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Development and validation of a questionnaire to measure association factors with suicide: An instrument for a populational survey

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Abstract

Background and Aims: Our goal was to develop an online questionnaire to survey the prevalence of suicidal behavior.

Methods: We developed a questionnaire with 51 variables and proceeded with validations. Validations were performed using face validity, content validity, and construct validity. Reliability was performed by test–rest.

Results: The face validity was 1.0 and the content validity was 0.91. The exploratory factor analysis got Kaiser–Meyer–Olkin = 0.86 and extracted one principal factor. The confirmatory factor analysis demonstrates root mean square error of approximation = 0.000 and comparative fit index = 1.000. The test–retest had an intraclass correlated coefficient of 0.98.

Conclusion: The adequate development questionnaire was validated, and we have an instrument to survey suicide behaviors during the pandemic time.

Patient or Public Contribution: The general population of Marília voluntarily responded to the questionnaire, as well as patients from the principal investigator's office.

KEYWORDS

questionnaire, reliability, suicide, validity

1 | INTRODUCTION

Alarmed by the constant and raising notices of suicide occurrences in Marilia in the past 4 years and by the inefficiency of every collective method of prevention used so far, it's noticed the need to perform a better study on the subject. It's known that suicide is an event of complex treatment in general and is related to many mental disorders such as depression, bipolar disorders, panic disorders, schizophrenia, personality disorders, and mental disorders correlated to substance abuse or dependence, and others.[1,2] In the last two decades, the neurobiological understanding of suicide has made correlations with stress and violence experienced in childhood.[3] It is known that the epigenetic alterations promoted by these stressors are involved in alterations in the expression of the glucocorticoid receptor (GR) gene

in the hippocampus with the hypothalamic-pituitary-adrenal axis dysfunctions.[4]

To have access to these correlations with suicide in a population, it is necessary to carry out a survey. Epidemiological studies on suicide have never been carried out in the city of Marília. To evaluate the possibility of taking advantage of studies carried out in other places, we started to contextualize our city with the world. According to World Health Organization, 800,000 people committed suicide in the year 2015.[2] In Brazil, in that same year, there were 10,000 suicides, which is much lower (5/100,000 inhabitants) than in European countries (20/100,000 inhabitants).[5,6] The Brazilian cities that were described as having the highest risk of suicide in this same period were Taipas do Tocantins, in the State of Tocantins (79.68/100,000 inhabitants), Itaporã in the State of Mato Grosso (75.15/100,000 inhabitants), Mampituba in the State from the Rio Grande do Sul (52.98/100,000 inhabitants), Paranhos in the State of Mato Grosso do Sul (52.41/100,000 inhabitants) and Monjolos in the State of Minas Gerais (52.08/100,000).

There are some scales to measure suicide behavior, like Psychache Scale, Unberable Psychache Scale, Tolerance for Mental Pain Scale-10, Mee-Bunney Mental Pain Scale etc.[7] Others questionnaires were found to assess the risk of suicide in specific communities in Brazil.[6,8] However, we understood that none of them present in all of their items the security to apply the questionnaire remotely and the completeness of our questions. Furthermore, we know only one study on the prevalence of suicidal ideation, suicidal programming, and suicide attempts was published in Brazil more than 10 years ago.[9] This study used WHO research as a reference and did not validate the instrument. So, we created a new questionnaire because no investigative instruments that can be fully replicated were found. This new questionnaire will address four life dimensions that may be related to the risk of suicide, what are the history of illnesses (psychiatric and general), the relationship with the primary support group (closest family), the relationship with the secondary support group (friends and others) and social occupation (schooling, work, religiosity, and others).[10,11]

2 | OBJECTIVE

Our goal is to develop an online questionnaire to survey the prevalence of suicidal behavior.

3 | METHOD

The study was approved by the FAMEMA Research Ethics Committee with the number: CAAE: 40205820.0.0000.5413. An informed consent form was developed.

The questionnaire went through a long process of theorizing. A long literature review was carried out, including philosophical, theological, religious, sociological, political, neurobiological, psychological, psychoanalytic and psychiatric aspects.[12] The questionnaire was developed to research the prevalence of factors associated with suicide since its prodromal state—suicidal ideation, suicidal programming, and suicide attempt. In addition, we included one more variable that directly addresses tragic suicide. We consider tragic suicide one that could be committed in the imminence of a tragedy. Then, the variables were structured in the proper order. The questionnaire was structured in a non-aggregated manner, meaning that not all variables address the same construct.[13] A questionnaire for a broad epidemiological population study must be understood as a whole. Although there are many facets, which could constitute different scales, in a survey all the variables assume the role of subjugating the subject of the study, in this case, suicide.

This type of questionnaire differs greatly from the traditional diagnostic scales used in the health area. The commonly used scales have the quantitative objective of diagnosing a certain disease. The developed questionnaire is proposed for a population epidemiological study. People living in Marilia city of São Paulo state of Brazil were chosen to answer our questions. We contact them by phone and others form online. All dates were obtained from the responses of the participants.

The sample size calculation was based on confirmatory factor analysis. A number of 5−10 observations has been stipulated for each variable analyzed. The questionnaire was created with 51 variables. Thus, a sample of 255−510 observations was needed. Data collection was done by online convenience sampling to avoid contact during these pandemic times. The sample consisted of 497 observations.

The questionnaire went through all stages of validity and reliability. Validation was performed using face validity, content validity, and construct validity. Reliability was performed by test−rest. All calculations were performed using SPSS version 28 of the year 2021. Confirmatory factor analysis was performed using the SPSS Amos complement.

Facial validity was performed by face-to-face application of the questionnaire to patients at the investigator's office to observe their understanding of the questions and the response time. The content validity aimed to certify the preparation of the questionnaire through the appreciation of trained and experienced professionals in the care of people with suicidal behavior. For construct validation, confirmatory factor analysis was used.

For the confirmatory factor analysis, we followed the methodology described in the book by Timothy A. Brown entitled Confirmatory Factor Analysis for Applied.

Research in its second edition of 2015.[14] Confirmatory factor analysis is a type of structural equation modeling that is used during the process of scale development to examine latent structure of a questionnaire.

Although confirmatory factor analysis is an independent procedure, it is usually preceded by exploratory factor analysis. In this case, the main exploratory objective is the extraction of constructs. In addition, the exploratory factor analysis must demonstrate a correlation between the variables that are measured by the Kaiser−Meyer−Olkin (KMO) sample suitability measure and Bartlett's sphericity test. The KMO index assesses the adequacy of factor

analysis. Values greater than 0.5 were considered adequate. Bartlett's sphericity test evaluates the hypothesis that the variables were not correlated in the population. The values of Bartlett's sphericity test with levels of significance ($p < 0.05$) indicate that the matrix is factorable, rejecting the null hypothesis that the data matrix is similar to an identity matrix.

As the questionnaire was developed to study the prevalence of suicide, only the variables of this scale of the questionnaire were taken for construct validation by confirmatory factor analysis. The suicide construct was divided into prodromal factors.

The analysis procedures took into account several error correlations in the search for a better understanding of the construct. The comparative fit index (CFI) and the root mean square error of approximation (RMSEA) were used to certify the model adequacy. The values of CFI greater than 0.90 and values of RMSEA smaller than 0.06 were considered adequate.

Reliability was calculated by test–retest. The population sample was split into two halves to calculate the intraclass correlation coefficient (ICC). The values of ICC greater than 0.70 were considered adequate.

In summary, the following were used for validation and reliability: face validity [observing full understanding of the questions and time less than 15 min to complete the questionnaire], the agreement percentage for content validity [it was accepted by more than 90% of agreed], KMO measure [it was accepted more than 70%], exploratory factor analysis [components were accepted to extract with auto value more than 0.5], confirmatory factor analysis [RMSEA < 0.08 and CFI > 0.95] and ICC [it was accepted more than 90%]. It was accepted $p < 0.05$ and we make the statistics measure with SPSS software version 28 of the year 2021 and Amos, version 27 of the year 2022.

4 | RESULTS

4.1 | Development

Sociological, psychiatric, theological, philosophical, psychological, historical, phenomenological, psychoanalytic, and neurobiological foundations were considered as the theoretical bases of the questionnaire.[15–44]

The language used in the questions was Portuguese. To have an adequate assessment of possible risk factors for suicide, the instrument was structured with open and closed questions. These use nominal, ordinal, and interval measurements. All questions were analyzed by quantitative methods. The structure of the questionnaire had 3 questions that directly address suicidal ideation, suicidal programming, and suicide attempt with 6 divisions that together total 9 variables. One question about tragic suicide and another 19 questions are included that unfold into 42 two variables that address all the factors theorized as important for this study (Figure 1).

The questionnaire in Portuguese can be obtained in full by email sent directly to the authors. Questions that directly address the topic of suicide should take the lead in the instrument. They are formulated from a no-risk level to a higher risk. The question: "Você já conversou com algum sobre suicídio?"* Should take the first position. But we believe it is better to invert its position to the latter to demystify the popular common sense that one cannot talk about suicide and have the effect of deconstructing negative beliefs with the application of the questionnaire in people more vulnerable to suggestion, although there is no unfavorable evidence in this regard.[45] We take the question about psychiatric treatment to the first question. Questions two and three address the topic of suicide with its derivations in an increasing degree of severity as proposed.

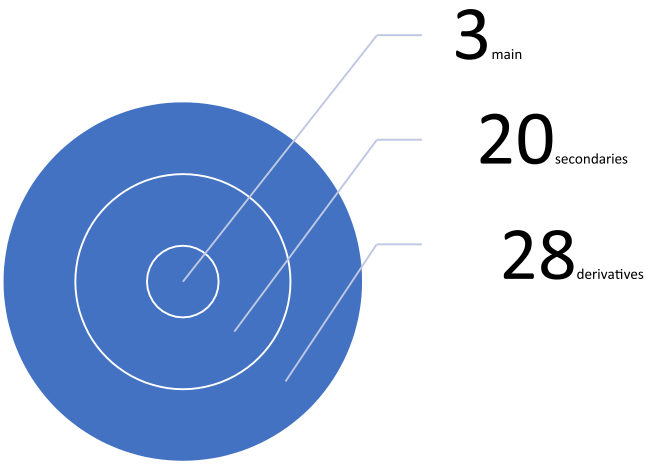


FIGURE 1 Three main variables with six derivatives and 20 secondary variables with. twenty-two secondary variables. The three main variables are questions about suicidal ideation, programming and suicide attempt. The 20 secondary variables are the factors to be correlated with the main variables. This 23 variables had derived especifications.

In the middle part of the questionnaire, all items on comorbidities, education, and primary support group were inserted. The secondary support group approach and religiosity are inserted in the final stage of the questionnaire with the same objective of leaving a message of hope for those more suggestible people. The main constructs are listed in Figure 2.

Although there were other constructs besides suicide in the questionnaire, it takes the "fragmented" form, since the other variables assume a unitary character of evaluation, not being considered in this instrument for prevalence studies their abstractions together.[13]

4.2 | Validity and reliability

4.2.1 | Face validity

The questionnaire was applied to 10 patients in the office of one of the researchers. All answered the questionnaire in less than 15 min. None of them needed help to fill in and all answers were consistent with the questions. It is not usual to describe face validity in numbers, since it is perceptual. However, according to the result according to our proposal, we could say that we obtained a value of 100%.

4.2.2 | Content validity

The questionnaire was evaluated by two psychiatrists who have been working with suicidal people for over 10 years. One of them showed an agreement of 86.9% and the other of 95.6%. No questions or comments were made regarding the content of the disagreed questions. They only made suggestions in the formulation of the questions. In our understanding, the simplicity of some formulations is important to reach a large audience and not need the researcher's help to guide and clarify the answers. Therefore, we rejected the suggestions and accepted *the agreement percentage of 91.3%*.

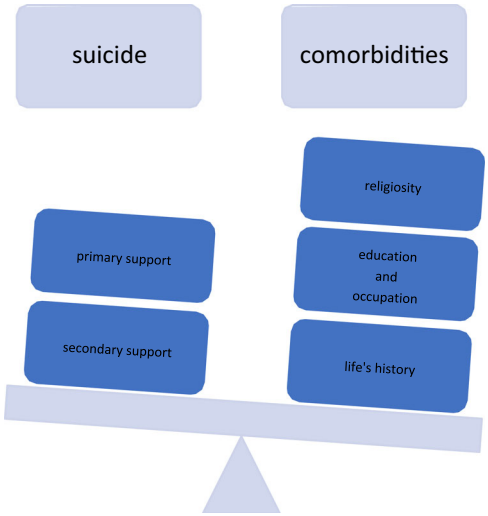
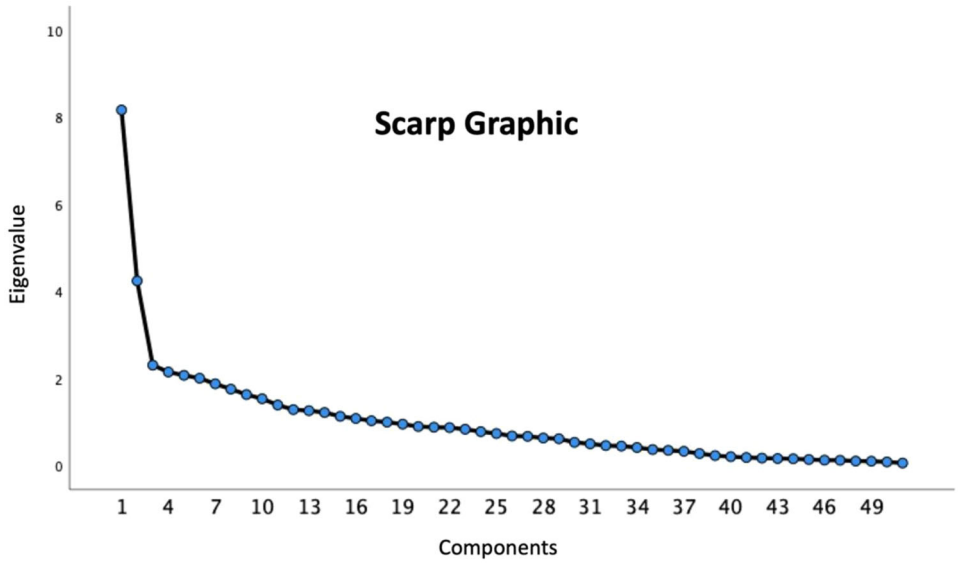


FIGURE 2 Theoretical factors for the development of the questionnaire. The three main factors were correlated with the other 48 factors within aspects suicide. as primary support, secondary support, comorbidities, religiosity, education, occupation, and life's history.

4.2.3 | Construct validation

A sample of 497 observations from the population group was used. Bartlett's Sphericity Test rejected the null hypothesis that the variables correlate with zero and the *Kaiser–Meyer–Olkin measure was 0.86 (p level < 0.000)*. Exploratory factor analysis was performed with all 51 variables using the principal component analysis method with rotation by oblimin with a selection of components with an eigenvalue greater than or equal to 1. 17 factors were extracted (graph 1). The same analysis was performed using the maximum likelihood method with varimax rotation, also extracting 17 factors. Varimax rotation converged for 13 interactions, where the first factor brings together the variables of personal identification and the second the variables related to suicide. We emphasize that the two main factors are identical to the oblimin rotation in reverse order (Table 1). Components were accepted to extract with auto value more than 0.5.

With the extraction of these factors, we started to perform Confirmatory Factor Analysis. For this, we initially recognized the questionnaire model for population survey, in which the existence of many factors found in the exploratory factor analysis has no meaning for validating this instrument since the only construct that interests us is that related to the suicide theme. All others are important for further correlation to prevalence studies.



GRAPHIC 1 17 components with an eigenvalue greater than or equal to 1. Bartlett's Sphericity Test rejected the null hypothesis that the variables correlate with. zero and the *Kaiser–Meyer–Olkin measure was 0.86 (p level < 0.000)*. Exploratory. factor analysis was performed with all 51 variables using the principal component analysis method with rotation by oblimin with a selection of components with. eigenvalue greater than or equal to 1. Although 17 factors were extracted in. exploratory factor analysis, we noticed that only two of them are differentiated.

Of the two main factors extracted by the exploratory factor analysis, one is related to the identification of people and the other to the theme of suicide. Therefore, only the second is of interest to us.

TABLE 1 Two main factors extracted by maximum likelihood.

Factor 1	Factor 2
Date of birth	Question 2
Question 11	Question 2A
Question 12	Question 2B
Question 12A	Question 2C
Question 12B	Question 2D
Question 13	Question 2E
Question 17	Question 3
Question 17A	
Question 17B	

Note: Of the two main factors extracted by the exploratory factor analysis, one is related to the identification of people and the other to the theme of suicide. Only the second is of interest to us.

Thus, we started to outline the 9 variables in Amos, version 27, of the SPSS, abstracting four factors in a reflexive indicator model. The variables were analyzed using the maximum likelihood method, demonstrating an RMSEA of 0.064 and a CFI of 0.987. To find the ideal construct, we included the correlations of the errors shown in Figure 3. With this, we obtained an *RMSEA of 0.000 and a CFI of 1.000*, with 21 degrees of freedom and p level < 0.000 [$\chi^2 = 183.423$] (reference values: RMSEA < 0.08 and CFI > 0.95), thus validating the construct.[14]

4.2.4 | Reliability

The online questionnaire was applied for 15 days, and 509 observations were obtained. We identified 11 people who answered the questionnaire twice. Of these, 10 responded identically and one of them was disregarded. One person answered the questionnaire differently and both answers were excluded. Of the remaining 497, the first 298 were considered the test, and the last 297 the retest. The test–retest demonstrated an *intraclass correlation coefficient of 0.98 (CI 95%: 0.97–0.99)*.

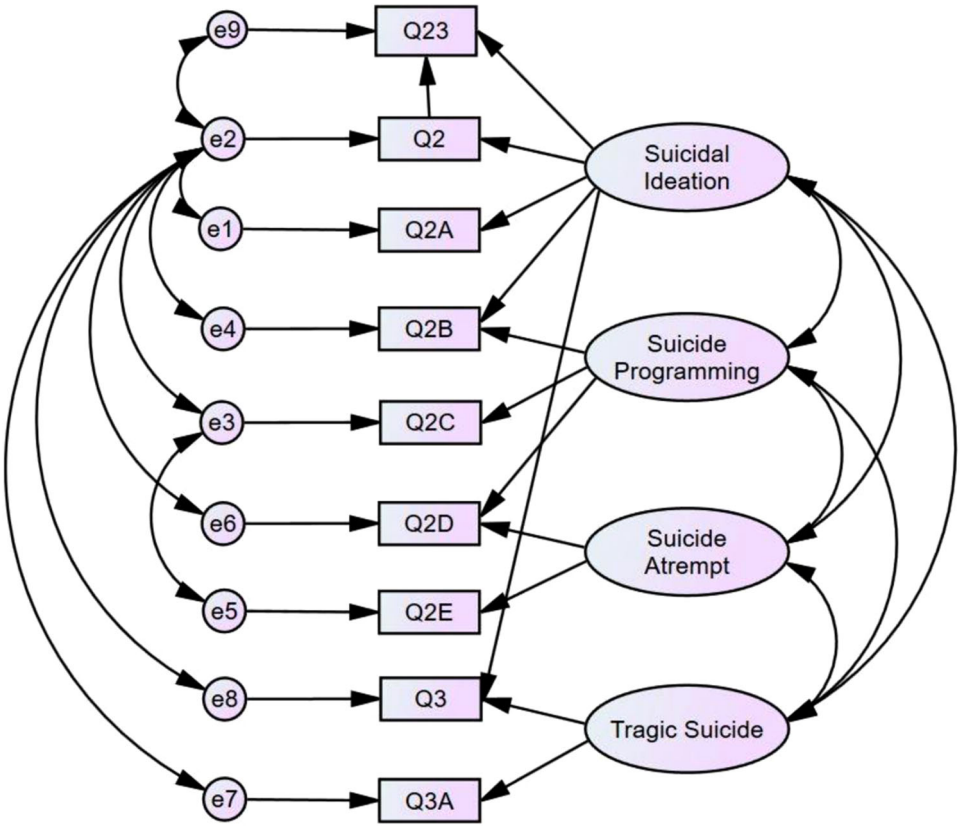


FIGURE 3 Design for construct analysis. The three main variables and one of the secondary variables, that directly. addressed the suicide theme, were correlated with their respective derivatives. The confirmatory factor analysis process is quite dynamic and requires multiple tests. Finally, it was identified that the model that correlates the errors in this specific is the one that demonstrates the most perfect abstract concept of the questionnaire. We obtained an *RMSEA of 0.000* and a *CFI of 1.000*, with 21° of freedom and *p* level < [$\chi^2 = 183.423$] (reference values: RMSEA < 0.08 and CFI > 0.95), thus validating the construct.

5 | DISCUSSION AND CONCLUSION

Applying science in these pandemic times requires adaptations to the new normal. The development of an instrument for collecting population data needs to consider the need for social distancing. Given the growing need to study suicidal behavior in Brazil, the proposal for a new questionnaire that fits into this current context comes with profound relevance.

The most important step for the development of a work tool is the theoretical foundation. Without neglecting the important role of practical experience, it is known that an experienced bricklayer will find it easier to think about which anvil is best for his craft. Those who work directly with suicides when they come to bibliographic searches are clear about the breadth of the topic.

Suicide confronts health professionals with a vast amount of transdisciplinary knowledge. Only with the humility of an eternal apprentice is it possible to go to philosophy, sociology, theology, and other human sciences to understand the man who gives up on life. It was in this spirit that the team, over the course of a year, dedicated itself to many studies.

After a broad theoretical explanation, the structure considered the times of social isolation and the safety of applying the questionnaire through social networks. It was very important to understand the dynamics of the internet and virtual users. It is known that these pandemic times have required healthcare professionals to experience unprecedented online immersion. In Brazil, telemedicine was authorized. Research in the medical sciences is needed to follow this path.

Although we have used all validation protocols, it is recognized that construct validity is the gold standard. Evaluating a construct is not a passive procedure. On the contrary, it requires in-depth knowledge of the topic and the purpose of the instrument. Confirmatory factor analysis needs to be accompanied by observation intervals in which the language of numbers needs to be deciphered. After each reading, new analyzes need to be done. Fortunately, we now have powerful software to perform the calculations. Otherwise, this entire process would require more than a year.

Test–retest is often used in procedures to assess reliability. In some situations, it is advised to give a 2-week interval between the test to the retest to remove the respondents' recall bias. We understand that this interval was not necessary for this virtual questionnaire understudy, as we were not working with the same respondents in the test and the retest.

With a great deal of theorizing work that considered all aspects of the suicidal syndrome, the statistical validation analyses presented no major difficulties along the way. The questionnaire proved to be a reliable tool for suicide prevalence studies.

AUTHOR CONTRIBUTIONS

Juliano Flávio Rubatino Rodrigues: Conceptualization; Data curation; Formal analysis; Investigation; Methodology; Validation; Writing—original draft. **Gerardo Maria Araújo Filho**: Writing—review & editing. **Lívia Peregrino Rodrigues**: Writing—review & editing. **Fernando Victor Martins Rubatino**: Supervision. **Hannes Fischer**: Software. **Spencer Luiz Marques Payão**: Project administration; Supervision.

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CONFLICT OF INTEREST STATEMENT

The authors declare no conflict of interest.

DATA AVAILABILITY STATEMENT

All research data are archived and available for professional consultation.

ETHICS STATEMENT

The study was approved by the FAMEMA Research Ethics Committee with the number: CAAE: 40205820.0.0000.5413. An informed consent form was developed.

TRANSPARENCY STATEMENT

The lead author Juliano Flávio Rubatino Rodrigues affirms that this manuscript is an honest, accurate, and transparent account of the study being reported; that no important aspects of the study have been omitted; and that any discrepancies from the study as planned (and, if relevant, registered) have been explained.

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ENDNOTES

* Have you ever talked to anyone about suicide?

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