19 in oral health services in different environments (public versus private), level of training (technician versus higher education or generalists versus specialists),

in order to compare the different stages of the pandemic or locations (municipalities, states and regions), among others. Furthermore, the data are of great value for strategies of greater adherence to the measures, which could refer to identification of the items with greater or lesser compliance or even assist in the planning of actions to guarantee continuing education structural or organizational changes so that there cooed be a decline in the risk of contamination by Covid-19 among workers and users.

The process of validation involves several steps, and to validate the construct, a sample of over 1800 participants was included in the study. Larger samples tend to stabilize the component pattern, minimize the probability of errors, maximize the accuracy of population estimates, in addition to allowing an increase in generalization of the results [42]. Therefore, the instrument provided the capability for a comprehensible manner of measuring and identifying a broad, but convergent of factors related to the process of working in Dentistry in order to combat Covid-19.

Furthermore, it is important to point out that this study had limitations Relative to the theoretical framework, the study was developed in a very early period of the syndemic, when there were daily advances in scientific research about Covid-19, to an extent unprecedented in the history of modern science. This was achieved through funding and the continuous collaboration of researchers around the world. When developing the questionnaire, the (B Brazilian researchers chose to prioritize the inclusion of questions that had a more general and broader capacity for assessment. They restricted items that could be changed, depending on the stage of the syndemic.

Relative to the sample, the study was conducted with a convenience sample, and it was performed as a web survey. To minimize the impact of the above-mentioned factors., there was an active search and the use of sample control strategies throughout the weeks during which the study was conducted. Post-stratification, with the comparison of the final sample and the number of people enrolled in Federal Council of Dentistry[45] according to gender, age, professional category and place of work, were considered , factors that were indicative of the adequacy of the sample.

Among the limitations of the validation process, it is noteworthy that, although validity and construct procedures were carried out, criterion validity was not possible, due to the absence of another validated instrument with the same focus, whether in Portuguese or in other languages. To overcome this limitation, measures such as the test-retest method were used, with high reliability and [42], in which only two questions were not significant, however, it was

borderline. Thus, due to the limited sample size in the respective phase, were kept that question for evaluation in subsequent stages of validation.

Although the instrument presented inclusion of the three professional categories as a difference, it is important to note that the psychometric analysis considered the set of responses for the group of oral health professionals, and not each category individually. The study of the particularities and differences between each category, therefore, requires greater depth and further research.

CONCLUSION

The present study was to validate an instrument designed for oral health professionals (dentists, hygienists or assistants) in compliance with measures to combat Covid-19 in dental services according to the guidelines of the Brazilian National Health Surveillance Agency.

In its final version, the instrument showed adequate psychometric properties relative to reliability and representation of the phenomenon studied, on an accessible measurement scale. Despite the updates to NT 04/2020, the recommendations for combating Covid-19 remained in place, and therefore, the instrument can be used in other contexts in Brazil.

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Submitted: June 12, 2023

Accepted: February 12, 2024

Published: August 12, 2024

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All authors approved the final version of the text.

Conflict of Interest: There is no conflict of interest.

Financing: Does not have financing

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Editor: Dr. Meire Coelho Ferreira
Editor-in-chief: Dr. Adriane Cristina Bernat Kolankiewicz