Alcohol 101 (2022) 9–16

Contents lists available at ScienceDirect

Alcohol

journal homepage: http://www.alcoholjournal.org/

Development of a 20-item questionnaire for drinking behavior pattern (DBP-20) toward personalized behavioral approaches for alcohol use disorder

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ARTICLE INFO

Article history:
Received 17 January 2021
Received in revised form
13 January 2022
Accepted 10 March 2022

Keywords:
Addiction
Alcohol use disorder
AUDIT
DBP-20
Drinking behavior
Drinking motives

ABSTRACT

Although screening tools are available for alcohol use disorders (AUD), such as the Alcohol Use Disorders Identification Test (AUDIT), these tools do not directly characterize individual drinking behavior for patients with AUD. Therefore, the aim of this study was to develop a new self-report questionnaire to identify the characteristics of drinking behavior patterns in patients with AUD.The study team developed a self-administered 20-item questionnaire for drinking behavior pattern (DBP-20) based on semi-structured interviews of patients with AUD. The DBP-20 and AUDIT were administered to 232 patients with AUD and 222 normal drinkers ($1 \leq$ AUDIT <20) as controls. Exploratory factor analysis of the DBP-20 was conducted for patients with AUD, followed by comparisons of its item and subscale scores between patients with AUD and controls. Correlations of AUDIT with total and subscale scores of the DBP-20 were also analyzed. Receiver operating characteristic (ROC) analyses for the DBP-20 and its subscales were performed to distinguish patients with AUD from controls.Exploratory factor analysis revealed a multidimensional 4-factor model of the DBP-20: coping with negative affect, automaticity, enhancement, and social use. Significant differences in DBP-20 total and subscale scores were observed for patients with AUD versus controls for all factors, except the social use subscale. Both the coping with negative affect and automaticity subscale scores as well as total DBP-20 scores were highly correlated with AUDIT scores. Total DBP-20 scores showed the greatest sensitivity, negative predictive value, and area under the ROC curve to distinguish patients with AUD from normal drinkers.Drinking as a means of coping with negative affect and automaticity may be specific for patients with AUD. DBP-20 may help patients with AUD to be aware of their own targeted problematic drinking behaviors and to seek their personalized behavioral approaches in a collaborative relationship with therapists.

Introduction

Alcohol use disorder (AUD) is one of the most prevalent mental disorders in the world (Rehm & Shield, 2019; World Health Organization, 2018). This disorder causes various types of physical and mental disability at considerable levels (Samokhvalov, Popova, Room, Ramonas, & Rehm, 2010) and is closely associated with high mortality through serious comorbid medical conditions such as heart disease, stroke, cancer, and liver cirrhosis (Schuckit, 2009; Schwarzinger, Thiébaut, Baillot, Mallet, & Rehm, 2017). Moreover, AUD can become a psychological and financial burden on the patient's family, friends, and coworkers, as well as the surrounding community and society at large (Greenfield, Karriker-Jaffe, Kaplan, Kerr, & Wilsnack, 2015; Lewis-Laietmark et al., 2017). Despite such harmful outcomes, the treatment rate for AUD is known to be unacceptably low (Hasin, Stinson, Ogburn, & Grant, 2007; Shield, Rehm, Rehm, Gmel, & Drummond, 2014).

AUD is a complex and multifaceted disorder from biological and behavioral perspectives. The pathogenesis of AUD has been proposed to result from complex interactions of genetic elements

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https://doi.org/10.1016/j.alcohol.2022.03.002

(Prescott & Kendler, 1999), environmental factors (Viken, Kaprio, Koskenvuo, & Rose, 1999), personality traits (Sher, Grukin, & Williams, 2005), and cognitive impairment as an outcome of AUD (Corral, Holguín, & Cadaveira, 2003). With regard to such pathogenetic heterogeneity, subtyping of cognitive and behavioral patterns and providing individualized treatment appears to be more of a necessity for patients with AUD. Although various subtypes of AUD (Babor et al., 1992; Cloninger, Bohman, & Sigvardsson et al., 1981; Jellinek, 1960; Lesch & Walter, 1996; Moss, Chen, & Yi, 2007) and tailored behavioral therapies for AUD (Leggio, Kenna, Fenton, Bonenfant, & Swift, 2009; Project MATCH Research Group, 1997) have been proposed based on clinical profiles, consensus on the subcategorization of AUD and the relevant approaches are still a matter of debate.

Cox and Klinger (1988) proposed the drinking motivation model, the concept of which is based on the assumption that people drink alcohol to seek and achieve some valuable outcome. Thereafter, Cooper (1994) developed the Drinking Motivation Questionnaire-Revised (DMQ-R) and proposed a 4-factor structure of the drinking motive model: *social*, *coping*, *enhancement*, and *conformity*. Although the latter provides a possible subtyping model for drinking behaviors, subsequent studies of this model have mainly targeted healthy adolescents (Hauck-Filho, Teixeira, & Cooper, 2012; Kuntsche, Stewart, & Cooper, 2008; MacLean & Lecci, 2000; Németh et al., 2011), whose behaviors may not necessarily fit the pathologic behaviors of clinical patients with AUD.

Addiction causes acute and long-term neuroadaptive changes, leading to a composite addiction cycle consisting of three stages: *binge/intoxication*, *withdrawal/negative affect*, and *preoccupation/anticipation* (Koob & Volkow, 2010). The early phase of addiction to alcohol is characterized by positive reinforcement and impulsivity, which are hypothetically mediated by both dopaminergic and opioidergic activity within the ventral striatum (Mitchell et al., 2012; Volkow, Fowler, & Wang, 2003). Thereafter, neuroadaptation to stress systems in the extended amygdala shifts the drinking motivation from positive to negative reinforcement, allowing individuals to drink alcohol for alleviation of negative emotional states (Koob, 2008; Koob & Kreek, 2007; Koob & Le Moal, 2005). Alcohol-associated stimuli contribute to automaticity and habit learning through dopaminergic and glutamatergic signaling in the dorsal striatum (George & Koob, 2017). These postulated neurochemical consequences affecting several neuronal networks are a reminder of the necessity of set shifting from goal-oriented behavior promoted by positive/negative reinforcement, to the habitual and automatic behavior behind the nature of the addictive drinking process (Everitt & Robbins, 2013).

Many studies have targeted patients with AUD for their behavioral analysis and have attempted to clarify the process of drinking behavior in patients with AUD based on various assessments, including the DMQ-R (Cooper, 1994), the Alcohol Abstinence Self-Efficacy scale (DiClemente, Carbonari, Montgomery, & Hughes, 1994), the Inventory of Drinking Situations (Annis, Graham, & Davis, 1987), the Amsterdam Motives for Drinking Scale (AMDS) (Ooteman, Koeter, Verheul, Schippers, & Van Den Brink, 2006), and the Alcohol Expectancy Questionnaire (AEQ) (Brown, Christiansen, & Goldman, 1987). However, these scales only deal with the aspects of goal-oriented drinking behavior, which cannot draw a full picture of addictive and pathological drinking behaviors in patients with AUD.

Recently, some researchers have developed new scales, focusing on habitual behaviors in patients with AUD, such as the UCLA Reward, Relief, and Habit Drinking Scale (Grodin et al., 2019) and the Habit, Reward, and Fear Scale (Piquet-Pessôa et al., 2019). These scales shed light on problematic changes in behaviors in patients with AUD, although the authors were rather interested in and paid their attention to the basic mechanisms of behavioral processes for general addiction, which were not necessarily applicable to clinically relevant behaviors of AUD.

To enhance the motivation for treatments of AUD, an adaptive coping strategy based on individualized behavioral analysis should be provided for patients with AUD. Initially, the screening process must identify individual behavior problems. Subsequently, understanding the personalized behavioral process of addiction to alcohol and planning for healthier behavior modification are the next steps for patients with AUD, which should be shared with therapists as a collaborative alliance. Although the Alcohol Use Disorders Identification Test (AUDIT) (Saunders, Aasland, Babor, de la Fuente, & Grant, 1993) is widely known as a screening tool for AUD patients, this scale does not directly lead to the description of individual drinking behaviors of AUD patients.

Therefore, we developed a 20-item self-report questionnaire, targeting clinical patients with AUD and summarizing actual drinking patterns in patients with AUD in the present study. To the best of our knowledge, no such experience/behavioral scales solely based on personal information from patients with AUD have been made to date. This study also focused on differences in drinking behaviors between patients with AUD and normal drinkers to reveal problematic drinking behavior patterns in patients with AUD.

Materials and methods

Participants and procedures

Before the development of DBP-20, the authors conducted a semistructured interview of patients with AUD using the KJ Method as a qualitative research strategy (Scupin, 1997). We asked 121 patients to participate in our study, and 100 patients agreed (82.6%). Participants for the interview were 100 patients with AUD (75 men/25 women, 27 outpatients/73 inpatients) who were assessed at the National Hospital Organization Ryukyu Hospital in outpatient and inpatient settings and were diagnosed with AUD according to the Diagnostic and Statistical Manual of Mental Disorders, 5th edition (DSM-5) criteria (American Psychiatric Association, 2013) during the period between August 2017 and December 2017. The mean age ±standard deviation was 47.9 ± 11.8 years. During the interview, narrative information on the past and current drinking patterns was collected from each patient. An interview guide with the following questions was used: (1) “What was the past reason for drinking when you started drinking? What were you drinking for?” and (2) “What is the current reason for drinking when you still continue drinking? What are you drinking for?” A one-on-one interview in a separate room was conducted for inpatients during their hospitalization and for outpatients at their regular visit to our clinic by one of the well-trained psychiatrists with a subspecialty in AUD diagnosis and treatment. We used an audio-recorder to collect narrative data from the interview. All participants’ responses to questions were collected and then sorted into various subcategories to extract drinking behavior characteristics of patients with AUD in a neutral and comprehensive manner using the KJ method as a qualitative research strategy (Scupin, 1997). We defined such multidimensional behaviors related to drinking motives and expectations for drinking as “drinking behavior patterns”. Based on the analyses of the semistructured interview, the research team developed the *self-administered 20-item questionnaire for drinking behavior pattern (DBP-20)*, focusing on the current setting for drinking and patterns of drinking behaviors (Figure 1A & B). We have discussed the data with five psychological experts to enhance reliability and credibility.

As the next procedure to test the validity of the DBP-20, we asked 258 patients to participate in our study, and 232 (89.9%) agreed to participate. Patients with AUD (187 men/45 women, 40 outpatients/192 inpatients), who visited the National Hospital Organization Ryukyu Hospital during the period between March 2018 and March 2020, were recruited. They were currently diagnosed with AUD according to the DSM-5 criteria (American Psychiatric Association, 2013) by two experienced psychiatrists. Their mean age and age range were 47.8 ± 11.6 years and 20–78 years as follows: 11 patients in their 20s; 50 patients in their 30s; 67 patients in their 40s; 71 patients in their 50s; 25 patients in their 60s; and eight patients in their 70s. The mean years of education were 11.9 ± 2.1. The mean AUDIT (Saunders et al., 1993) score was 27.2 ± 7.0 (Table 1). Regarding the coexistence of mood disorders, eight patients with AUD (3.4%) had major depressive disorder and three patients (1.3%) had bipolar disorder. Inpatients self-checked their drinking behavior by completing the DBP-20 in their rooms during hospitalization, whereas outpatients completed the form in a waiting room of the outpatient clinic at their first or regular visit.

As controls for comparison with the patients with AUD, 222 normal drinkers (177 men/45 women), who were closely age-, sex-, and education-matched with patients with AUD, were also recruited from participants in a local medical examination in November 2019. The DBP-20 was administered to healthy volunteers having AUDIT scores of 1–19; they were enrolled in the study and received an incentive of approximately $5. Their mean age and age range were 48.2 ± 14.0 years and 20–78 years as follows: 24 in their 20s; 48 in their 30s; 43 in their 40s; 46 in their 50s; 51 in their 60s; and 10 in their 70s. The mean years of education were 11.8 ± 2.1. The mean AUDIT score was 8.3 ± 4.7 (Table 1).

All study participants gave their written informed consent to voluntarily participate in the research. All data were anonymously treated during the study, and only coded and grouped data were used for analyses. An explanation for the purpose of the study, measures for protection of personal information, and the right to withdraw from the study were provided to each participant. The study protocol was approved by the Ethics Committee of University of the Ryukyus and the National Hospital Organization Ryukyu Hospital.

Measures

In the present study, we used the Japanese version of the DBP-20 (Fig. 1B). This original version of the DBP-20 was then translated into English (Fig. 1A) and was again back-translated into Japanese by two native speakers for both English and Japanese, followed by confirmation from all the authors.

The 20 items on the measure were: 1) stress, 2) escape from reality, 3) sadness, 4) anxiety, 5) irritable mood, 6) unpleasant events, 7) combined activity, 8) free time, 9) social communication, 10) encouragement, 11) seeking stimulation, 12) desperation, 13) easy access, 14) preference, 15) scheduled time, 16) loss of self-control, 17) isolated situation, 18) togetherness, 19) unknown reason, and 20) natural behavior (Table 2). Each item of the DBP-20 was scored using 4-scale steps by the frequency of each behavior pattern as follows: 0 = never; 1 = only occasionally; 2 = often; 3 = almost always.

For comparison of drinking behavior between alcoholic and nonalcoholic individuals, the DBP-20 and AUDIT were administered to 232 patients with AUD and to 222 controls. Exploratory factor analysis of the DBP-20 was conducted to find behavioral clusters for alcohol drinking in the 232 patients with AUD. To examine the validity of the newly developed DBP-20, the method of comparing it with other questionnaires such as DNQ-R, AEQ, and AMDS was initially considered, but none of them was standardized in Japanese. Therefore, in this study, correlation of the DBP-20 with the established AUDIT was examined instead in the overall participants.

Statistical analyses

The Mann–Whitney *U* test was used for group comparison of such background characteristics as age, education, and the AUDIT scores between alcoholic and nonalcoholic participants, except for sex distribution, which was analyzed using the chi-square test. The factor structure of the DBP-20 was examined using exploratory factor analysis after Promax rotation. To determine the number of factors to retain in the final model, evaluating for Eigenvalues above 1 was used. Items loading at least 0.50 were kept for analysis in the model. Items with loadings on ≥2 factors were removed, and analyses were repeated until all items strongly loaded on a single factor. The Cronbach's alpha coefficient was used to assess internal consistency. Total, subscale, and item scores of the DBP-20 were compared between patients with AUD and control by using the Mann–Whitney *U* test. Correlation between the DBP-20 and AUDIT was examined for participants overall using Spearman rank correlation. Receiver operating characteristic (ROC) analyses for the DBP-20 and its subscales were performed to distinguish patients with AUD from controls. A two-tailed p value < 0.05 was regarded as statistically significant. All statistical analyses were performed using SPSS 16.0 J for Windows (SPSS Japan; Tokyo, Japan).

Results

Exploratory factor analysis of the DBP-20

Four distinct components of the DBP-20 were extracted from exploratory factor analysis (Table 2) as follows: *coping with negative affect*, which comprised anxiety, unpleasant event, escape from reality, irritable mood, stress, sadness, desperation (Cronbach's α,

Table 1
Demographics of patients with alcohol use disorders (AUD) and healthy controls.

	AUD (n = 232)	Controls (n = 222)	p value
Age (years)	47.8 ± 11.6	48.2 ± 14.0	$p = 0.548$
Sex[a] [n (%)]			
Male	187 (80.6)	177 (79.7)	
Female	45 (19.4)	45 (20.3)	$p = 0.906$
Education (years)	11.9 ± 2.1	11.8 ± 2.1	$p = 0.694$
AUDIT (Total score)	27.2 ± 7.0	8.3 ± 4.7	$p < 0.001$
Hazardous alcohol use (Q1 ~ Q3)	10.9 ± 1.8	6.0 ± 2.8	$p<0.001$
Dependence symptoms (Q4 ~ Q6)	6.3 ± 3.9	0.5 ± 0.9	$p<0.001$
Harmful alcohol use (Q7 ~ Q10)	10.1 ± 3.2	1.8 ± 2.3	$p<0.001$

AUDIT: Alcohol Use Disorders Identification Test. Values except for sex are expressed as mean ± S.D.
[a] Chi-square test is used for testing group differences.
The Mann–Whitney *U* test was used for comparison of age (years) and education (years) as well as the total and subscale scores of the AUDIT. p value less than 0.05 is considered significant.

A * Names of the items and footnotes need to be withdrawn for clinical use.

The 20-item questionnaire for assessment of drinking behavior pattern : DBP-20

"How frequent do you feel like drinking alcohol under the following conditions?"

0: never
1: only occasionally
2: often
3: almost always

1. Stress :	"I drink when I feel stress"	0	1	2	3
2. Escape from reality :	"I drink when I want to escape from reality"	0	1	2	3
3. Sadness :	"I drink when I am sad"	0	1	2	3
4. Anxiety :	"I drink when I am anxious"	0	1	2	3
5. Irritable mood :	"I drink when I am irritable"	0	1	2	3
6. Unpleasant events :	"I drink after I experienced unpleasant events"	0	1	2	3
7. Combined activity :	"I drink while being amused with my hobby"	0	1	2	3
8. Free time :	"I drink when I have nothing to do"	0	1	2	3
9. Social communication :	"I drink when I communicate with others"	0	1	2	3
10. Encouragement :	"I drink to increase my motivation"	0	1	2	3
11. Seeking stimulation :	"I drink to seek something stimulating"	0	1	2	3
12. Desperation :	"I drink when I am desperate"	0	1	2	3
13. Easy access :	"I drink if I easily get alcohol around myself"	0	1	2	3
14. Preference :	"I drink if I have my favorite alcohol beverage"	0	1	2	3
15. Scheduled time :	"I habitually drink around the fixed time"	0	1	2	3
16. Loss of self-control :	"I drink because I cannot stop drinking by myself"	0	1	2	3
17. Isolated situation :	"I drink when I am alone"	0	1	2	3
18. Togetherness :	"I drink when I am with someone such as my family or friends"	0	1	2	3
19. Unknown reason :	"I drink alcohol for no reason"	0	1	2	3
20. Natural behavior :	"It is natural for me to drink alcohol"	0	1	2	3

B * 臨床使用の際は、項目名および脚注を除く。

飲酒行動パターンの自記式評価表：DBP-20

「あなたはどんな状況においてお酒を飲みますか？」

0: まったくない
1: たまにそうなる
2: しばしばそうなる
3: いつもそうである

1. ストレス :	ストレスを感じた時に飲む。	0	1	2	3
2. 現実逃避 :	現実から逃げたい時に飲む。	0	1	2	3
3. 悲しみ :	悲しい時は飲む。	0	1	2	3
4. 不安 :	不安な時に飲む。	0	1	2	3
5. イライラ感 :	イライラした時は飲む。	0	1	2	3
6. 嫌な出来事 :	嫌なことがあると飲む。	0	1	2	3
7. 付帯行為 :	趣味の活動をしながら飲んでいる。	0	1	2	3
8. 空き時間 :	何もすることがないと飲んでしまう。	0	1	2	3
9. 社交 :	人とコミュニケーションする際に飲む。	0	1	2	3
10. 気分高揚 :	やる気を出したい時に飲む。	0	1	2	3
11. 刺激希求 :	何か刺激が欲しい時に飲む。	0	1	2	3
12. 自暴自棄 :	投げやりになっている時に飲む。	0	1	2	3
13. 易アクセス性 :	身近にお酒があれば飲んでしまう。	0	1	2	3
14. 嗜好 :	気に入ったお酒があると飲みたくなる。	0	1	2	3
15. 決まった時間 :	いつも決まった時間になると飲んでいる。	0	1	2	3
16. 制御不能 :	自分では止められなくて飲んでいる。	0	1	2	3
17. 孤立した状況 :	一人でいると飲んでしまう。	0	1	2	3
18. 連帯 :	家族や友人など誰かと一緒の時に飲む。	0	1	2	3
19. 理由不詳 :	何となく飲んでしまう。	0	1	2	3
20. 自明な行為 :	飲むのが当たり前と思っている。	0	1	2	3

Fig. 1. A. The 20-item questionnaire for assessment of drinking behavior pattern (DBP-20) in English. B. The 20-item questionnaire for assessment of drinking behavior pattern (DBP-20) in Japanese.

Table 2
Exploratory factor analysis of the 20-item questionnaire for assessment of drinking behavior pattern (DBP-20) in 232 patients with alcohol use disorders.

Item	Factor 1	Factor 2	Factor 3	Factor 4
Coping with negative affect (Cronbach's α=.913)				
Anxiety	**.876**	-0.153	0.037	-0.046
Unpleasant events	**.822**	0.019	0.022	-0.006
Escape from reality	**.821**	0.003	-0.011	-0.013
Irritable mood	**.767**	0.042	-0.058	0.060
Stress	**.763**	0.108	-0.076	-0.030
Sadness	**.753**	-0.085	0.091	0.059
Desperation	**.522**	0.227	0.042	0.009
Automaticity (Cronbach's α=.868)				
Unknown reason	-0.077	**.767**	-0.090	-0.008
Easy access	-0.022	**.759**	0.129	-0.014
Isolated situation	0.076	**.748**	-0.052	-0.137
Loss of self-control	0.004	**.698**	-0.028	-0.092
Natural behavior	0.073	**.696**	-0.092	0.099
Preference	-0.107	**.585**	0.131	0.107
Free time	0.046	**.562**	0.132	-0.034
Scheduled time	0.020	**.528**	-0.062	0.111
Enhancement (Cronbach's α=.719)				
Encouragement	0.019	-0.080	**.838**	-0.099
Seeking stimulation	0.060	0.021	**.585**	0.058
Combined activity	-0.032	0.047	**.582**	0.095
Social use (Cronbach's α=.687)				
Togetherness	0.022	-0.059	-0.069	**.919**
Social communication	-0.011	0.100	0.159	**.522**

0.913); *automaticity*, which comprised unknown reason, easy access, isolated situation, loss of self-control, natural behavior, preference, free time, and scheduled time (Cronbach's α, 0.868); *enhancement*, which comprised encouragement, seeking stimulation, combined activity (Cronbach's α, 0.719); and *social use*, which comprised togetherness and social communication (Cronbach's α, 0.687).

Comparison of the DBP-20 scores between patients with AUD and controls.

Total, subscale, and item scores of the DBP-20 were compared between patients with AUD and controls (Table 3). Patients with AUD versus controls had higher total scores (31.1 ± 12.4 vs. 10.0 ± 7.5; $p < 0.001$); coping with negative affect (11.3 ± 6.0 vs. 2.5 ± 3.3; $p < 0.001$); automaticity (13.6 ± 6.1 vs. 3.5 ± 4.1; $p < 0.001$); and enhancement (3.1 ± 2.4 vs. 0.9 ± 1.3; $p < 0.001$). No significant differences between patients with AUD versus controls were found for the subscale and item scores for social use (3.1 ± 1.7 vs. 3.1 ± 1.7; $p = 0.919$).

Convergent validity

Correlations between the AUDIT score and total/subscale scores of the DBP-20 are shown in Fig. 2. Total scores (rs = 0.751; $p < 0.001$) and subscale scores of *coping with negative affect* (rs = 0.684; $p < 0.001$) and *automaticity* (rs = 0.728; $p < 0.001$) were strongly correlated with the AUDIT score. Subscale score for *enhancement* only showed a moderate correlation with the AUDIT score (rs = 0.491; $p < 0.001$), whereas no significant correlation was found between the social use subscale score and the AUDIT score.

Accuracy to distinguish patients with AUD from normal drinkers

Usefulness of total and subscale scores of the DBP-20 for screening patients with AUD was examined by ROC analysis. As a result, total DBP-20 scores distinguished patients with AUD from controls with the greatest sensitivity (0.897), negative predictive value (0.882), and area under the ROC curve (0.924) at the cut-off of 16 (Fig. 3 & Table 4).

Table 3
Comparison of average scores in the 20-item questionnaire for assessment of drinking behavior pattern (DBP-20) between patients with alcohol use disorders (AUD) and healthy controls.

	AUD (n = 233) (mean ± SD)	Controls (n = 227) (mean ± SD)	*p* value
Total score	31.1 ± 12.4	10.0 ± 7.5	<0.001
Coping with negative affect	11.3 ± 6.0	2.5 ± 3.3	<0.001
Anxiety	1.6 ± 1.0	0.3 ± 0.6	<0.001
Unpleasant events	1.7 ± 1.0	0.4 ± 0.7	<0.001
Escape from reality	1.6 ± 1.1	0.3 ± 0.6	<0.001
Irritable mood	1.7 ± 1.1	0.5 ± 0.7	<0.001
Stress	1.8 ± 0.9	0.6 ± 0.7	<0.001
Sadness	1.4 ± 1.1	0.3 ± 0.5	<0.001
Desperation	1.5 ± 1.1	0.1 ± 0.4	<0.001
Automaticity	13.6 ± 6.1	3.5 ± 4.1	<0.001
Unknown reason	1.7 ± 1.0	0.6 ± 0.8	<0.001
Easy access	1.8 ± 1.0	0.4 ± 0.7	<0.001
Isolated situation	2.0 ± 1.0	0.4 ± 0.7	<0.001
Loss of self-control	1.8 ± 1.0	0.1 ± 0.4	<0.001
Natural behavior	1.4 ± 1.2	0.4 ± 0.9	<0.001
Preference	1.6 ± 1.1	0.6 ± 0.9	<0.001
Free time	1.7 ± 1.1	0.3 ± 0.7	<0.001
Scheduled time	1.6 ± 1.1	0.6 ± 1.0	<0.001
Enhancement	3.1 ± 2.4	0.9 ± 1.3	<0.001
Encouragement	1.0 ± 1.0	0.3 ± 0.6	<0.001
Seeking stimulation	0.9 ± 0.9	0.2 ± 0.5	<0.001
Combined activity	1.2 ± 1.0	0.4 ± 0.7	<0.001
Social use	3.1 ± 1.7	3.1 ± 1.7	0.869
Togetherness	1.4 ± 1.0	1.5 ± 1.0	0.560
Social communication	1.7 ± 1.0	1.7 ± 0.9	0.727

Discussion

The newly developed DBP-20 was essentially based on narrative self-reports of drinking behaviors from patients with AUD.

An exploratory factor analysis of DBP-20 revealed a 4-factor model of drinking behavior pattern: coping with negative affect, automaticity, enhancement, and social use (Table 2).

The DBP-20 extracted and categorized four types of characteristic drinking behaviors of AUD patients, although the Cronbach α of enhancement or social use was relatively low. Thus, the internal consistency for these two categories is controversial and must be carefully considered for the clinical implications of DBP-20.

Among these clusters, coping with negative affect, enhancement, and social use are overlapped with the factor structuring of the DMQ-R based on data from healthy volunteers (Cooper, 1994). Thus, these elements may be generalized as common drinking behavior patterns in both patients with AUD and nonalcoholic individuals. Especially, the mean score for social use of DBP-20 in AUD patients was almost similar to that of healthy controls (Table 3), suggesting that social use may not be pathologic drinking. In contrast, the automaticity factor appears to be the most characteristic factor of AUD and is probably alien to usual drinking behavior in nonalcoholic healthy individuals (Tables 3 and 4).

Verplanken and Orbell (2003) developed the Self-Report Habit Index (SRHI) and proposed that automaticity was included as an important element of the basic habit model. These same authors defined *automaticity* as habitual behaviors lacking control and consciousness but equipped with efficiency. Piquet-Pessôa et al. (2019) applied SRHI to clinical patients with AUD and further developed the Habit, Reward, and Fear Scale, suggesting that drinking behaviors with habituality, unconsciousness, and automaticity were predominantly observed in patients with AUD. Moors and De Houwer (2006) also reported that the automaticity was characterized by multiple components, the nature of which were essentially unintentional, uncontrollable, goal-independent, autonomous, purely stimulus-driven, unconscious, efficient, and fast.

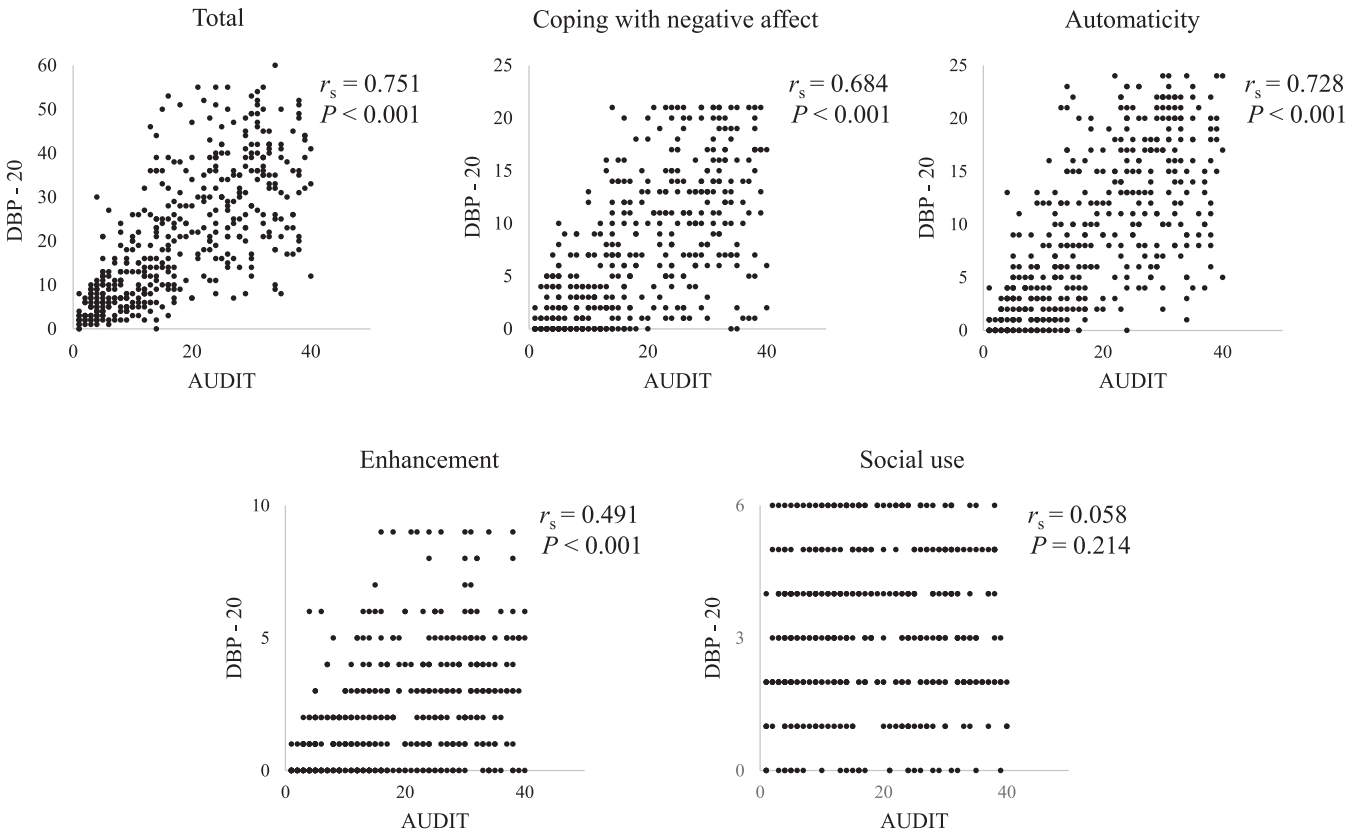

Fig. 2. Correlations between Alcohol Use Disorders Identification Test (AUDIT) scores and total/subscale scores of the 20-item questionnaire for assessment of drinking behavior pattern (DBP-20).

The automaticity subscales of the DBP-20 comprised eight items: unknown reason, easy access, isolated situation, loss of self-control, natural behavior, preference, free time, and scheduled time. Interestingly, these items accord well with previously described elements of habitual behaviors (Moors & De Houwer, 2006), as well as the process proposed by Koob and Volkow's theory on the neurocircuitry of addiction (Koob & Volkow, 2010). In addition, a large discrepancy in the automaticity subscale scores between the AUD and control groups (Table 3) and a close correlation between the automaticity cluster of the DBP-20 and the AUDIT (Fig. 2) may also support a specific role of automaticity in drinking behaviors of AUD. These results suggest that automaticity should be highlighted as the main treatment target for behavioral modification and environmental rearrangement in clinical patients with AUD.

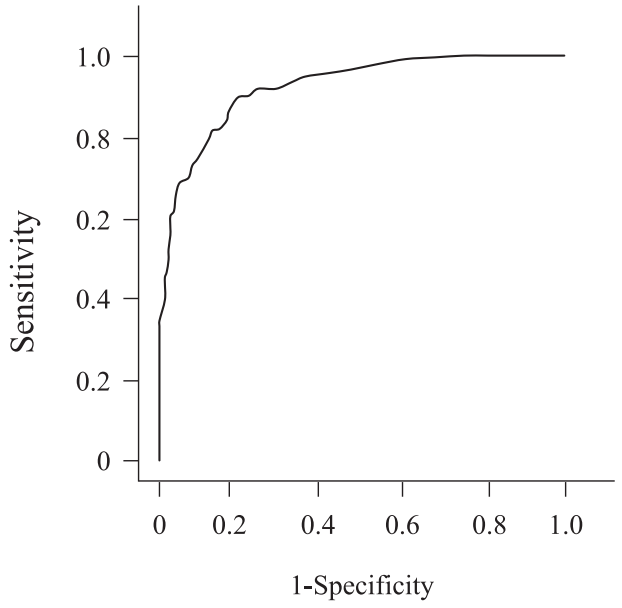

Fig. 3. Receiver operating characteristic (ROC) curve distinguishing alcohol use disorders by total scores of the 20-item questionnaire for assessment of drinking behavior pattern (DBP-20). Area under the curve = 0.924.

Other than the automaticity cluster, subscale scores of coping with negative affect and enhancement were also greater in patients with AUD than in nonalcoholic controls (Table 3) and were well correlated with the AUDIT score (Fig. 2). It has been suggested that patients with AUD are more dependent on alcohol use to cope with negative affect than healthy individuals (Carpenter & Hasin, 1998). Furthermore, Cooper (1994) described that drinking style excessively related to coping with negative affect and enhanced motives may positively predict heavy and problematic drinking in the future. Thus, clinicians and patients should be aware that alcohol use as a remedy to ease psychological pain, thus serving as a rationalized motivation enhancer may be easily repeated and eventually become addictive.

AUD is often mistakenly seen as a moral and personal failing (Peluso Ede & Blay, 2008), and stigma against AUD is still a serious issue among the general population (Schomerus, Corrigan, et al., 2011). Several studies have stressed that the stigma against AUD devalues self-efficacy of patients with AUD and reduces the chances of treatment success (Probst, Manthey, Martinez, & Rehm, 2015; Schomerus, Lucht, et al., 2011). This effect may be partly because

Table 4
Results of receiver-operator characteristic (ROC) analyses using total and subscale scores of the 20-item questionnaire for assessment of drinking behavior pattern (DBP-20) for screening of alcohol use disorder.

	Cut-off	Sensitivity	Specificity	PPV	NPV	Youden Index	+ LR	− LR	AUC of ROC
Total	16	0.897	0.806	0.829	0.882	0.694	4.42	0.129	0.924
Coping with negative affect	6	0.806	0.833	0.835	0.804	0.630	4.58	0.235	0.898
Automaticity	7	0.841	0.829	0.837	0.833	0.660	4.65	0.194	0.911
Enhancement	3	0.586	0.887	0.844	0.672	0.471	5.10	0.468	0.781
Social use	5	0.263	0.793	0.570	0.507	0.056	1.27	0.929	0.497

PPV, positive predictive value; NPV, negative predictive value; + LR, positive likelihood ratio; − LR, negative likelihood ratio; AUC, Area Under the Curve. The best cut-off was determined by the maximal Youden index.

the behavioral aspects of automaticity are plausibly far beyond understanding for the nonalcoholic population. However, automaticity is nothing less than a reality in habitual alcohol users (Table 3), and these individuals should not be accused of having abandoned behavioral control or of attempting to escape consequences of their behavior. Understanding the progressive process of automaticity may rather help in seeking better solutions toward behavior modification and environmental rearrangement for therapeutic aspects.

In recent years, the importance of individualized treatment for AUD has been increasingly emphasized (Campbell, Lawrence, & Perry, 2018; Litten et al., 2015). By recognizing behavioral patterns and inducible situations for drinking, patients with AUD may be more aware of hidden risks within their daily lives and be more highly motivated to acquire protective behavior to avoid drinking. Also, patients eventually will know their own targeted behaviors by answering the DBP-20 items for themselves and then trying to share their problems and solutions in a collaborative relationship with therapists.

The AUDIT functions as a screening of problematic drinking to reveal the fact-based hazardous alcohol use, dependence symptoms, and harmful alcohol use (Saunders et al., 1993). In contrast, the DBP-20 is a behavior-oriented assessment tool, widely covering the common motives for drinking and risky behaviors leading to AUD. However, the present study clearly showed a strong relationship between the AUDIT and the DBP-20 (Fig. 2). Moreover, total DBP-20 scores were an excellent tool to distinguish patients with AUD from nonalcoholic individuals (cut-off score $\geq$16), with high sensitivity (0.897) and sufficient negative predictive value (0.882) (Fig. 3 & Table 4). These findings suggest that the DBP-20 is useful in distinguishing problematic drinking behaviors in AUD from normal drinking patterns in healthy individuals. In addition, the feedback of drinking behavior profiles with high scores in the DBP-20 may be beneficial for patients with AUD to obtain efficient self-monitoring of their behavior and enhanced motives for healthier adaptation without alcohol use. The DBP-20 can also be used as a screening tool for high-risk alcohol users with problematic drinking behaviors among the general population, e.g., in regular health check-up settings.

It is important to note that this research is still preliminary and has some limitations. First, the results were obtained from a relatively small number of Japanese participants. Second, the DBP-20 may not be used as a diagnostic tool for AUD because it only deals with behavioral aspects of alcohol drinking and covers a wide range of drinking behaviors from normal to pathologic levels. Third, self-bias (denial and underestimation) cannot be entirely ruled out because the DBP-20 is basically a self-evaluation scale. Fourth, the credibility and effectiveness of the English version of DBP-20 has not yet been justified in other ethnic groups. Therefore, the DBP-20 factor model needs further review in future studies with a larger number of participants as well as for individuals with different ethnicities and languages.

Conclusions

Drinking as coping with negative affect and automaticity may be specific for patients with AUD. The DBP-20 appears to be helpful in assessing problematic drinking behavior patterns together with planning of personalized behavioral approaches for patients with AUD.

Author contributions

Kazuhiro Kurihara, Hotaka Shinzato, Munenaga Koda, Hiroyuki Enoki, Taku Otsuru, Yoshikazu Takaesu, and Tsuyoshi Kondo designed the study, wrote the protocol, undertook the statistical analyses, and wrote the manuscript. Kazuhiro Kurihara, Hotaka Shinzato, and Tsuyoshi Kondo collected the data and verified the manuscript. Tsuyoshi Kondo raised the funding sources. All the authors have sufficiently contributed to the manuscript and have approved this submission.

Role of funding sources

This study was supported by JSPS KAKENHI (grant number JP17K10311, JP21K07504). The funders had no role in study design, data collection, analysis, writing of the manuscript, or decision to publish.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Acknowledgments

The authors would like to thank Enago (www.enago.jp) for the English language review.

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