# Title

Psychometrics Properties of the Brazilian Portuguese version of the Readiness to Change Questionnaire – RCQ-BR.

# Authors

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# Abstract

**Introduction** - The stage of changes model is one of the most popular models used for changing health related behaviors. The Readiness to Change Questionnaire (RCQ-12) was created and validated in order to assist clinicians in classifying patients into stages of change. Although many validation studies have been conducted, the factorial structure of the instrument is still not well established and no validation studies were conducted with the Brazilian Portuguese version. **Aims** –The aims were: to evaluate the psychometric properties of the Brazilian version of the RCQ-12 for internet use; to compare the factorial structure with models proposed by previous studies; and to create a score that can be used in future studies. **Methods –** We conducted exploratory and confirmatory factorial analysis. Six hundred, forty-one participants were recruited and filled out the RCQ-12, AUDIT-C (Alcohol Use Disorders Identification Test) and demographics from the Brazilian version of the web-based intervention “*Beber Menos*” (Drinkless). **Results –** The average age of participants was 39.5 (± 10.3) years, 51.6% were males, and the sample was classified by AUDIT-C scores as: 34.2% low-risk, 31.3% suggestive dependence, 23.4% at risk, and 11.1% at high risk. All confirmatory models had poor fitness indexes: one-factor: CFI = .720, RMSA = .196; two-factor: CFI = .815, RMSA = .161; Three factor uncorrelated: CFI = .568, RMSA = .238. The model created with 4 items to score the items in future studies had satisfactory indexes: CFI = .998; RMSA = .045. **Conclusions –** We found that the RCQ-12 is not a useful to classify users into the stages of change model but the 4-item model may be used as a predictor in future web-based studies. For clinical purposes, we do not recommend the use of the Portuguese version of the instrument.

# Introduction

The motivation to change behavior described by the transtheoretical model of change is a dynamic process and includes the stages of change. The stages of change model proposed by Prochaska and DiClemente (1982) is one of the most popular models to change health related behaviors, including alcohol abuse and dependence (Norcross, Krebs, & Prochaska, 2011). Prochaska and DiClemente (1982) proposed a series of stages that changes overtime: precontemplation, contemplation, preparation, action and maintenance. Precontemplation is the stage which the patients are not seeking any behavior modification. Contemplation is the stage which the patients are aware of their problems but are not committed to change. Preparation is the stage which the patients plan to take action and are making some minor behaviors changes. Action is the stage which the patients modify behaviors to solve their health problems. Maintenance is the stage which the patients work to avoid relapse and keep the modified behavior accomplished in the action stage.

Some instruments were developed to assist clinicians classifying stages of change of their patients with alcohol abuse and dependence such as the Readiness to Change Questionnaire - RCQ (Rollnick, Heather, Gold, & Hall, 1992), the Stages of Change Readiness and Treatment Eagerness Scale - SOCRATES (Miller & Scott, 1996), and the Rhode Island Change Assessment – URICA (McConnaughy, DiClemente, Prochaska, & Velicer, 1989). The Readiness to Change Questionnaire is the shortest scale to assess readiness to change with 12 items and have shown reasonable psychometric properties (Budd & Rollnick, 1996; Defuentes-Merillas, Dejong, & Schippers, 2002; Forsberg, Ekman, Halldin, & Rönnberg, 2004; Forsberg et al., 2004; Heather, Rollnick, & Bell, 1993; Napper et al., 2008; Rodríguez-Martos et al., 2000; Rollnick et al., 1992).

One of the problems of the RCQ is its non-well established factor structure. Different studies have identified a different number of components. Using a principal components approach, Rollnick et al. (1992) and Rodríguez-Martos et al. (2000) found a three component structure that was not confirmed by studies from Hannöver et al. (2002) and Defuentes-Merillas et al. (2002), that found a two component structure (Component 1 - precontemplation + contemplation; and Component 2 - action). These later two studies, divided the component one items by its loading signals and scored the scale following the original study.

Two studies using confirmatory factors analyzes reached different results. Budd and Rollnick (1996) found poor fit indexes for the three factor model treating them as correlated and proposed as an alternative an one factor model that measures readiness to change. In contrast, Forsberg et al. (2003) found that the one factor model had a poor fit (RMSEA = .12; CFI = .83) and the three factor solution had a better fit (RMSEA = .06; CFI = .96).

Most of the RCQ validation studies have used the method of principal components analysis (Defuentes-Merillas et al., 2002; Hannöver et al., 2002; Rodríguez-Martos et al., 2000; Rollnick et al., 1992), even though it is not the most appropriated method to study the factorial structure of scales as pointed out by Fabrigar, Wegener, MacCallum and Stragan (1999). Furthermore, the RCQ studies used Pearson's correlations, which are not recommended to deal with polytomous items. In order to overcome these limitations, the use of polychoric correlations and the use of factorial analysis would be a more suitable solution (Holgado–Tello, Chacón–Moscoso, Barbero–García, & Vila–Abad, 2010).

Due to its short length and reasonable psychometric properties, RCQ-12 was used to classify alcohol users into stages of change in the “Beber Menos” intervention the Brazilian version of Drinkless (available at [www.bebermenos.org.br](http://www.bebermenos.org.br/)) a fully automated web-based intervention to reduce alcohol consumption of problematic users. This intervention is a six weeks program including electronic screening, a tailored brief intervention and referral to treatment. User information were collected through psychometric instruments and others user inputs like page views in order to deliver personalized feedback. The original Dutch version of this intervention (Riper, Kramer, Smit, Conjunm Schippers & Cuijpers, 2008) was translated and adapted into Portuguese, Spanish, Russian, Hindi, and English by the World Health Organization.

We aimed in this study: (1) to evaluate the psychometric properties of the Brazilian Portuguese version of “Readiness to change questionnaire” (RCQ-12) used in the “Beber Menos” web-based intervention; (2) to compare the factorial structure found in the first aim with models proposed by literature using a confirmatory factor analysis with polychoric correlations matrices; and (3) to create a more appropriate score that can be used in future comparisons among Drinkless versions.

# Methods

# Sample characteristics

We invited to enroll in the study users from the web-based intervention “*Beber Menos*” from 10/21/2013 to 03/11/2014. To recruit users, we sent an email to approximately 100,000 health professionals in Brazil asking them to share the intervention link with their patients. During this period, the Brazilian version received 29,386 visits. Each user has viewed on average 4,38 pages and spent 5 minutes on the website. One thousand thirty-six persons filled out the questionnaires. From these, 641 participants consented to participate in the research, filled up all the RCQ items and were included in our analyses. Regarding to these participants,, 51.6% were males and 48.4% females. The age ranged from 19 to 73 years (M = 39.5, SD ± 10.3). The sample characteristics are described in table 1.

## Instruments

Demographic Questionnaire – with questions about sex, age, employment status, educational level, and region of living. This questionnaire was developed by all researchers involved in the development of the portal.

The Alcohol Use Disorders Identification Test (AUDIT) – a 10-item questionnaire used to identify and classify users into alcohol consumption zones - no risk, low risk, high risk, and suggestive dependence. Developed by World Health Organization, AUDIT is used as a screening tool in many countries, including Brazil (Lima et al., 2005; Meneses-Gaya, Zuardi, Loureiro, & Crippa, 2009; Santos, Gouveia, Fernandes, Souza, & Grangeiro, 2012). The audit score is computed as a simply sum of items. Scores lower than 7, indicate low risk use; between 7 and 15, risk user; between 16 and 19, high risk and above 20, suggestive dependence.

*Readiness to change questionnaire* (RCQ-12) – is used to classify alcohol users in three stages of changes: precontemplation, contemplation and action. The RCQ-12 was first proposed by Rollnick, Heather, Gold & Hall (1992), and has 12 items answered in a 5-point Likert scale which ranges from “Strongly disagree” (-2) to “Strongly agree” (+2). The scores are obtained by using a simple sum of the items from each stage – Precontemplation: 3, 4, 8, 9; contemplation: 1, 5, 10, 12; and, action: 2, 6, 7, 11. The person is classified into the stages according to highest score. In case of ties, the person is classified using the most advanced stage. As Defuentes-Merillas et al. (2002) proposed in the Dutch validation study, negative items were rewritten in a positive format to enhance comprehension by respondents. The English version of RCQ-12 used in “Beber Menos” intervention was translated by the authors into Portuguese.

## Procedures

After filled up all the questionnaires participants received a tailored brief intervention composed by information about their alcohol consumption, opportunity to set goals, relapse preventions strategies and follow-up by e-mail. Users information was stored in an online database using a primary and unique identifier. All procedures were approved by the Institutional Review Board of *Universidade Federal de São Paulo*.

## Data analysis

We extracted from the online database all data that was collected using the previously described questionnaires. We conducted descriptive analysis on demographic variables, AUDIT and items of RCQ-12.

In order to perform the exploratory and confirmatory factor analysis, we split the data from participants randomly into two halves. All analysis were performed using the R language (R Development Core Team, 2014). The script of analysis and the data are available in this link: <https://github.com/henriquepgomide/rcq-ptbr>.

* Exploratory factor analysis - we checked sampling adequacy by using Kaiser-Meyer-Olkin (KMO) and Bartlett test. To identify the number of factors to be retained, we used the Horn’s method of parallel analysis (Horn, 1965) with polychoric correlations as suggested by Garrido, Abad & Ponsoda (2013) and the method of Very Simple Structured (VSS) for estimating the number of interpretable factor (Revelle & Rocklin, 1979). We conducted the exploratory factor analysis using polychoric correlations matrices with the oblique rotation “Oblimin”. This analysis was performed considering the underlying structure of the questionnaire and its ordinal level of measurement items (Fabrigar et al., 1999). It also allows the use of fit index Tucker-Lewis Index (TLI) and residuals inspection with the root mean square error of approximation (RMSEA). Cronbach's alpha (Cronbach, 1951) was used as an indicator of reliability. R package “psych” was used to perform all exploratory factor analysis procedures (Revelle, 2014).
* Confirmatory factor analysis – we compared the fit indices for the three models as evaluated by Forsberg, Halldin and Wennberg (2003): 1-factor solution considering all items; 3-factors orthogonal, and 3-factors correlated considering for the two last models the original theoretical factor organization as described in the instruments section. Additionally, we included the 2-factor model proposed in our exploratory factor analysis. The fit indices used for comparisions were the Comparative Fit Index (CFI) where values greater than .90 indicated good fit. Akaike Information Criterion (AIC) and Bayesian Information Criterion (BIC) were also used, with lower values indicating a better model. To check the adjustment of the model, we inspected the RMSEA considering as a good model those with values lower than .08 (Brown, 2006). Confirmatory fator analysis were performed using the R package “lavaan” (Rosseel, 2012). Modification indices were used to improve the final model fit.

# Results

## Exploratory factor analysis

The sample was considered adequate for factor extraction according to Kayser-Meyer-Olkin and Bartlett's test of homogeneity of variances (KMO = .89 and Bartlett's χ2 = 79.97, p < .001). Either the Horn’s parallel analysis and the very simple structure methods suggested the existence of three factors (Eigenvalues of original data: F1 = 5.92; F2 = 1.66; F3 = 0.26; Eigenvalues of simulated data: F1 = 0.84; F2 = 0.29; F3 = 0.24), but due to the small amount between the eigenvalues of simulated and original data, we chose the solution with two factors.

The results of the factor loadings are shown in Table 2. The 2-factor model explained 68% of variance and the correlation between factors was weak (r = .26). The items were divided in the following order: F1 (Pre contemplation + contemplation) – 1, 3, 4, 5, 8, 9, 10, 12 and F2 (Action)= 2, 6, 7, 11.The fit indexes were considered poor (TLI = .88; RMSEA = .130 - CI95% = .123 - .143). The overall Cronbach's alpha was .88 (CI95% = .85 - .92). For the first and second factors, the alpha was .91 (CI95% = .87 - .94) and .82 (CI95% = .75 - .89) respectively.

## Confirmatory factor analysis

The 3-factor correlated model was not converged due to the negative value covariance in the matrix of latent variables, which indicated lack of fitness. Either the 1-factor and the 2-factor and 3-fator orthogonal models showed poor fit indexes. To find a better model, we analyzed the items according to modification indexes creating an 1-factor improved model with four items (CFI=.998 RMSEA= .045, X²=3.44 df=2). The evaluation of the confirmatory models are described in Table 3.

## Final Scale

The 1-factor improved model was considered the best model constituted by items 1,4,8,10 and with a Cronbach's alpha value of .90 (CI95% = .84 - .96). The simple score is made with the sum of the four items. The items 1 and 10 must be reverse coded before summing. The mean raw score was 3, standard deviation of 4.46, skewness -.94 and kurtosis .08.

# Discussion

This is the first validation study of Readiness to Change Questionnaire with a sample of Internet users and that combined either exploratory and confirmatory approaches. The number of factors suggested by either Horn’s Parallel Analysis and Very Simple Structure was different from the original study (Rollnick et al., 1992) and from the Spanish version (Rodríguez-Martos et al., 2000), that proposed a 3 factor model using a principal component analysis with an orthogonal rotation. Contemplation and precontemplation seemed to constitute the same factor as found in the Dutch validation study, which also used a principal components approach (Defuentes-Merillas et al., 2002). Differently from Defuentes-Merillas et al. (2002), we preferred to treat the precontemplation and contemplation as one factor, once they had negative loadings and did not constitute a separated factor with enough proportion of explained variance in a third factor considering their eigenvalues.

The preliminary 2-factor solution found in Exploratory Factorial Analysis in this study was comparable with the Dutch validation study in regard to the good internal consistencies and the reasonable proportion of explained variances. However, estimates of this analysis revealed poor fit indexes leading us to compare our 2-factor model with other ones proposed in literature using Confirmatory Factorial Analysis and some comparisons indexes (Budd & Rollnick, 1996; Forsberg et al., 2003).

All confirmatory models tested showed poor fit indexes. This finding was different from Budd and Rollnick (1996) study that found the 3-factors solution initially proposed by Rollnick *et al*. (1992) had poor fit indexes and suggested as an alternative the 1-factor model, which is supposed to evaluate motivation and had good fit indexes. This was not the case in our study, in wich 1-factor model also had poor indexes, Following in the opposite direction, Forsgerg *et at.* (2003) found poor indexes for the 1-factor model (CFI = .83, RMSEA = .12) and the best fit for a 3-factors correlated solution (CFI = .96, RMSEA = .06), which was not confirmed in our study.

The inconsistencies found among the studies might also indicate problems not with the measures only but also with the stages of change model. West (2005) pointed out several limitations of the states of change model. First of all, the boundaries among the stages can be considered arbitrary. Second, the models presumes that individuals make coherent and stables plans. Third, some stages contain different types of constructs. Fourth, the model emphasizes on conscious decision-make and planning proccesses, not considering well known aspects of human motivation such as reward and punishment. Besides the cristism regarding the transtheoretical model of change, some replies to West (2005) stress the point that limitations in measuring stages of change indicates the need of more research and development of alternative ways to operationalize and evaluate this construct as some evidence-based intervention uses this concept with some level success (Prochaska, 2006).

As far as we know, this is the first validation study of a web-based version of the Readiness to Change Questionnaire. Considering the poor fit of the models previously validated in paper-based administrations or interviews to our sample, we proposed the 1-factor improved version performed by a confirmatory factorial analysis with polychoric correlation matrices to offer, at least, a proper way to score some of the RCQ items a factor structure (Holgado–Tello et al., 2010).

Our version can be used as a motivation measure in a web-based screening or intervention. Therefore, our recommendation of use is limited to this kind of media, considering our sample characteristics and procedures. Even though, there are limitations regarding use of our RCQ version, we proposed an alternative way to score questionnaires for researchers and developers of web-based interventions. Further studies comparing self-administrated and interviews versions of RCQ are necessary to elucidate if there are consistent differences among these versions.

However, this study had limitations. This is the first study conducted with users from Internet interventions and they may not represent the clinical samples or the general population, included in the others validations studies (Defuentes-Merillas et al., 2002; Forsberg et al., 2004; Hannöver et al., 2002; Rodríguez-Martos et al., 2000; Rollnick et al., 1992). We found that 72.1% of the sample had at least a college degree, proportion really far from that found in general population or clinics in Brazil. Second, we included in the analyses low-risk users who were not included in the other validation studies. We included this type of users because they are one of the targets of the *“Beber Menos”* intervention. Third, the data is limited to Brazil, which has a different culture compared with countries where studies of validation were conducted.

In conclusion, we found that the RCQ-12 is not useful to classify users into motivation stages, even though some of its items can be used as a motivation measure in future studies. All previous models suggested by literature, except for the 1-factor improved model that we created, showed really poor fit indexes. This indicates that the RCQ-12 is not useful to classify users into motivation stages for a internet sample.. For clinical settings in Brazil, we do not recommend, at this moment, the use of RCQ, since the instrument has not been evaluated yet for this population Future studies should use the 4-item model for web-based alcohol interventions and further studies are necessary to evaluate its performance in clinical samples. Theoretical aspects regarding differences among validation studies need to be addressed either considering possible advance in transtheoretical model of change or even new theories about changing behavior.

Table 1 – Sample demographic characteristics (n=641)

|  |  |
| --- | --- |
| Items | % |
| Education |  |
| College | 73.1 |
| High school | 24.3 |
| Elementary | 2.5 |
| Employment? |  |
| Yes | 84.6 |
| No | 15.4 |
| Brazil's region |  |
| Southeast | 49.3 |
| Northeast | 21.9 |
| South | 16.2 |
| Middle-west | 11.7 |
| North | 0.1 |
| AUDIT Classification |  |
| Low risk | 34.2 |
| Suggestive dependence | 31.3 |
| At risk | 23.4 |
| High risk | 11.1 |

Table 2 – Factor loadings with an “Oblimin” rotation for 2-factors model (n=320 ??).

|  |  |  |  |
| --- | --- | --- | --- |
|  | Factor\* | |  |
| Items\*\* | PC (+) e C(-) | Action | h2 |
| 1. I don't think I drink too much. | -.88 |  | .72 |
| 2. I am trying to drink less than I used to. | .40 | .55 | .57 |
| 3. I enjoy my drinking, but sometimes I drink too much. | .84 |  | .66 |
| 4. Sometimes I think I should cut down on my drinking. | .87 |  | .83 |
| 5. It is a waste of time thinking about drinking. | -.46 |  | .80 |
| 6. I have just recently changed my drinking habits. |  | .90 | .78 |
| 7. Anyone can talk about wanting to do something about drinking, but I am actually doing something about it. |  | .67 | .47 |
| 8. I am at the stage where I should cut down on my drinking. | .84 |  | .76 |
| 9. My drinking is a problem sometimes. | .86 |  | .70 |
| 10. There is no need for me to think about changing my drinking. | -.88 |  | .84 |
| 11. I am actually changing my drinking habits right now. |  | .91 | .84 |
| 12. Drinking less alcohol would be pointless for me. | -.84 |  | .78 |

\* PC – Pre-contemplation and C – Contemplation. Proportion of variances explained by factor: PC-C (47%) and Action (21%).

\*\* Portuguese translation– 1. 'Eu acho que bebo demais'; 2. 'Estou tentando beber menos do que costumava beber'; 3. 'Eu gosto de beber, mas às vezes eu bebo demais'; 4. 'Às vezes eu acho que deveria reduzir o meu consumo de álcool'; 5. 'É um desperdício de tempo pensar sobre o meu consumo de álcool'; 6. 'Eu mudei recentemente meus hábitos de consumo'; 7. 'Qualquer pessoa pode falar sobre querer fazer algo relacionado ao consumo de álcool, mas eu estou realmente fazendo algo sobre isso'; 8. 'Eu estou em um momento em que eu deveria pensar em beber menos álcool'; 9. 'Algumas vezes, meu consumo é um problema'; 10. 'Sinto necessidade de pensar em mudar minha maneira de beber'; 11. 'Atualmente, eu de fato estou mudando meus hábitos de consumo'; 12. 'Beber menos álcool poderia me beneficiar'.

Table 3 – Comparisons among confirmatory models

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Models | CFI | RMSEA | BIC | AIC | X² | df |
| 1-factor | .720 | .196 | 12364.5 | 12271.4 | 794.36 | 54 |
| 2-factor | .815 | .161 | 12119.0 | 12022.0 | 543.60 | 53 |
| 3-factor correlated\* | - | - | - | - | - | - |
| 3-factor\* orthogonal | .586 | .238 | 12720.0 | 12627.0 | 1150.17 | 54 |
| 1-factor - improved model\*\* | .998 | .045 | 3824.0 | 3793.0 | 3.44 | 2 |

\* The three factor correlated solution not converged because the covariance matrix of latent variables were not positive defined. \*\* The improved model was constituted by items 1,4,8,10.

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