

Development and validation of a questionnaire to determine knowledge, attitudes and practices in antibiotics prescription in dentistry¹

Diseño y validación de un cuestionario para determinar conocimientos, actitudes y prácticas en la prescripción de antibióticos en odontología¹

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Abstract

Introduction: antibiotic prescription in dentistry is usually performed during the treatment of oral infections or as a prophylactic measure for patients at risk; however, studies in other countries report an inadequate prescription by dentists. The purpose of this study was to validate a questionnaire to identify the knowledge, attitudes, and practices around antibiotic prescription by dentists. **Methods:** the study was developed in five stages: 1. A survey was designed. 2. Content validity by an expert panel. 3. A pilot study. 4. Application of the questionnaire to determine its unidimensionality, reliability, and psychometric index. 5. The scales were standardized to present the results independently of the number of questions. **Results:** in stages 1 and 2, a survey was developed showing an appropriate level of agreement by an expert panel (with the following Kendall's W values: sufficiency: 0.68; consistency: 0.69; relevance: 0.72; clarity: 0.81). Stage 3 showed that the questionnaire was too long. In stage 4, some items did not satisfy psychometric indicators such as internal consistency. Therefore, the instrument was adjusted to 36 items, improving the psychometric index [biserial correlation coefficient > 0.0, discrimination index >= 0, non-response index between 0-0.15, unidimensionality ($p = 0.93$)] and obtaining good internal consistency (KR = 0.81). In stage 5, the questionnaire was qualified with a percentile rank in three levels: low, medium, and high. **Conclusions:** the results from this study indicate an appropriate and validated survey, with adequate number of items and scale scores. All this despite the fact that antibiotic prescription by dentists is complex due other factors that determine this process.

Keywords:

antibacterial agents, drug resistance, dentistry, validation studies

Resumen

Introducción: los estudios en otros países reportan una prescripción inadecuada de antibióticos por parte de los odontólogos. El objetivo de este estudio es validar un cuestionario para medir los conocimientos, actitudes y prácticas de los odontólogos del Meta respecto a la prescripción de antibióticos. **Metodología:** el estudio consistió en 5 fases: 1. Diseño del instrumento con grupo focal. 2. Validez de contenido con un panel de expertos. 3. Prueba piloto con siete odontólogos. 4. Aplicación de la encuesta a 98 odontólogos, donde se determinó la confiabilidad, los índices psicométricos y la unidimensionalidad de las preguntas. 5. Construcción de escalas para uniformizar los resultados. **Resultados:** en las fases 1 y 2, se diseñó un instrumento con un nivel adecuado de concordancia por parte de expertos (W de Kendall en suficiencia: 0.68, concordancia: 0.69, relevancia: 0.72 y claridad: 0.81). En la fase 3 se detectó que la encuesta estaba muy extensa. En la fase 4, algunos ítems no cumplieron con indicadores psicométricos como la consistencia interna. Por tanto, se ajustó el instrumento a 36 ítems que cumplieron con todos los indicadores psicométricos [(coeficiente de correlación biserial > 0.0, índice de discriminación >= 0, índice de no respuesta entre 0-0.15 y unidimensionalidad ($p = 0.93$))] y con una consistencia interna global buena (KR = 0.81). En la fase 5, se establecieron los niveles de calificación. **Conclusiones:** el cuestionario desarrollado en este estudio es válido en términos de confiabilidad, índices psicométricos y unidimensionalidad. Asimismo, presentó adecuados índices de no respuesta y de confiabilidad, y una escala sencilla de calificación.

Palabras clave:

antibacterianos, farmacorresistencia microbiana, odontología, estudios de validación

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INTRODUCTION

The World Health Organization (WHO) encourages all sectors of society to help solve the problem of antibiotic resistance.¹ It has been estimated that about 10% of antibiotics are prescribed in dentistry, not always in the right way.²⁻⁴ In dentistry, antibiotics help control bacterial infections, without replacing dental intervention which is essential to eliminate the focus of infection (e.g. pus from acute abscesses or necrotic pulp). The election of an antibiotic is based on host-related factors (e.g. age, immune status, or allergic history), pharmacological factors (e.g. spectrum of action of the antibiotics, pharmacokinetics, possible pharmacological interactions, etc.) and microbiological factors (e.g. types of bacteria present). Regarding microbiological factors, practitioners make their prescriptions according to possible bacteria that may be causing the infection, bearing in mind that most come from the oral cavity, which is polymicrobial in nature.^{5,6} In addition, antibiotics are prescribed as a prophylactic measure in dental procedures where there is a risk of endocarditis or other specific conditions.⁷

In Colombia, Holguin et al, 2013 conducted a study in clinical histories of patients with oral surgery procedures (open method exodontics, closed method exodontics and soft tissue biopsies), showing that only 10.26% of prescriptions or “no” antibiotics as a prophylactic measure were relevant. In addition, they found that 83.8% of cases had over-prescription, showing the existence of antibiotic abuse with no validated indications.⁸ It is therefore critical to know how dentists are prescribing antibiotics in Colombia, and it is necessary to produce validated and reliable instruments for this purpose. The development and validation of an instrument requires a rigorous process consisting of the search

for scientific information, the formation of a focal group, the definition of the construct to be measured, the composition and number of items, and the definition, arrangement and coding of responses.⁹ In addition, it is also important to submit the instrument to a content validation process with a group of experts, validating the construct using psychometric indicators such as biserial index, discrimination, non-response, and difficulty, in addition to measuring the test's internal consistency, in order to determine whether it has the ability to evaluate all the dimensions one wants to measure. The aim of the present study was to develop and validate an instrument to determine knowledge, attitudes, and practices (KAP) on antibiotics prescription in the field of dentistry.

METHODS

A qualitative and quantitative study was conducted during the period 2016-2017 in Villavicencio and other municipalities of the department of Meta (Colombia). Data was collected by providing an informed consent to participating dentists, who were selected according to a number of criteria, like being registered with the Secretary of Health. This study was approved by the Bioethics Subcommittee of the Universidad Cooperativa de Colombia. The study consisted of 5 phases:

Phase 1. Questionnaire construction and focus group

Version 1.0 questionnaire (Figure 1) was created based on scientific literature. This version was analyzed and discussed in a focus group consisting of general and specialized dentists (oral surgery, pediatric dentistry, rehabilitation, pharmacology) and one microbiologist.

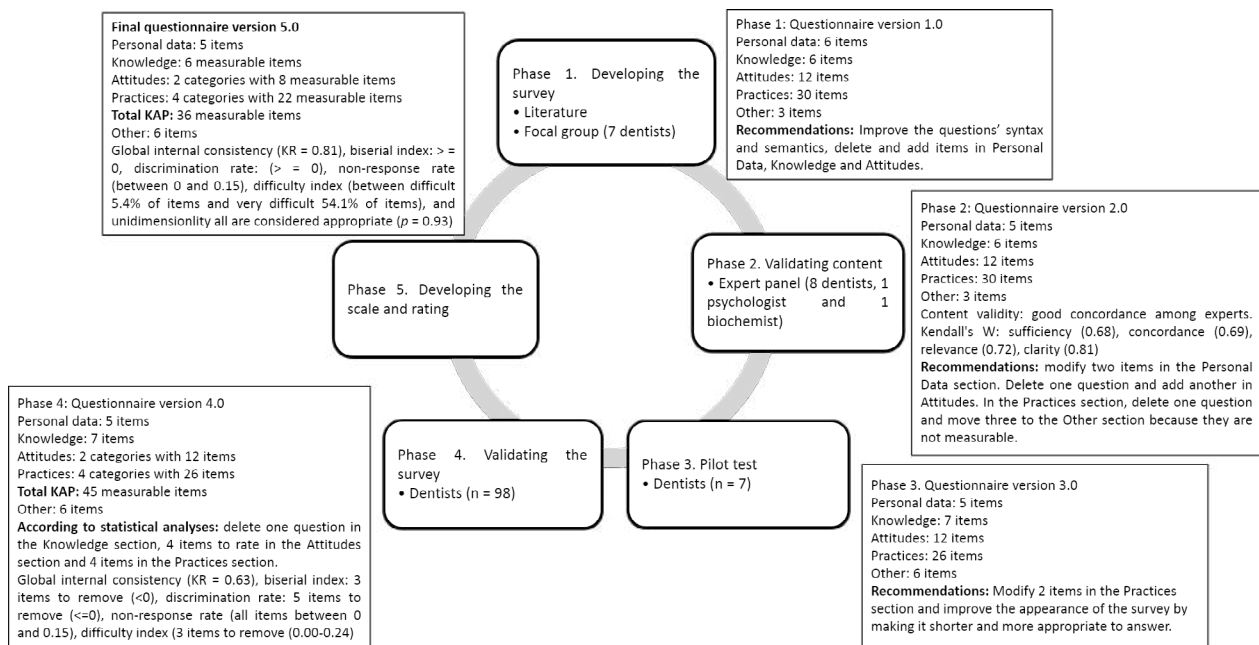


Figure 1. Phases for validation of the questionnaire to measure KAP on antibiotic prescription in dentistry

Source: By the authors

Phase 2. Validity of content by expert panel

Content validity by an expert panel is carried out to analyze the items that make up an instrument. One of the criteria for the selection of experts was to be familiar with the prescription of antibiotics in the field of dentistry. Therefore, three general dentists and five dentists specializing in areas such as endodontics, oral surgery, implantology, oral rehabilitation and periodontics were invited, as well as a biochemist (chosen for his knowledge on the basics of antibiotics) and a psychologist (for her experience in the construction of questions). The experts assessed the questionnaire individually, using a form with a standard rating measure of 1 to 5 for the categories of adequacy, clarity, consistency, and relevance. This information determined the concordance among them, using Kendall's W statistical test at 95% confidence. In addition, they

made recommendations on the formulation, terminology and relevance of the instrument.

Phase 3. Pilot test

To confirm the understanding of version 3.0 questionnaire, a test was applied to 7 dentists from the municipality of Acacias, Meta, who did not belong to the study population. The dentists were invited to answer the questionnaire and comment on whether they had difficulties or recommendations.

Phase 4. Quantitative validation

In this phase, the survey was applied to 50 dentists practicing the profession in Villavicencio and 48 in other municipalities of Meta, Colombia. The number of dentists was calculated according to the number of sections of the designed questionnaire, and data collection was done prior informed consent by the participating dentists. The practitioners were invited by visiting their

offices in the municipalities of Acacias, Barranca de Upia, Cabuyaro, Cumaral, El Castillo, El Dorado, Guamal, Granada, San Martín, San Luis de Cubarral, Puerto Gaitán y Puerto Lopez, Restrepo. As inclusion criteria, the dentists had to be registered in the Secretary of Health of Meta and have a ReTHUS record. In Villavicencio they were selected randomly, using a list provided by the Secretary of Health. With the collected information and since 98% of the questionnaire contained dichotomic items, the test's reliability analysis was conducted using the Kuder Richardson's formula. In addition, the psychometric indices analysis was conducted, including item-total correlation (biserial correlation), discrimination, difficulty index, non-response and unidimensional rates. The criterion for determining unidimensionality was the correlation between the full test and its half, using Pearson's Correlation Coefficient.

Phase 5. Scale construction and test rating

Scale and grading were done in order to standardize the results in the Knowledge, Attitudes, and Practices sections, regardless of the number of test items.

RESULTS

Phase 1. Questionnaire construction and focus group

The focus group showed that most items were relevant to determine how antibiotic prescription is being performed, and specific suggestions were made (Figure 1). The topics covered in the focus group included usefulness of antibiotics, the association of resistance and antibiotic prescription, clinical cases where antibiotics are prescribed, non-clinical factors, and prescription duration. One of the most discussed aspects in the focus group was the issue related to clinical cases and medical conditions in which antibiotics should be prescribed.

Phase 2. Validity of content by expert panel

A good level of agreement among experts was detected in version 2.0 (Kendall's: Sufficiency: 0.68, Concordance 0.69, Relevance: 0.72 and Clarity: 0.81) (Table 1), showing an appropriate inter-rater agreement to measure the reliability or reproducibility of the questionnaire. There were recommendations during this assessment, as shown in Figure 1.

Table 1. Kendall's W to determine concordance among experts

Dimension	* Kendall's W	P value	Dimension	* Kendall's W	P value
Sufficiency	0.68	0	Clarity	0.81	0
Consistency	0.69	0	Relevance	0.72	0

* KW ranges from 0 to 1, where 1 indicates total agreement and 0 total disagreement. Good 0.61-0.8; Excellent 0.81-1

Source: By the authors

Phase 3. Pilot test

During the pilot test conducted with version 3.0 of the questionnaire, dentists stated that the survey was unappealing and too long (Figure 1). Therefore, some of the items in the Attitudes and Practices sections were organized into categories in order to shorten these sections without removing the questions. Finally, with the help of a graphic designer, the instrument's appearance was improved, resulting in version 4.0.

Phase 4. Quantitative validation of questionnaire

Regarding the characteristics of dentists participating in this phase, 69.7% were male, 59.2% practiced privately and 47.9% had more than 10 years of experience. In addition, 35.5% of dentists had a specialization, with

16.8% in oral rehabilitation, 12.6% in oral surgery ($n = 3$) and 12.6% ($n = 3$) in health service management audit.

Internal reliability

In terms of questionnaire reliability, the original questionnaire with 45 items showed an internal consistency of 0.63 (Knowledge: KR20 = 0.44, Attitudes: KR20 = 0.42 and Practices: KR20=0.42 (Table 2a). However, after removing items ($n = 9$) not complying with the psychometric indicators as explained below, there was an increase in Richardson's K value (= 0.81), so the instrument's internal consistency was considered high. The following values were obtained in each section: Knowledge: KR20 = 0.67, Attitudes KR20=0.64, Practices KR20=0.71 (Table 2b).

Table 2. Questionnaire's internal consistency per Richardson's K test

a. Questionnaire's internal consistency version			b. Questionnaire's internal consistency version		
	K-Richardson	# of elements		K-Richardson	# of elements
Knowledge	0.44	7	Knowledge	0.67	6
Attitudes	0.42	12	Attitudes	0.64	8
Practices	0.42	26	Practices	0.71	23
Total	0.63	45	Total	0.81	36

Reliability under 0.50 = low. Between 0.50 and 0.80 = moderate. Over 0.80 = high¹²

Source: By the authors

Reliability under 0.50 = low. Between 0.50 and 0.80 = moderate. Over 0.80 = high¹²

Psychometric indexes of items

In version 4.0 of the questionnaire, the validity of questions in the item-total correlation coefficient was "very good" to "acceptable" for most questions (86.6%), but six items (13.3%) did not comply with this index (Table 3a). In the discrimination rate, most items (90.8%) were under the "acceptable" category and 11.1% under "remove" as they were not among the ranges of the index

(Table 3b). Regarding non-response rate, the items are suitable for the questionnaire as their values ranged from 0 to 0.15 (Table 3c), and in terms of difficulty index, 52.3% of items ($n = 23$) are very easy for respondents while 6.8% ($n = 3$) are very difficult (Table 3d).

Version 4.0 of the questionnaire was therefore modified, eliminating questions that were not among the expected values,

and when recalculating the psychometric indices of version 5.0 of the questionnaire, the biserial index showed that 100% of the questions were “very good” to “acceptable”. In the discrimination rate, 100% of questions were in some classification to be accepted (very high, high, moderate, and very low).

In terms of non-response rate, as in version 4.0, all items are adequate, and the difficulty index showed that 55.5% of questions ranked as very easy, while the rest (44.5%) were classified as easy, intermediate, difficult and very difficult.

Table 3. Psychometric analysis for the validated questionnaire

a. Biserial index version 4.0

Rating	Number of questions	Percentage
Very good	10	22.2
Acceptable	29	64.4
Remove	6	13.3
Total	45	100.0

Validity index: Very good 0.2-1, Acceptable 0-0.19, Remove <0

b. Discrimination rate version 4.0

Classification	Number of questions	Percentage
Very high	10	22.2
High	1	2.2
Moderate	6	13.3
Very low	23	51.1
Remove	5	11.1
Total	45	100.0

Discrimination rate: Very high 0.4-1, High 0.3-0.39, Moderate: 0.2-0.29, Very low: 0-0.19, Remove: <0.

c. Non-response rate version 4.0

Classification	Non-response index	Number of questions	Percentage
Adequate	0-0.15	45	100.0

Non-response rate: Adequate 0-0.15, Acceptable 0.16-0.2, Tolerable 0.21-0.29 and Removable 0.3-1

d. Difficulty rate version 4.0

Classification	Number of questions	Percentage
Very easy	24	53.3
Easy	7	15.5
Intermediate	7	15.5
Difficult	4	8.9
Very difficult	3	6.7
Total	45	100.0

Difficulty Index: Very easy 0.75-1, Easy 0.55-0.74, Intermediate 0.45-0.54, Difficult 0.25-0.44, Very difficult 0.00-0.24

a. Biserial index version 5.0

Rating	Number of questions	Percentage
Very good	10	27.8
Acceptable	26	72.2
Remove		
Total	36	100.0

Validity index: Very good 0.2-1, Acceptable 0-0.19, Remove <0

b. Discrimination rate version 5.0

Classification	Number of questions	Percentage
Very high	10	27.8
High	1	2.8
Moderate	6	16.7
Very low	19	52.8
Remove		
Total	36	100.0

Discrimination rate: Very high 0.4-1, High 0.3-0.39, Moderate: 0.2-0.29, Very low: 0-0.19, Remove: <0.

c. Non-response rate version 5.0

Classification	Non-response index	Number of questions	Percentage
Adequate	0-0.15	36	100.0

Non-response rate: Adequate 0-0.15, Acceptable 0.16-0.2, Tolerable 0.21-0.29 and Removable 0.3-1

d. Difficulty rate version 5.0

Classification	Number of questions	Percentage
Very easy	20	55.5
Easy	5	13.9
Intermediate	5	13.9
Difficult	4	11.1
Very difficult	2	5.6
Total	36	100.0

Difficulty Index: Very easy 0.75-1, Easy 0.55-0.74, Intermediate 0.45-0.54, Difficult 0.25-0.44, Very difficult 0.00-0.24

Source: By the authors

Regarding the unidimensional analysis of the final questionnaire, significance was 0.93 showing that the test is homogeneous for both the full test and its half (Table 4).

Table 4. Questionnaire's homogeneity index version

	Pearson's correlation	Full test	Semi-complete test
Full test	Signif. (Bilateral)	1	0.93
	N	36	18
Semi-complete test	Signif. (Bilateral)	0.93	1
	N	36	18

A value close to 1 is optimal

Source: By the authors

Phase 5. Scale and rating

The scale was constructed using the per-unit index, which corresponds to the test's percentages of success. This scale ranges from 0 to 1. Finally, to qualify the test, the percentile classification was used in each of the three dimensions (KAP). To this end, the number of items correctly answered was totaled, calculating percentiles 33 and 67 in order to create three rating levels: low, medium and high, based on the right items.

Final questionnaire

The final questionnaire was thus validated to assess knowledge with 6 measurable items on the usefulness and resistance of antibiotics. Attitudes are assessed by 2 categories with 8 measurable items on clinical and non-clinical factors to prescribe antibiotics, and practices are validated by 2 categories with 22 measurable items on clinical cases for prescription and duration. In addition, the questionnaire has a section with five questions about dentists' general information and a section of "Additional questions" with 6 items about the preference for an antibiotic, the number of patients prescribed in the last week and the interest in updates on the topic (Table 5). The results

found during the validation phase show that some dentists consider that antibiotics are to treat virus (11%) or fungal infections (20%), 46.6% do not know exactly what antibiotic resistance is, 56.6% do not consider that antibiotic resistance results from the prescription of these medications, 74.4% state that antibiotic use is common in dental practice and 85.5% use amoxicillin as the first-choice antibiotic.

Table 5. Content of final validated questionnaire

General data	<ul style="list-style-type: none"> ▪ Sex ▪ Type of practice ▪ Years of practice ▪ Dentist with or without specialization
Knowledge	<ul style="list-style-type: none"> ▪ Usefulness of antibiotics ▪ Knowledge on antibiotic resistance ▪ Association of antibiotic resistance with prescription ▪ Validated items: 6
Attitudes	<ul style="list-style-type: none"> ▪ What is your rationale for the prescription of antibiotics ▪ Non-clinical factors for prescribing antibiotics ▪ Validated items: 8
Practices	<ul style="list-style-type: none"> ▪ Clinical cases in which antibiotics are prescribed ▪ Clinical cases in which antibiotic prophylaxis is prescribed ▪ Prescribing antibiotics in practice is common ▪ Duration of the prescription of first-choice antibiotics ▪ Validated items: 22
Other	<ul style="list-style-type: none"> ▪ Number of patients who have been prescribed antibiotics in the last week ▪ Antibiotic type preference ▪ Interest in updates on the topic

Source: By the authors

DISCUSSION

Several steps were taken to validate the questionnaire in this study, starting with the construction of the instrument based on the scientific literature. This stage showed that many studies in other countries demonstrated an inadequate prescription of antibiotics but the instruments they used were not subjected to a rigorous validation process.¹³⁻¹⁵

Once the instrument was developed, a focus group was held to discuss the questions in it. During the focus group discussion, there were suggestions to eliminate or add questions, improve the wording, or specify and relocate some responses. There were also additional reactions stemming from the participants' experience, which helped improve the instrument, achieving the purpose of this process. As Escobar and Bonilla-Jimenez pointed out in 2009,¹⁶ the main purpose of focus groups is to have participants express attitudes, feelings, beliefs, experiences and reactions regarding the topic and instrument developed. During the focus group in the present study, a great deal of the discussion was about the cases in which antibiotics should be used, demonstrating lack of clarity in this regard due to inconsistent guidelines and protocols.¹⁷ Several authors express the need for additional studies to establish protocols for the use of antibiotics.¹⁸

During content validity by experts, like in the rigorous validation process of a questionnaire to measure knowledge and attitudes on antibiotics prescription in physicians by Lopez-Viquez et al, 2016¹⁰ and Teixeira et al, 2016,¹¹ the expert panel eliminated, added and reformulated questions, in addition to correcting grammar, syntax, organization, and logical sequence.

Later, during the pilot test, participating dentists made observations that helped improve the quality and acceptability of the instrument even more, thus confirming the importance of this phase. Lancaster et al claim that pilot tests ensure that questionnaires are understandable and appropriate, and that the questions are well defined, clearly understood and consistently presented.²¹

In the present study, reliability was assessed while the test was being applied

to respondents, showing low internal consistency in questionnaire version 4.0 (0.63); it also showed that some questions had to be removed. Some items detected in the psychometric test were then removed, showing an increase in internal consistency to 0.81. As in other validation studies, this question elimination process improved questionnaire reliability.^{10,11} Regarding unidimensionality, the questionnaire proved to be homogeneous, both in full and in half, with a value close to 1 (0.93).

This questionnaire has various strengths as shown by the validation process, with an adequate number of questions that facilitate participation, and a simple scale to grade the adequate items. Finally, it should be noted that, while all the indicators of the various analyses were adequate, a higher quality questionnaire could be achieved with higher reliability and homogeneity values. However, it is important to note that antibiotic prescription is a complex issue due to the various factors that may influence prescription,²² such as lack of clarity of protocols, fear of complications following a dental procedure, and lack of updates on the topic.

This qualitative and quantitative process offers a simple instrument that was developed and validated to assess knowledge, attitudes and practices on antibiotics prescription by dentists. This will help us understand how prescription is done and develop interventions to improve this activity and make a more rational use of antibiotics.

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CONFLICT OF INTERESTS

The authors state that they have no conflict of interest.

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