

Internal consistency and content validity of a questionnaire aimed to assess the stages of behavioral lifestyle changes in Colombian schoolchildren: The Fuprecol study

Confiabilidade e validade do conteúdo de um questionário para avaliar os estágios de mudança de comportamento no estilo de vida escolar, em crianças colombianas: estudo Fuprecol

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ABSTRACT

Objective

To assess internal consistency and content validity of a questionnaire aimed to assess the stages of Behavioural Lifestyle Changes in a sample of school-aged children and adolescents aged 9 to 17 years-old.

Methods

This validation study involved 675 schoolchildren from three official school in the city of Bogota, Colombia. A self-administered questionnaire called Behavioural Lifestyle Changes has been designed to explore stages of change regarding to physical activity/exercise, fruit and vegetable consumption, alcohol abuse, tobacco use, and drug abuse. Cronbach- α , Kappa index and exploratory factor analysis were used for evaluating the internal consistency and validity of content, respectively.

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Results

The study population consisted of 51.1% males and the participants' average age was 12.7±2.4 years-old. Behavioural Lifestyle Changes scored 0.720 (range 0.691 to 0.730) on the Cronbach α and intra-observer reproducibility was good (Kappa=0.71). Exploratory factor analysis determined two factors (factor 1: physical activity/exercise, fruit and vegetable consumption, and factor 2: alcohol abuse tobacco use and drug abuse), explaining 67.78% of variance by the items and six interactions $\chi^2/gL=11649.833$; $p<0.001$.

Conclusion

Behavioural Lifestyle Changes Questionnaire was seen to have suitable internal consistency and validity. This instrument can be recommended, mainly within the context of primary attention for studying the stages involved in the lifestyle behavioural changes model on a school-based population.

Keywords: Behavior. Lifestyle. Risk assessment. Validation study.

RESUMO

Objetivo

Estimar a confiabilidade e validade do conteúdo do Questionário de Mudança Comportamental nos Estilos de Vida em uma amostra de crianças e adolescentes escolares e adolescentes de 9 a 17 anos.

Métodos

Estudo de validação em 675 alunos pertencentes a 3 instituições oficiais de ensino da cidade de Bogotá, Colômbia. Elaborou-se e aplicou-se o Questionário de Mudança Comportamental nos Estilos de Vida, perguntando sobre as etapas de mudanças na atividade física/exercício, no consumo de frutas, legumes, drogas, tabaco e bebidas alcoólicas por esforço próprio, através de formulário estruturado. A α -cronbach, Kappa e a análise fatorial exploratória foram utilizadas para avaliar a confiabilidade e a validade do conteúdo, respectivamente.

Resultados

Da população avaliada, 51,1% eram homens e a idade média dos participantes foi de 12,7±2,4 anos. O Questionário de Mudança Comportamental nos Estilos de Vida mostrou um α -cronbach global de 0,720 (intervalo 0,691 a 0,730) e bom acordo de peritos (Kappa=0,71). A análise fatorial exploratória determinou dois fatores (fator 1: atividade física/exercício, consumo de frutas e verduras e fator 2: consumo de drogas, tabaco e álcool), que representaram 67,78% da variante, com seis interações $\chi^2/gL=11649,833$; $p<0,001$.

Conclusão

O Questionário de Mudança Comportamental nos Estilos de Vida apresentou consistência interna e validade adequadas. Este instrumento é recomendado principalmente no contexto de atendimento primário, para o estudo das etapas do modelo comportamental de estilos de vida na população escolar.

Palavras-chave: Conduta. Estilo de vida. Medição do risco. Estudos de validação.

INTRODUCTION

Lifestyle is defined as "The set of individual behaviors that show some consistency over time, under more or less constant conditions, and which can be dimensions of risk or safety depending on their nature" [1]. Several authors have discussed the concept of Healthy Lifestyles (HLS), reaching the conclusion that these are composed of health-related behavior patterns [1-3]. For Loef & Walach [2], the combination

of 5 determinants of an HLS, including regular physical activity, a healthy diet and the absence of the consumption of drugs, tobacco and alcohol, are associated with a 66% reduction in all-cause mortality risk. In 2009, Stanner [3] described that individual conduct and/or behaviors have a significant effect on health insofar as being favorable or unfavorable. Thus, several health agencies [4,5] encourage behaviors that stimulate the adoption of an HLS from the early stages of life [6].

Different models and explanatory theories of human behavior have been proposed to understand the adoption of an HLS. Prochaska & DiClemente [7] proposed the Transtheoretical Model (TTM) to explain changes in behavior regarding drug use and tobacco. Subsequently, this model has served as a basis for the effective development of interventions that promote behavior change to encourage physical activity [8]; the consumption of fruit and vegetables [9]; the adoption of protective behavior [10]; or to reduce harmful behaviors such as recreational use of drugs, tobacco and alcohol [11]. Thus, the implementation of the TTM based on psychological theories that focus on the causes of the behavior, such as social cognitive theory [12] and the theory of reasoned action [13], will approach the individual and social aspects that determine behavioral change actions.

Strengthening protective factors such as a healthy diet, the control of psychoactive substances and the practice of regular physical activity beginning in childhood and adolescence facilitate achieving holistic health in adulthood. Although cardiovascular and metabolic aspects are non-modifiable genetic factors, other factors can be acted upon to achieve a better state of health; these factors are related to lifestyle [3-6]. Among them, the main contributors to an unhealthy lifestyle are insufficient physical activity, excessive time spent in front of screens and the high consumption of sugary drinks and food with high caloric content [2-4]. In this regard, school-aged children are vulnerable because they are heavily influenced by environmental features at this time in their lives, and actions taken to modify the lifestyles of children and adolescents will help reduce the risk of morbidity and mortality from all causes over the short term and long term [6]. Thus, school is the ideal context to promote prevention strategies and an HLS at early stages [3].

In Latin America and particularly in Colombia, TTM has been used to study the distribution in the stages of behavioral changes regarding tobacco

consumption [13], alcohol intake [14], healthy behaviors [15] and physical activity [16]. The phases in the model are temporary, and there are 6 stages of behavioral changes, as follows: pre-contemplation, contemplation, preparation, action, maintenance and relapse [7]. However, validated and specific instruments based on the model of Prochaska and DiClemente [7] have been developed that facilitate the design of intervention programs to increase the stages of the behavioral model and can demonstrate whether the recommendations for an HLS were met. Therefore, in the absence of adaptation studies and validation of HLS questionnaires for the Colombian school-aged population, the present study was performed according to the standards for conducting and reviewing instrumental tests, with the aim of estimating content validity and convergent criteria of the Behavioural Lifestyle Changes (BLC-FUPRECOL) questionnaire in a sample of children and adolescents between 9 and 17 years old in the FUPRECOL study (In Spanish *Asociación de la Fuerza Prensil con Manifestaciones Tempranas de Riesgo Cardiovascular en Niños y Adolescentes Colombianos*) [17].

METHODS

We performed cross-sectional analyses of baseline data from participants in The FUPRECOL study, which focused on the associations between fitness, health and non-communicable diseases. We have recently published a complete description of The FUPRECOL Study design, methods, and primary outcomes for our current cohort [17]. In this study, we included a sub-sample (N=675) of 9 to 17.9 year old healthy Colombian children and adolescents (boys=345 and girls=330). The participants were recruited between April 2015 and June 2015.

The phases of the process of adaptation and validation were in accordance with the following rules for the development and review of instrumental tests described by McCallum

et al. [18], Bentler & Yuan [19], and Carretero Dios & Pérez [20]: (1) qualitative assessment of reactants via expert review, (2) final development of the questionnaire, (3) analysis of reactants and (4) Exploratory Factor Analysis (EFA) as the content validity criterion. In the first phase, a bibliographic review was performed, and some proposals for the evaluation of change processes made by the authors of the TTM were consulted (Prevention Research Center, web page; Prochaska & DiClemente [7]).

Qualitative reactants via expert review and final development of the questionnaire

In the first and second phases, a preliminary instrument of 8 domains or subscales was produced that inquired about the stages of change for (a) physical activity/exercise, (b) consumption of fruit, (c) consumption of vegetables, (d) consumption of harmful substances such as drugs, (e) tobacco, (f) intake of alcoholic beverages, (g) intake of sweets and, (h) health care use of vaccines, handwashing, etc. This instrument used the following Likert type response scale (*i.e.*: for harmful illicit substances such as “drugs”): Item 1: I think the consumption of “drugs” is not bad for my health; Item 2: I think the consumption of “drugs” might be bad for my health; Item 3: I know that the consumption of “drugs” is bad for my health and therefore have not smoked or consumed any in the past 6 months; and, Item 4: I know that the consumption of “drugs” is bad for my health, and I will not smoke or consume any in the next 6 months. For healthy behaviors, the scale was grouped with Likert-type responses as follows: Item 1: I don't do it/consume it and do not know the benefit to doing so, Item 2: I know the benefits and I want to do it/consume it in the future, Item 3: I have done it/consumed it every day for the past 6 months and, Item 4: I do it/consume it and will continue to do so for the next 6 months. The stage of preparation for the action was included in the pre-contemplation stage (Item 2), which has been suggested in previous

studies [7,13]. Regarding the consumption of foods such as fruits and vegetables and the intake of alcoholic or sugary beverages, eating habits were not studied, and motivations and restrictions or quantification portions were not identified because only individual HLS behaviors of interest were classified and consumption habit characterization was not the goal of this study.

The second phase involved the adaptation to Spanish and a qualitative assessment of the reactives and the relevance of the constructs by a panel of 3 experts whose task was to judge relevance, consistency with the chosen scales and the drafting of the items according to the criteria proposed by Cohen & Swerdlik [21]. Because of this analysis, 2 domains were removed (use of vaccines, handwashing, etc., and respect for classmate) because they were not viewed as consistent or relevant. The version of the BLC-FUPRECOL included 6 subscales and 4 response items for each domain as follows: (1) physical activity or exercise, (2) consumption of fruit, (3) consumption of vegetables, (4) consumption of harmful substances such as drugs, (5) consumption of tobacco and, (6) intake of alcoholic beverages. The following domains were removed: (7) intake of sugary beverages and (8) health care (use of vaccines, handwashing, etc.) because of low agreement between experts (Kappa=0.34). The content validity was estimated using the inter-expert concordance Kappa index [21]. The version of the BLC-FUPRECOL including the 6 subscales showed overall good kappa concordance among experts, with a 95% confidence interval (Kappa=0.71, 95% Confidence Interval (95%CI=0.66 to 0.82). See Attached (Stages of behavioral lifestyle changes in Colombian schoolchildren: The FUPRECOL study).

Analysis of reactives as internal consistency criterion

In the third phase, the criteria for retaining reactives was 0.60 in the corrected item-total

correlations, and the total internal consistency (Cronbach's α) of the scale was estimated. According to Nunnally [22], a Cronbach's α value equal to or greater than 0.70 is sufficient to use the questionnaire for comparison between groups.

Exploratory factor analysis as content validity criteria

For the fourth phase, an EFA was performed using the principal components with varimax rotation technique, deciding the number of factors to retain utilizing a parallel data matrix analysis for a random replica, repeating the process 250 times. Through Bartlett's sphericity test, the determinant of the correlations matrix and the Kaiser-Meyer-Olkin (KMO) test (acceptable with values above 0.6) were applicable in a factor analysis. Each item was included in a particular factor if the degree of saturation was at least 0.3 and there was an Eigenvalue greater than 1. The number of factors was determined without restricting the structure and later by determining a reduced number of factors according to the result of the screen test.

The study Protocol was explained verbally to the participants and their parents/guardians before they gave their written consent. Participation in the study was fully voluntary and anonymous, with no incentives provided to participants. The Review Committee for Research on Human

Subjects at the University of Rosario (Code nº CEI-ABN026-000262) approved all study procedures. The Protocol was in accordance with the latest revision of the Declaration of Helsinki and current Colombian laws governing clinical research on human subjects (Resolution nº 008430/1993 of Ministry of Health).

To assess content validity for a scale of 24 items in the program StudySize® 2.0.4 (CreoStat HB, Västra Frölunda, Sweden) following scale validation procedures suggested by McCallum *et al.* [18] and Bentler & Yuan [19], a sample size of 670 schoolchildren was calculated, assuming a type I error of 0.05, a power of 0.80, a Cronbach's α correlation coefficient equal to 0.80 for the alternative hypothesis and a Cronbach's α correlation coefficient equal to 0.70 for the null hypothesis. The processing and analysis of the information was conducted using the software Statistical Package for Social Science (SPSS Inc., Chicago, Illinois, United States), version 22

RESULTS

The socio-demographic characteristics of the sample are shown in Table 1. The sample included 675 schoolchildren belonging to 3 official schools in the city of Bogota, Colombia. Of the general population, 51.1% were male. The average age of the population was 12.7±2.4 years

Table 1. Characteristics among a sample of children and adolescents from Bogota, Colombia (N=675).

Characteristics	Age (years)				Total
	9-10	11-12	13-14	15-17	
Sex					
Girls (n)	94	87	74	75	330
Percentage by sex	28.5	26.4	22.4	22.7	100.0
Percentage by years	50.0	50.3	46.0	49.0	48.9
Boys (n)	94	86	87	78	345
Percentage by sex	27.2	24.9	25.2	22.6	100.0
Percentage by years	50.0	49.7	54.0	51.0	51.1

Internal consistency and analysis of reactivities

The results of the analysis of consistency and reactivities are presented in Table 2. The internal consistency per factor presented Cronbach's α values ranging from 0.692 to 0.756 and a general Cronbach's α of 0.720. All subscales obtained saturations (h^2) above 0.535, and most of the reactivities showed high factorial loads ranging from 0.629 to 0.894. The questionnaire took an average of 20 minutes to complete, including reading and signing the Informed Consent.

Table 3 reports the results of Exploratory Factor Analyses on our data. Using the screen test and the analysis of the scree plot (Figure 1),

2 factors were found, each consisting of 3 modules, which accounted for 67.78% of the variance, with 6 interactions (factor 1=37.20% and factor 2=30.50%). In the 24 reactivities, the test sampling adequacy (KMO=0.738) and Bartlett's sphericity test ($\chi^2/gL=11649.800$; $p<0.001$) indicated a moderate fit of the data for analysis.

DISCUSSION

The objective of this study was to estimate the reliability and content validity of the Colombian version of the BLC-FUPRECOL questionnaire in a sample of children and adolescents between 9 and 17 years of age.

Table 2. Internal consistency and analysis of reactivities of Behavioural Lifestyle Changes-FUPRECOL questionnaire.

Scale	Analysis of reactivities			h ²		
	Scale mean if item deleted	Corrected item-total	Cronbach's α	Factor 1	Factor 2	h ²
Physical activity/exercise	9.476	0.392	0.756	0.894	-	0.822
Consumption of fruits	9.628	0.477	0.732	0.859	-	0.770
Consumption of vegetables	9.586	0.432	0.743	0.791	-	0.654
Consumption of harmful substances ^a	10.160	0.549	0.725	-	0.837	0.717
Consumption of tobacco	8.203	0.612	0.692	-	0.807	0.665
Intake of alcoholic beverages	8.142	0.603	0.695	-	0.629	0.535
Total	-	-	0.720	-	-	-

Note: ^aIncluded: cannabis, heroin, cocaine, amphetamine-type stimulants and other illicit drugs; h²= saturations.

Table 3. Components and factorial statistical of Behavioural Lifestyle Changes-FUPRECOL questionnaire.

Statistical	Inicial eigenvalues			Sums of squared extractions loadings		
	Total	Variance (%)	Cumulative (%)	Total	Variance (%)	Cumulative (%)
Factor 1	2.8	46.7	46.7	2.2	37.2	37.2
Factor 2	1.2	21.0	67.7	1.8	30.5	67.7
<i>Factorial component</i>						
KMO index	0.738	-	-	-	-	-
Barlett test (χ^2)	11649.800	-	-	-	-	-
Degrees freedom (gL)	15	-	-	-	-	-
α -Cronbach	0.720	-	-	-	-	-
Significant trend	0.0001	-	-	-	-	-

Note: KMO: Kaiser-Meyer-Olkin. Extraction method: Principal component analysis and varimax rotation.

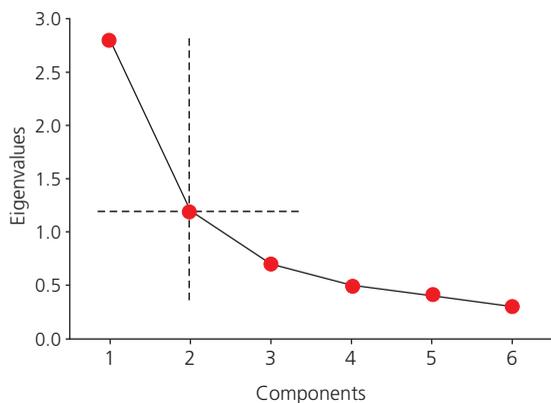


Figure 1. Sedimentation graph of the Behavioural Lifestyle Changes-FUPRECOL questionnaire among a sample of children and adolescents from Bogota, Colombia.

This instrument was developed to assess the behavioral stage associated with the incorporation of an HLS in school contexts. The primary results of this study show that the BLC-FUPRECOL behavioral-change questionnaire has adequate psychometric properties, both globally and for each dimension (content validity and reliability). For example, the internal consistency of the BLC-FUPRECOL instrument reached an α of 0.72, confirming the existence of a reliable scale, despite being less than that obtained recently by Ochoa-Meza *et al.* [23] at the general level ($\alpha=0.81$) or in the fruit and vegetable subscales ($\alpha=0.76$ and 0.83 , respectively) for a representative sample of schoolchildren from 9 European countries. Similarly, our findings agree with other questionnaires based on the TTM developed by Prochaska & DiClemente [7], such as the Iranian version of the smoking cessation questionnaire [24], the stages of change questionnaire for physical activity and dietary behaviors in overweight women with by Robinson *et al.* [25] and the instrument for the incorporation of an HLS in American schoolchildren [26].

Complementary to the above, the content validity was adequate for the total reactives and constructs, with an adequate Kappa concordance value between experts (Kappa=0.71). However,

authors such as Nunnally [22] have suggested that the total explained variance must be significantly high (80%) for the number of factors to be sufficient. This percentage has rarely been achieved in previous studies based on the stages of behavioral change originally described by Prochaska & DiClemente [7], and our study considered an appropriate percentage for the explanation of total variance to be between 40% and 60% in accordance with reports by Ochoa-Meza *et al.* [23]. The construct validity presented an internal structure of 2 factors with reduced variance explained by factors and a moderate internal consistency in the 6 subscales evaluated. The EFA revealed an appropriate index fit to confirmed models, with eigenvalues greater than 1 explaining 67.7% of the total variance, with high factorial loads (range: 0.629 to 0.894). These results confirm information reported in a review study on models of psychosocial factors associated with habits and patterns of healthy diet by Ocho-Meza *et al.* [23], where it was shown that the explanation of the variance of these habits tends to be close to 30%. The low dimensionality of the instrument assessed in the present study stands out, as demonstrated by the high variance explained by the first factor (46.7%) for eigenvalues greater than 1 and for internal consistency values considered moderate in the 6 subscales (range: 0.691 to 0.730). The extraction method used in this study was the principal component analysis with varimax rotation, a statistical technique supported by the KMO statistic, which, in this study, showed a good sampling fit of the data to the analysis model and indicated the proportion of the variance that the estimated variables have in common. The KMO statistic found for this study was 0.738, showing a variable fit based on Bartlett's sphericity test ($\chi^2/gL=11649.800$; $p<0.001$). In addition, the results of this study show communality between factors greater than 0.535. These data match the psychometric theory by Nunnally [22] showing that each factor must contain variables that are highly and

exclusively correlated with this factor with values above 0.50.

As strengths of this study, we highlight the implementation of many of the methodological steps to develop and evaluate a scale [19-21,23,24]. To date, this study is one of the first validation studies conducted in the Colombian school-aged population that describes the conceptual framework from which one may apply the BLC-FUPRECOL questionnaire to evaluate the prevalence of risk factors for cardiovascular and metabolic diseases beginning at early ages. These findings are useful for determining behaviors associated with 5 determinants of an HLS, as reported by Loef & Walach [2], which are associated with a 66% reduction of the risk of mortality from all causes in adulthood. However, future investigations with representative samples from other regional contexts of Colombia must estimate the test-retest reliability and confirmatory construct validity to identify more evidence of different sources of reliability and validity.

Although the instrument presents limitations inherent in all self-reporting instruments, such as social prejudices and convenience sampling of the study population, the data show that the BLC-FUPRECOL instrument is valid and reliable for estimating behavior regarding the 6 most determinant domains of an HLS. Another limitation is inherent in its cross-sectional nature, in addition to the existence of a selection bias, limiting the participation of schoolchildren in other geographical areas of Bogota, Colombia; the age range of participants (9 to 17 years) included in this work is also a limitation. However, this work used a tool based on the theory of behavioral change and the works of Cardoso-Ricardo *et al.* [27] and Prochaska & DiClemente *et al.* [7] have indicated that the TTM effectively predicts health behaviors in young subjects. Socioeconomic level, food practices, the consumption of fat and/or fast food were also not included, all of which are described as factors associated with food security and excess

weight in children and adolescents of both sexes [27-30]. However, the limitations described in this work do not compromise the results achieved in the population studied.

In conclusion, the results of this study provide evidence of sufficient validity for the Colombian version of the BLC-FUPRECOL instrument to evaluate the stages of behavior change toward an HLS in schoolchildren 9 to 17 years of age. Subsequent studies should continue the process of providing evidence of confirmatory and divergent validity in other areas of Colombia and South America.

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CONTRIBUTORS

R RAMÍREZ-VÉLEZ conceived, designed the study, and analyzed the data. Y CARRILLO-BERNATE and JE CORREA-BAUTISTA analyzed the data and wrote the paper. All authors read and approved the final manuscript.

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ATTACHED

Stages of behavioral lifestyle changes in Colombian schoolchildren: The FUPRECOL study

Instructions. It is very important that you do this test by yourself without taking into account the answers given by your classmates. Please answer all the questions and do not leave any blank. Mark only one answer per question [X], and more important: be sincere.

Thank you for your cooperation.

Date [_____]

¿Are you a boy or a girl? (Mark with [X])

Boys _____

Girls _____

1. ¿How old are you? _____ years

2. ¿What school do they attend? _____

	<p>Physical activity/exercise, scale ¿In which of these stages would you place your current behavior towards the physical activity/exercise (for example: walking, playing at recess, running, cycling, playing with balls, etc.)?</p>
	<p><input type="checkbox"/> No, I do not intend to practice exercise every day <input type="checkbox"/> No, but I am thinking to practice exercise but not right now <input type="checkbox"/> No, but I am thinking about to practice exercise in the next month or so <input type="checkbox"/> Yes, I have been to practice exercise everyday for 6 months or more</p>
	<p>Fruits intake, scale Do you currently provide 5 servings of fruits and vegetables every day?</p>
	<p><input type="checkbox"/> No, I do not intend to intake 5 servings of fruits every day <input type="checkbox"/> No, but I am thinking to intake 5 servings of fruits but not right now <input type="checkbox"/> No, but I am thinking about to intake 5 servings of fruits in the next month or so <input type="checkbox"/> Yes, I have to intake 5 servings of fruits everyday for 6 months or more</p>
	<p>Vegetables intake, scale Do you currently provide 5 servings of fruits and vegetables every day?</p>
	<p><input type="checkbox"/> No, I do not intend to intake 5 servings of vegetables every day <input type="checkbox"/> No, but I am thinking to intake 5 servings of vegetables but not right now <input type="checkbox"/> No, but I am thinking about to intake 5 servings of vegetables in the next month or so <input type="checkbox"/> Yes, I have to intake 5 servings of vegetables everyday for 6 months or more</p>
	<p>Consumption of harmful substances such as: cannabis, heroin, cocaine, amphetamine-type stimulants and other illicit drugs, scale</p>
	<p><input type="checkbox"/> Gives no thought to quitting use, and has no intention to use harmful substances in the near future (i.e., within next 6 months) <input type="checkbox"/> Has begun to examine their harmful substances use and desire consumption to harmful substances; Is weighing the pros and cons of harmful substances <input type="checkbox"/> Has made a commitment to harmful substances (usually within next 30 days), and has begun developing a plan for harmful substances <input type="checkbox"/> Has put their plan for harmful substances into action (<6 months)</p>
	<p>Consumption of tobacco, scale</p>
	<p><input type="checkbox"/> Gives no thought to quitting use, and has no intention to quit in the near future (i.e., within next 6 months) <input type="checkbox"/> Has begun to examine their tobacco use and desire to quit; Is weighing the pros and cons of quitting tobacco <input type="checkbox"/> Has made a commitment to quit (usually within next 30 days), and has begun developing a plan for quitting <input type="checkbox"/> Has put their plan for quitting tobacco into action (<6 months)</p>
	<p>Consumption of alcohol, scale</p>
	<p><input type="checkbox"/> Gives no thought to quitting use, and has no intention to intake alcohol in the near future (i.e., within next 6 months) <input type="checkbox"/> Has begun to examine their intake alcohol use and desire to consumption alcohol; Is weighing the pros and cons of harmful substances <input type="checkbox"/> Has made a commitment to intake alcohol (usually within next 30 days), and has begun developing a plan for intake alcohol <input type="checkbox"/> Has put their plan for intake alcohol into action (<6 months)</p>

