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ORIGINAL ARTICLE

Assessment of Benzodiazepine Withdrawal Syndrome: French Psychometric Validation of the Clinical Institute Withdrawal Assessment–Benzodiazepines Scale

Marie-Paule Gustin[1,2], Alessia Hoti[3], Mélinée Chapoutot[4,5], Mélanie Havy[3], Hélène Bastuji[5,6,7], Wendy Leslie[8], Royce Anders[9], Edward M Sellers[10], Yasser Khazaal[11], Benjamin Putois[3,4*]

[1]Public Health, Epidemiology and Evolutionary Ecology of Infectious Diseases (PHE3ID), International Centre for Infectiology Research (CIRI), INSERM U1111, CNRS UMR5308, ENS Lyon, Lyon, France.
[2]Institute of Pharmaceutic and Biological Sciences, Public Health department, Biostatistics, University Claude Bernard Lyon 1, Villeurbanne, France.
[3]Faculty of Psychology, UniDistance Suisse, 3900 Brig, Switzerland.
[4]Sleep center, CHVR, Av. du Grand-Champsec 80, 1951 Sion, Switzerland.
[5]Lyon Neuroscience Research Center, CNRS UMR 5292 - INSERM U1028 - Lyon 1 University, 95 Bd Pinel, 69500 Bron, France.
[6]Sleep Medicine and Respiratory Disease Center, Croix-Rousse Hospital, CHU of Lyon, 103 Gd Rue de la Croix-Rousse, 69000 Lyon, France.
[7]Lyon 1 University, 43 Bd du 11 Novembre 1918, 69000 Lyon, France.
[8]Xceltranslate, 06000, Nice, France.
[9]Univ Paul Valéry Montpellier 3, Univ. Montpellier, EPSYLON EA 4556, F34000, Rte de Mende, Montpellier, France.
[10]University of Toronto, 27 King's College Circle. Toronto, Ontario M5S 1A1 Canada
[11]Addiction Medication Department, CHUV, Rue du Bugnon 23, 1005 Lausanne, Switzerland.

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ABSTRACT

Background. Benzodiazepines use is common in the treatment of insomnia. Discontinuation induces withdrawal symptoms, notably rebound insomnia and anxiety, which contribute to resumption of use, despite medical advice, and ultimately, long-term dependence. The Clinical Institute Withdrawal Assessment–Benzodiazepines (CIWA-B), was derived from the CIWA for alcohol withdrawal to assess the severity of benzodiazepines withdrawal.

Objective. This study aimed to conduct the French cross-cultural validation of the CIWA-B and to evaluate its psychometric properties in the context of hypnotic benzodiazepine use.

Methods. One hundred and seven chronic users of hypnotic benzodiazepines enrolled in a withdrawal protocol participated in the study. Construct validity, internal consistency, test–retest reliability, as well as divergent, convergent, and discriminant validity were assessed.

Results. Exploratory factor analysis revealed a three-factor structure comprising anxiety, physiological symptoms, and sleep. Internal consistency, test–retest reliability, and convergent, divergent, and discriminant validity were good. The sensitivity of the scale could not be evaluated in this study.

Conclusion. The 20-item French version of the CIWA-B demonstrates satisfactory psychometric properties and represents a relevant tool for assessing benzodiazepine withdrawal syndrome. Further validation in populations using benzodiazepines for anxiolytic purposes and in less gradual withdrawal contexts is warranted.

Keywords: Benzodiazepines, insomnia, withdrawal syndrome, Clinical Institute Withdrawal Assessment, psychometric validation

Introduction

Benzodiazepines and related compounds (Z-drugs; BZs) constitute a class of psychotropic agents with effects similar to those of alcohol. They potentiate γ-aminobutyric acid type A (GABA-A) receptor activity, producing hypnotic, anxiolytic, muscle-relaxant, anticonvulsant, and amnestic effects[1]. The duration of action of these substances depends on their elimination half-life (i.e., the time required for the body to eliminate half of the administered dose), which is classified as short (1–12 hours), intermediate (12–40 hours), or long (> 40 hours). These medications are prescription-only and should be used under medical supervision. Their short-term efficacy in the treatment of insomnia[2,3] and anxiety[4–6] is well documented; however, health authorities warn of an unfavorable benefit–risk ratio with long-term use[7,8]. Although patients often report subjective satisfaction, objective measures indicate that these agents impair sleep quality, particularly by reducing slow-wave sleep and rapid eye movement (REM) sleep[9], while also disrupting daytime cognitive functioning[10–12] and increasing the risk of accidents[13,14]. Official guidelines restrict their prescription to four weeks for hypnotic indications and to sixteen weeks for anxiolytic indications[8]. Despite these regulations, approximately 2% of the adult population use these medications abusively[15,16]. In France, 13.5% of users take these drugs beyond the maximum recommended duration conveyed by national health authorities[17]. Furthermore, one in three individuals over the age of 65 uses them regularly[18].

This overuse is largely explained by the rapid development of dependence, fueled by users' subjective satisfaction despite adverse effects and the difficulty of dose reduction or discontinuation[19]. Dose tapering induces a withdrawal syndrome in 50–80% of users[20,21]. This syndrome is primarily characterized by rebound insomnia[22] and rebound anxiety[23], but also by a wide range of symptoms, including irritability, headaches, muscle and abdominal pain, sensory hypersensitivity, marked weight loss, and seizures. Withdrawal symptoms are more severe following discontinuation of short–half-life BZs than long–half-life agents[24–28]. Benzodiazepine withdrawal frequently leads patients to resume their initial dosage, thereby reinforcing dysfunctional beliefs that BZs are the solution to their disorder[29]. This mechanism contributes to the persistence of dependence[30,31].

Several instruments are available to assess BZs withdrawal syndrome; however, each has limitations, and none has undergone cross-cultural psychometric validation in French. The Sophia Observation Withdrawal Symptoms Scale[32] is administered to young patients in pediatric intensive care units to assess BZs withdrawal. It is intended for children aged 0–16 years who have received BZs or opioids within the previous five days. The Physician Withdrawal Checklist[33] is largely based on a scale originally developed for antidepressant withdrawal and requires administration by a clinician. Neither of these instruments is specific to benzodiazepines.

The most widely used questionnaire in this field is the Benzodiazepine Withdrawal Symptom Questionnaire (BWSQ)[34]. This 20-item self-report measure assesses a range of perceptual, somatic, and affective symptoms; however, it does not capture anxiety levels or sleep quality, which are core features of withdrawal during tapering of anxiolytic or hypnotic benzodiazepines. Moreover, the BWSQ uses a three-point Likert scale, which is relatively insensitive to mild symptoms and has been discouraged by several authors (Alwin et Krosnick, 1991; Maydeu-Olivares et al., 2017). The Benzodiazepine Hypnotics Withdrawal Symptom Scale (BHWSS))[35] was developed more recently and addresses some of the limitations of earlier instruments; however, like the BWSQ, it is not freely available for use or reproduction.

In contrast, the Clinical Institute Withdrawal Assessment–Benzodiazepine (CIWA-B)[36] provides a structured and standardized evaluation of all relevant dimensions, including anxiety and sleep quality. Comprising 20 items, it is simple and quick to administer, but has never been validated in the French language.

Given its clinical relevance, versatility, and ease of use, the aim of this study was to conduct the French cross-cultural validation and to evaluate the psychometric properties of the CIWA-B in the context of withdrawal from hypnotic benzodiazepines, with the objective of providing an instrument that can be freely and openly disseminated.

Method

SCALE ADAPTION PROCEDURES

The original author of the CIWA-B, Usoa Busto, is deceased. Authorization to conduct the French validation of the CIWA-B was obtained from one of its principal co-authors, Professor Emeritus Edward M. Sellers. In accordance with contemporary methods recommended in the scientific literature[37], the present work was conducted in three stages:

PHASE 1: TRANSLATION, BACK-TRANLATION, AND EXPERT COMMITTEE REVIEW

An initial translation was performed by W.L., a psychologist and professional translator, followed by a back-translation conducted by M.C., psychologist. The wording was adapted to the cultural and linguistic specificities of contemporary French as used in Switzerland and France. Given that the first three items of the original version were clinician-rated, they were reformulated as self-report items to facilitate the use of the CIWA-B: Observe behaviors of agitation or restlessness (Item 1); Extend your arms with fingers spread and observe tremor (Item 2); Observe signs of sweating or clammy hands (Item 3).

Subsequently, to validate this version, B.P., PhD in scientific psychology, clinical psychologist and cognitive-behavioral psychotherapist, together with M.C., clinical psychologist, evaluated the strengths, weaknesses, and any potential issues of the proposed translations.

PHASE 2: PRETESTING, ASSESSMENT OF ITEM COMPREHENSION, AND DEVELOPMENT OF THE FINAL VERSION

An initial sample of participants rated their comprehension of the validated French translation for each questionnaire item using a Likert scale ranging from 1 (“the statement is not at all clear; I barely understand it”) to 7 (“the statement is very clear; I understand it perfectly”). Median comprehension scores were then calculated for each item. Specifically, items with a median score below 4 were revised to improve clarity. This process was repeated until all items achieved a comprehension score of 4 or higher.

PHASE 3: PSYCHOMETRIC VALIDATION OF THE CIWA-B

The full version of the CIWA-B was psychometrically validated through the examination of standard indices of internal consistency (Cronbach’s α, McDonald’s Ω), exploratory factor analysis (EFA), test-retest validity, and the assessment of convergent and divergent validity using correlation significance tests (adjusted for multiple comparisons) with relevant scales.

PARTICIPANTS

For Phase 2 (pretesting, item comprehension assessment, and final version development), native French-speaking participants were recruited from the general population to evaluate the clarity of the translated questionnaire.

For Phase 3 (psychometric validation), participants were recruited in France and Switzerland between May 2021 and July 2022 as part of the BENZOSTOP research program, supported by the National Sleep Research Association (PROSOM: Association nationale de Promotion des Connaissances sur le Sommeil). BENZOSTOP is a five-year research initiative aimed at improving understanding of strategies to reduce benzodiazepine consumption. All research projects within this program received ethical approval from the relevant committees in France (Comité de protection des personnes EST I, 06/05/2021) and Switzerland (Commission cantonale d’éthique de la recherche sur l’être humain, Vaud, 25/11/2021).

Enrollment in the study was open to individuals experiencing insomnia who wished to discontinue benzodiazepine use. Participants were required to

have used BZs for at least 12 months (the minimum duration defined by the DSM-5 for a Benzodiazepine Use Disorder, BUD) with a frequency of more than four nights per week. Individuals using BZs for indications other than sleep disorders were excluded.

Protocol

Participants completed the CIWA-B at two time points without any change in their benzodiazepine use (T1–T2) and once after reducing their dose by 25% (T3), according to a follow-up consultation within the withdrawal program, which occurred between 1 and 7 days. The exact day of dose reduction was recorded to identify short–half-life benzodiazepine users who had reduced their dose within 48 hours prior to completing the CIWA-B, and intermediate- or long–half-life users who had reduced their dose 5 to 7 days before completion. This procedure was chosen to maximize the likelihood of administering the CIWA-B during periods when withdrawal symptoms were expected to be most pronounced.

Measures

The set of questionnaires was administered anonymously and following written informed consent via the secure platform symptosite.com. Participants first completed a screening questionnaire to verify eligibility, based on their benzodiazepine use (diazepam-equivalent dose, number of BZs consumed, indication, half-life, dose consumed over the previous 7 days) and sociodemographic data (age, sex, etc.).

CIWA-B. The CIWA-B was initially developed based on data collected from 63 patients aged 20–48 years with benzodiazepine abuse or dependence[36]. The data included the time course and severity of withdrawal. From 36 withdrawal symptoms, 20 were selected in the original publication's initial analysis. In the original version, Items 1–3 are clinician-rated, while Items 4–20 are self-reported by the patient. Items are scored on a 0–4 scale, ranging from "not at all" to "extremely." The last two items of the original version are not included in the total score and were therefore not considered in this validation.

The *Insomnia Severity Index* (ISI) is a 7-item self-report scale assessing the severity of insomnia, satisfaction with sleep, daily functioning, and anxiety related to sleep disturbances[38].

The *Symptom Checklist-90* (SCL-90) is a 90-item self-report inventory measuring psychological distress across multiple symptom dimensions, including aggression/hostility, anxiety, depression, paranoid ideation, phobic anxiety, psychoticism, somatization, interpersonal sensitivity, and compulsivity [39(p90)].

The *Comprehensive Assessment of Acceptance and Commitment Therapy* (CompACT) is a 23-item self-report questionnaire assessing psychological flexibility across behavioral awareness, valued action, and openness to experience[40].

The *Acceptance and Action Questionnaire* (AAQ-2) is a 10-item self-report measure of psychological flexibility[41].

The *Mindful Attention Awareness Scale* (MAAS) is a 15-item self-report scale measuring awareness and attention to the present moment across physical, cognitive, emotional, and interpersonal domains[42].

Data Analysis

DESCRIPTIVE ANALYSIS

The study population is described using the mean ± standard deviation (mean ± SD) for quantitative variables and counts with percentages (n, %) for categorical variables. For statistical analyses involving quantitative variables, the normality of their distribution was assessed both graphically and numerically (Anderson–Darling test, moment coefficients of skewness and excess kurtosis were calculated using R package e1071). Depending on the distribution, either Student's t-test or the Wilcoxon signed-rank test, and Pearson or Spearman correlation coefficients, were used.

Psychometric validation of the CIWA-B was conducted using the scores from the 20 items obtained at the first administration (T1). Given the ordinal nature of the scores (5-point Likert scale, 0–4), a polychoric correlation matrix for all pairwise item combinations was used in the factor analyses.

Factor Structure. An exploratory factor analysis (EFA) was conducted after determining the number of factors to retain using Horn's parallel analysis (function paran in R package paran). Factor analyses were performed using the WLSMV estimator in MPlus, which accounts for item skewness, and an oblique "geomin" rotation was chosen because correlations between factors were expected[43]. A root mean square error of approximation (RMSEA) < 0.06 and a comparative fit index (CFI) > 0.95 were considered indicative of good model fit[44]. The resulting factor structure was subsequently validated via confirmatory factor analysis (CFA) on the same sample, due to the small sample size for these analyses.

Reliability (Internal Consistency). Cronbach's α was used to assess internal consistency. Values between 0.60 and 0.70 are considered indicative of acceptable reliability, and α > 0.80 strong reliability.

Test–Retest Reliability. Because the CIWA-B does not measure specific withdrawal symptoms (e.g., anxiety, insomnia, irritability), assessing test–retest reliability without any change in BZs use was important. Reliability was evaluated over a 2-week interval by comparing mean differences in CIWA-B scores between the two administrations (T1-T2).

Convergent and Divergent Validity. Convergent validity of the CIWA-B was assessed using the ISI and SCL-90 scales, with positive correlations indicating that the measures capture similar constructs. Divergent validity was examined by comparing CIWA-B scores with the MAAS, AAQ-2, and CompACT scales, where negative correlations suggest distinct constructs.

Sensitivity. The CIWA-B was expected to be sensitive to BZs dose reduction. Within-subject comparisons were planned between T1 and the first dose reduction (T3) for short–half-life BZs users who completed the CIWA-B within 48 hours post-reduction, and for intermediate- or long–half-life BZs users who completed it 5–7 days after the first reduction.

For all statistical analyses, significance was set at p < 0.05. Analyses were performed using R version 4.3.2 (http://cran.r-project.org/) and Mplus 7.11 for factor analyses.

Results

PHASE 1: TRANSLATION AND BACK-TRANSLATION

No issues were identified during back-translation. The validated French version is provided in the supplementary data.

PHASE 2: PRETESTING

The pretest sample included 20 participants, predominantly female (75%), with a mean age of 38 ± 8.2 years. All items achieved a median comprehension score of 7, except for Item 1, which had a median of 4.5. Consequently, all items in the French CIWA-B demonstrated very good comprehensibility.

PHASE 3: PSYCHOMETRIC VALIDATION OF THE CIWA-B

Participants

Of the 133 participants enrolled in the withdrawal protocol, 26 were excluded from the analyses due to study dropout, noncompliant completion of the CIWA-B, or failure to reduce their BZs consumption. The final sample included 107 native French-speaking participants, comprising 28 men and 79 women aged 25–70 years (Table 1). At inclusion, participants were taking a hypnotic BZs every night between 3 and 7 times per week and had been using BZs for an average of 11 years, with a mean of 9 previous attempts to discontinue. Among the participants, 53 used short–half-life BZs, while 54 used intermediate- or long–half-life BZs.

Table 1: *Main characteristics of the patients* (n = 107)

Variables	ALL n = 107	Mean ± SD
Age (years)	107	54.6±10.1
Sex (Female)	107	79(73.8)
Marital status:		
Single	107	35(32.7)
Married		53(49.5)
Registered patnership		7(6.5)
Cohabiting unmarried		12(11.2)
Number of children	107	1.6±1.2
Diagnosis:		
Insomnias	107	105(98.1)
Benzodiazepine use disorder		
Mild dependence	107	14(13.1)
Moderate dependence	107	33(30.8)
Severe dependence	107	60(56.1)
Other psychological disorder	107	27(25.2)
CompACT Total score	107	87.2±18.5
AAQ2	106	44.1±10.2
MAAS	106	57.5±13.8
Benzodiazepine dependence		
Diazepam equivalence dose	107	5.7±3.9
Number of attempts to discontinue BZs	107	8.8±19.2
Duration of consumption (years)	107	15±10.9
Knowledge of the risk of addiction	107	80(74.8)

mean ±SD for quantitative variables and n(%) for binary variables

Factor Structure

The polychoric correlation matrix (Table S1) was calculated to estimate correlations between items (ordinal responses). The mean inter-item correlation was 0.42 (SD = 0.15), with 95% of correlations ranging from 0.19 to 0.76 and an overall range of 0.09–0.86. Notably, Items 15 and 17 were highly correlated with each other (r = 0.75) but showed weaker correlations with the other items (ranging from 0.15 to 0.48).

Horn's parallel analysis suggested retaining two factors. The two-factor EFA model showed acceptable fit (RMSEA = 0.078, CFI = 0.962) and explained 54.9% of the total variance. However, Items 2, 3, and 10 cross-loaded on both factors with loadings very close to each other (difference < 0.05), and none of their loadings were significantly different from zero. Consequently, a three-factor solution was examined.

The three-factor EFA model demonstrated good fit (RMSEA = 0.066, CFI = 0.976) and explained 62.3% of the total variance. All items loaded significantly on their respective factors with loadings > 0.36 (Table 2), and most items (14 of 20, 70%) had loadings > 0.60.

The first factor (8 items; eigenvalue = 9.12, 45.6% of variance explained) encompasses the *irritability and anxiety* dimension and is strongly represented by Items 14, 6, and 4. The second factor (8 items; eigenvalue = 1.86, 9.3% of variance explained) represents the *physical symptoms* dimension and is primarily reflected by Items 12, 9, 18, and 11. Finally, the third factor (2 items; eigenvalue = 1.48, 7.4% of variance explained) pertains to *sleep quality* and is mainly represented by Items 17 and 15, which are highly correlated with each other. Factors 1 and 2 are strongly correlated with each other (r = 0.68) but show weaker correlations with Factor 3 (*sleep quality*) (r = 0.40 with F1 and r = 0.29 with F2).

Table 2: Exploratory Factor Analysis (EFA) at First Benzodiazepine Reduction (n = 107)

Factor	Item	Factor 1	Factor 2	Factor 3	Label
F1 irritability anxiety	**Q14**	**0.95**	*-0.11*	*0.14*	q14 Vous sentez-vous contrarié(e) ?
	Q06	**0.87**	*0.01*	*0.07*	q06 Vous sentez-vous tendu(e) ?
	Q13	**0.84**	*0.14*	*-0.08*	q13 Vous sentez-vous anxieux/se, nerveux/se ou agité(e) ?
	Q04	**0.74**	*0.01*	*0.13*	q04 Vous sentez-vous irritable ?
	Q20	0.66	*0.11*	*0.00*	q20 Avez-vous été inquiété(e) par des contrariétés ces derniers temps ?
	Q19	0.60	*0.20*	*-0.02*	q19 Avez-vous des peurs, des craintes ?
	Q01	0.46	*0.31*	*0.00*	q01 Observez votre corps : êtes-vous agité(e), impatient(e) ?
	Q08	0.37	*0.21*	*0.11*	q08 Avez-vous perdu l'appétit ?
F2 physical symptoms	**Q12**	*-0.20*	**0.94**	*0.01*	q12 Ressentez-vous des douleurs ou des raideurs musculaires ?
	Q09	*-0.26*	**0.80**	*0.00*	q09 Avez-vous des engourdissements ou des brûlures au niveau du visage, des mains ou des pieds ?
	Q18	*-0.12*	**0.78**	*-0.02*	q18 Avez-vous des troubles visuels ? (sensibilité à la lumière, vision trouble)
	Q11	*-0.15*	**0.71**	*0.16*	q11 Avez-vous des maux de tête ou la tête lourde ?
	Q02	*0.01*	0.64	*-0.24*	q02 Etendez vos bras avec vos doigts écartés, tremblez-vous ?
	Q10	*0.03*	0.62	*-0.08*	q10 Avez-vous des palpitations ou des battements du cœur rapides ?
	Q16	*0.01*	0.61	*0.33*	q16 Vous sentez-vous faible ?
	Q05	*0.13*	0.56	*0.33*	q05 Vous sentez-vous fatigué(e) ?
	Q03	*0.17*	0.50	*-0.01*	q03 Avez-vous des signes de transpiration, les mains moites ?
	Q07	*0.22*	0.45	*0.19*	q07 Avez-vous des difficultés de concentration ?
F3 sleep	**Q17**	*-0.04*	*0.01*	**0.91**	q17 Pensez-vous avoir assez dormi la nuit dernière ?
	Q15	*0.12*	*0.00*	**0.76**	q15 Votre dernière nuit a-t-elle été réparatrice ?
Explained variance (%)		45.6	9.3	7.4	
Cumulative variance (%)		45.6	54.9	62.3	

Confirmatory factor analysis supported the obtained factor structure (RMSEA = 0.051, CFI = 0.982) (Figure 1). The first two dimensions were strongly correlated (r = 0.76) and showed lower correlations with the third dimension (r = 0.40 and r = 0.55, respectively).

Reliability (Internal Consistency)

Results indicated very good internal consistency for both total scores and individual factors: total score α = 0.91; Factor 1 α = 0.84; Factor 2 α = 0.82; Factor 3 α = 0.81.

Test–Retest Reliability (Table S2)

Spearman correlations of CIWA-B total scores between two follow-ups (T1 and T2), without any dose reduction, were all significant (n = 107): for the total score and the first two factors (0.73-0.81), and lower for the third factor (0.31 0.40). Correlations remained similar across BZs half-life groups. As expected, no significant differences were observed between paired mean scores (T1 vs. T2), particularly when participants used BZs with the same half-life ($p > 0.08$), except for Factor 1, which showed a small but significant difference ($p < 0.05$).

Convergent and Divergent Validity (Table S3)

The SCL-90 ($r = 0.55$, $p < .001$) and ISI ($r = 0.38$, $p < .001$) scores were positively correlated with the CIWA-B total score, as were Factors 1 and 2. The correlation between the SCL-90 and Factor 3 (sleep) was the lowest ($r = 0.26$). The CIWA-B total score was negatively correlated with the MAAS ($r = –0.36$, $p < .001$), the AAQ-2 ($r = –0.32$, $p < .001$), and the CompACT ($r = –0.35$, $p < .001$). Spearman correlation coefficients were used for all analyses.

Sensitivity

Among the 107 participants, only 31 short–half-life BZs users completed the CIWA-B within 48 hours of their first dose reduction (group 1), and only 8 intermediate- or long–half-life BZs users completed it 5–7 days after their first dose reduction (group 2). The Student test was used to compare paired CIWA-B total scores at T1 and T3 in each group. Results showed no significant differences.

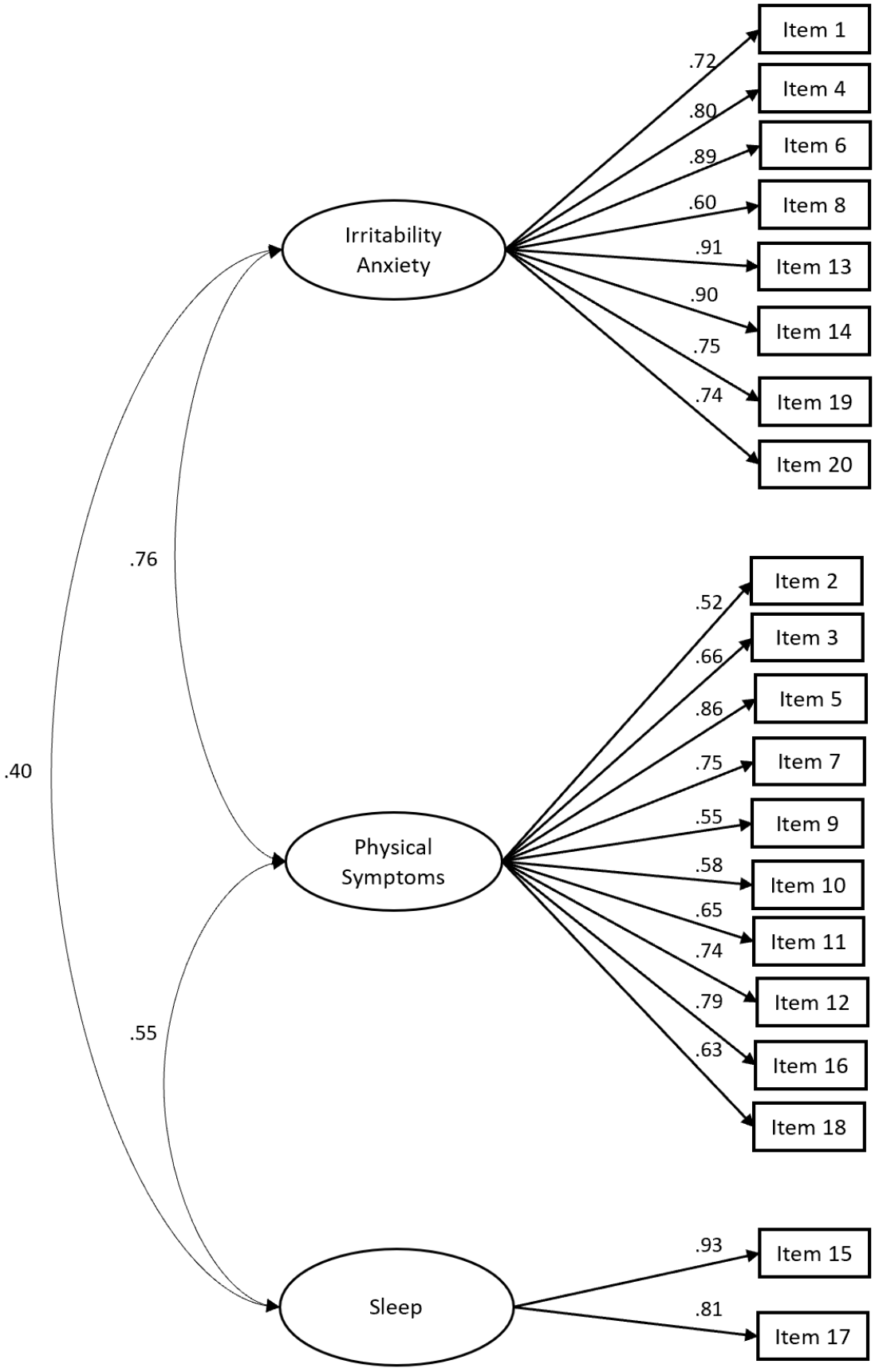

Figure 1: Confirmatory Factor Analysis (CFA) of the French version of the 20-item CIWA-B at First Benzodiazepine Reduction (n = 107). Single-headed arrows represent factor loadings, while double-headed arrows on the left indicate correlations between factors. All coefficients are standardized.

Discussion

The objective of this study was the cross-cultural validation of the CIWA-B[36] in the French language for assessing BZs withdrawal symptoms. The steps of translation, back-translation, and item comprehension were successfully completed. The questionnaire is structured around three factors corresponding to the three typical withdrawal syndromes: anxiety (F1), physiological symptoms (F2), and sleep (F3). These three factors together account for over 60% of the total variance. The percentage of variance explained is very satisfactory, especially since most of the symptoms described are not specific to the effect of BZs. Convergent and divergent validity, as well as test–retest reliability, were found to be satisfactory.

The observed reduction in the anxiety factor between the two time points raises questions. This effect may reflect expectancy effects, as participants were enrolled in a closely monitored research protocol designed to support BZs discontinuation. Another explanation is that this factor may not specifically measure anxiety related to BZs withdrawal, but rather general anxiety, which could have varied in this sample. Therefore, it is advisable to interpret CIWA-B results within the restricted context of benzodiazepine dose reduction.

STRENGTHS

This study validates the first French-language scale specifically measuring BZs withdrawal syndrome. This represents an important step, particularly given that France is one of the countries that exhibit the highest rates of BZs consumption worldwide. It is estimated that 2–5% of the general population misuse benzodiazepines (*i.e.*, use beyond prescribed indications) or continue taking them for longer than six months[31,45,46]. Several national health authorities advise against long-term benzodiazepine use (the French national agency for drug safety[47]; the United Kingdom's Department of Health[48]). The major issue with long-term BZs use is the high level of dependence these substances induce[49,50] and side effects[10,12,51]. To support adherence to deprescribing guidelines[52–56], the CIWA-B scale represents a valuable clinical tool. Unlike other BZs withdrawal scales, the CIWA-B assesses rebound insomnia and anxiety, capturing the core symptoms it is intended to measure. As these phenomena are clinically known to be common, CIWA-B appears to be one of the only scales that truly measures withdrawal syndrome.

Validation was conducted in a population of long-term BZs users. Despite the relatively small sample size, the results demonstrated strong psychometric properties. The scale is free to use and easy to administer. Its factor structure appears relevant not only for insomniac BZs users, as in this study, but potentially also for patients with anxiety disorders.

LIMITATIONS AND RECOMMENDATIONS FOR FUTURE RESEARCH

This protocol did not allow for a robust assessment of the CIWA-B's sensitivity, as too few participants completed the scale at optimal time points. Ideally, the CIWA-B should be administered to all short–half-life BZs users within 12 hours of dose reduction, and to all intermediate- or long–half-life users 5 days after their reduction. Additionally, withdrawal in this study was conducted very gradually (25% dose reductions); it would be informative to assess the CIWA-B during more abrupt dose reductions.

Not all BZs users experience withdrawal symptoms, so it would be valuable to administer the CIWA-B to a larger sample undergoing tapering. This is particularly relevant because our confirmatory factor analysis was conducted on the same sample as the exploratory factor analysis, which is a methodological limitation.

This study validated the CIWA-B in the context of dose reduction of hypnotic BZs. Its performance may differ for anxiolytic BZs, although the first factor from the exploratory factor analysis clearly highlighted the *irritability and anxiety* dimension, which may reflect rebound anxiety associated with BZs withdrawal.

Moreover, the sample consisted of long-term users taking moderate BZs doses. It is plausible that the CIWA-B would be more sensitive in populations

with higher or abusive BZs use, who are more likely to experience severe withdrawal syndromes.

Finally, future studies should consider establishing a threshold score using Receiver Operating Characteristic (ROC) analysis, by diagnosing withdrawal syndrome through expert assessment and comparing it to CIWA-B scores. This approach is particularly relevant given the considerable heterogeneity in the severity of benzodiazepine withdrawal symptoms.

Conclusion

The CIWA-B is the first French-language scale available to assess benzodiazepine withdrawal syndrome. While it is valuable for research purposes, it also provides clinicians with a free and easy-to-use tool. Monitoring withdrawal symptoms is particularly relevant in routine clinical care to identify patients at risk of more severe withdrawal, who may require closer support and follow-up during the tapering process.

Ethics:

The study's methods, objectives, and inclusion/exclusion criteria were pre-registered in 2021 on ClinicalTrials.gov under the title "Telepsychology for Benzodiazepine Withdrawal in Adults Suffering From Hypnotic-Dependent Insomnia" (NCT04751851) and received ethical approval the same year from French regulatory authorities (ID RCB 2021-A00196-35 – 05/06/2021) and Swiss authorities (ID 2021-01626 – 25/11/2021). Data collection was declared to the French Data Protection Authority (CNIL, 1612473vO). The REDCap and Symptosite software platforms were used to ensure secure data storage.

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Author Contributions:

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Abbreviations:

The following abbreviations are used in this manuscript:

AAQ-2, Acceptance and Action Questionnaire II

AFE, Analyse Factorielle Exploratoire

BZs, Benzodiazépines

CIWA-B, Clinical Institute Withdrawal Assessment – Benzodiazepine

CompACT, Comprehensive Assessment of Acceptance and Commitment Therapy

ISI, Insomnia Severity Index

MAAS, Mindful Attention Awareness Scale

SCL-90, Symptom Checklist-90

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Supplementary Data

French adaptation of the CIWA-B

ÉCHELLE DE SEVRAGE DES BENZODIAZÉPINES (CIWA-B Français)

Pour chacune des questions suivantes, veuillez cocher la réponse qui décrit le mieux ce que vous ressentez aujourd'hui.

1. Observez votre corps : êtes-vous agité(e), impatient(e) ?	0 Aucun	1	2	3	4 Je suis incapable de rester en place, je fais les 100 pas
2. Etendez vos bras avec vos doigts écartés, tremblez-vous ?	0 Je ne tremble pas	1	2	3	4 Cela est sévère, même avec les bras non tendus
3. Avez-vous des signes de transpiration, de mains moites ?	0 Aucun signe	1	2	3	4 J'ai des sueurs abondantes
4. Vous sentez-vous irritable ?	0 Pas du tout	1	2	3	4 Tout à fait
5. Vous sentez-vous fatigué(e) ?	0 Pas du tout	1	2	3	4 Incapable de fonctionner à cause de la fatigue
6. Vous sentez-vous tendu(e) ?	0 Pas du tout	1	2	3	4 Absolument
7. Avez-vous des difficultés de concentration ?	0 Aucune difficulté	1	2	3	4 Incapable de me concentrer
8. Avez-vous perdu l'appétit ?	0 Aucune perte d'appétit	1	2	3	4 Pas d'appétit, incapable de manger
9. Avez-vous des engourdissements ou des brûlures au niveau du visage, des mains ou des pieds ?	0 Aucun engourdissement	1	2	3	4 Brûlures ou engourdissements intenses
10. Avez-vous des palpitations ou des battements du cœur rapides?	0 Aucune perturbation	1	2	3	4 Palpitations constantes
11. Avez-vous des maux de tête ou la tête lourde ?	0 Pas du tout	1	2	3	4 Maux de tête sévères
12. Ressentez-vous des douleurs ou des raideurs musculaires ?	0 Pas du tout	1	2	3	4 Raideurs ou douleurs sévères
13. Vous sentez-vous anxieux/se, nerveux/se ou agité(e) ?	0 Pas du tout	1	2	3	4 Tout à fait
14. Vous sentez-vous contrarié(e) ?	0 Pas du tout	1	2	3	4 Tout à fait
15. Votre dernière nuit a-t-elle été réparatrice ?	0 Très réparatrice	1	2	3	4 Pas du tout
16. Vous sentez-vous faible ?	0 Pas du tout	1	2	3	4 Tout à fait
17. Pensez-vous avoir assez dormi la nuit dernière ?	0 Oui, tout à fait	1	2	3	4 Pas du tout
18. Avez-vous des troubles visuels ? (sensibilité à la lumière, vision trouble)	0 Pas du tout	1	2	3	4 Très sensible à la lumière, vision trouble
19. Avez-vous des peurs, des craintes ?	0 Pas du tout	1	2	3	4 Absolument
20. Avez-vous été inquiété(e) par des contrariétés ces derniers temps ?	0 Pas du tout	1	2	3	4 Tout à fait

Cotation : Le score total des échelles est la somme des items 1 à 20. Le sous-score d'anxiété/irritabilité est la somme des items 1, 4, 6, 8, 13, 14, 19, 20. Le sous-score de symptômes physiologiques est la somme des items 2, 3, 5, 7, 9, 10, 11, 12, 16, 18. Le sous-score sommeil perturbé est la somme des items 15, 17.

Table S1. Correlation matrix of CIWA-B items.

	q01	q02	q03	q04	q05	q06	q07	q08	q09	q10	q11	q12	q13	q14	q15	q16	q17	q18	q19	q20
q01	1	0.425	0.478	0.626	0.465	0.648	0.554	0.321	0.263	0.454	0.251	0.503	0.641	0.573	0.294	0.367	0.266	0.444	0.397	0.433
q02	0.425	1	0.601	0.169	0.268	0.272	0.235	0.171	0.443	0.437	0.153	0.37	0.354	0.252	0.184	0.287	0.15	0.326	0.415	0.389
q03	0.478	0.601	1	0.458	0.545	0.434	0.377	0.195	0.292	0.187	0.354	0.394	0.533	0.39	0.326	0.445	0.263	0.369	0.369	0.496
q04	0.626	0.169	0.458	1	0.551	0.729	0.564	0.336	0.23	0.267	0.331	0.402	0.672	0.767	0.302	0.402	0.291	0.41	0.452	0.512
q05	0.465	0.268	0.545	0.551	1	0.599	0.637	0.533	0.377	0.506	0.581	0.551	0.556	0.536	0.438	0.763	0.48	0.427	0.465	0.489
q06	0.648	0.272	0.434	0.729	0.599	1	0.508	0.42	0.295	0.429	0.459	0.441	0.859	0.796	0.38	0.482	0.238	0.318	0.623	0.597
q07	0.554	0.235	0.377	0.564	0.637	0.508	1	0.538	0.296	0.285	0.386	0.522	0.516	0.543	0.288	0.626	0.319	0.486	0.395	0.374
q08	0.321	0.171	0.195	0.336	0.533	0.42	0.538	1	0.089	0.23	0.431	0.347	0.536	0.588	0.257	0.425	0.163	0.372	0.323	0.504
q09	0.263	0.443	0.292	0.23	0.377	0.295	0.296	0.089	1	0.507	0.421	0.519	0.319	0.339	0.375	0.297	0.324	0.592	0.301	0.203
q10	0.454	0.437	0.187	0.267	0.506	0.429	0.285	0.23	0.507	1	0.357	0.455	0.49	0.329	0.273	0.276	0.194	0.469	0.314	0.407
q11	0.251	0.153	0.354	0.331	0.581	0.459	0.386	0.431	0.421	0.357	1	0.628	0.415	0.299	0.338	0.548	0.272	0.494	0.389	0.236
q12	0.503	0.37	0.394	0.402	0.551	0.441	0.522	0.347	0.519	0.455	0.628	1	0.504	0.396	0.329	0.602	0.254	0.596	0.363	0.298
q13	0.641	0.354	0.533	0.672	0.556	0.859	0.516	0.536	0.319	0.49	0.415	0.504	1	0.809	0.298	0.468	0.184	0.328	0.696	0.607
q14	0.573	0.252	0.39	0.767	0.536	0.796	0.543	0.588	0.339	0.329	0.299	0.396	0.809	1	0.402	0.527	0.245	0.372	0.681	0.731
q15	0.294	0.184	0.326	0.302	0.438	0.38	0.288	0.257	0.375	0.273	0.338	0.329	0.298	0.402	1	0.416	0.752	0.261	0.29	0.222
q16	0.367	0.287	0.445	0.402	0.763	0.482	0.626	0.425	0.297	0.276	0.548	0.602	0.468	0.527	0.416	1	0.449	0.43	0.467	0.467
q17	0.266	0.15	0.263	0.291	0.48	0.238	0.319	0.163	0.324	0.194	0.272	0.254	0.184	0.245	0.752	0.449	1	0.261	0.224	0.256
q18	0.444	0.326	0.369	0.41	0.427	0.318	0.486	0.372	0.592	0.469	0.494	0.596	0.328	0.372	0.261	0.43	0.261	1	0.464	0.38
q19	0.397	0.415	0.369	0.452	0.465	0.623	0.395	0.323	0.301	0.314	0.389	0.363	0.696	0.681	0.29	0.467	0.224	0.464	1	0.663
q20	0.433	0.389	0.496	0.512	0.489	0.597	0.374	0.504	0.203	0.407	0.236	0.298	0.607	0.731	0.222	0.467	0.256	0.38	0.663	1

Table S2. Test and re-test results between T1 and T2.

	CIWAB score	**r**	**p-value**	**At t1[$]**	**At t2[$]**	**t2-t1[$]**	**p-value**	
All n=107	Total	0.81	0.000	1.05±0.62	0.97±0.61	-0.08±0.37	0.03	*
	F1	0.75	0.000	1.13±0.80	0.97±0.80	-0.16±0.53	0.002	
	F2	0.80	0.000	0.80±0.60	0.76±0.55	-0.04±0.35	0.21	
	F3	0.35	0.000	1.94±1.13	2.03±1.23	0.08±1.33	0.59	
Short Half-Life n=53	Total	0.83	0.000	1.05±0.62	0.96±0.62	-0.09±0.39	0.08	*
	F1	0.77	0.000	1.14±0.83	0.97±0.80	-0.17±0.57	0.03	
	F2	0.78	0.000	0.78±0.57	0.76±0.53	-0.02±0.35	0.67	*
	F3	0.40	0.003	2.07±1.16	1.92±1.22	-0.15±1.28	0.34	
Long Half-Life n=54	Total	0.81	0.000	1.04±0.62	0.98±0.6	-0.06±0.36	0.21	*
	F1	0.73	0.000	1.12±0.78	0.97±0.8	-0.16±0.49	0.02	*
	F2	0.81	0.000	0.81±0.63	0.75±0.57	-0.06±0.35	0.19	*
	F3	0.31	0.021	1.82±1.10	2.14±1.25	0.31±1.36	0.12	

r: Spearman correlation coefficient; t1 or t2: 1 or 2 weeks after start of tapering program

[$] mean ± SD

* Student test instead of Wilcoxon signed rank test

F1: irritability anxiety ; F2: physical symptoms; F3: sleep

Table S3. Correlation coefficients for Construct validity of the CIWA-B and its subscales

Variable	CIWA-B	r	P-value
SCL-90	Total	0.55	0.0000
	F1	0.46	0.0000
	F2	0.57	0.0000
	F3	0.26	0.0059
ISI	Total	0.38	0.0001
	F1	0.31	0.0011
	F2	0.36	0.0002
	F3	0.34	0.0004
MAAS	Total	-0.36	0.0002
	F1	-0.28	0.0031
	F2	-0.39	0.0000
	F3	-0.16	0.0914
AAQ-2	Total	-0.32	0.0007
	F1	-0.37	0.0001
	F2	-0.28	0.0037
	F3	-0.10	0.3091
COMPACT	Total	-0.35	0.0002
	F1	-0.35	0.0002
	F2	-0.36	0.0002
	F3	-0.14	0.1535

F1: irritabilityanxiety ; F2: physicalsymptoms ; F3: sleep
r: Spearman correlation coefficient