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Psychometric Validation of the Brief Alcohol Social Density Assessment in an Adult Community Sample

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Abstract

Background: Individuals' social networks exert a strong influence on alcohol use, but valid assessment of network drinking behavior is typically lengthy and high in participant burden. The aim of this study was to validate the Brief Alcohol Social Density Assessment (BASDA), an efficient measure of perceived alcohol use within a person's social network, in a sample of adult drinkers from the general community. Specifically, the convergent, criterion-related, incremental validity and internal validity were investigated by examining the BASDA in relation to other established measures of drinking motives, weekly drinking level, and severity of involvement.

Methods: Participants were 903 (56% female) adults who reported drinking in the last year and who completed the BASDA, the Drinking Motives Questionnaire, the Daily Drinking Questionnaire, and the Alcohol Use Disorders Identification Test (AUDIT).

Results: Significant positive correlations were found between the BASDA and drinking motives, drinking quantity, and the AUDIT ($r_s = 0.21$ to 0.51 , $p_s < 0.001$), providing support for convergent validity. There was a significantly higher BASDA score for those scoring at or above an AUDIT cutoff for hazardous drinking ($p < 0.001$), providing support for criterion-related validity. Finally, beyond motives and covariates, the BASDA was significantly associated with total AUDIT score ($R^2 = 0.09$, $p < 0.001$), indicating its additive contribution and providing support for incremental validity. Confirmatory factor analysis revealed excellent fit, and all items significantly loaded onto a single factor ($p < 0.0001$), providing evidence of internal validity. The resulting alcohol social

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CONFLICT OF INTEREST

JM is a senior scientist and principal in BEAM Diagnostics, Inc. There are no other conflicts of interest to declare.

SUPPORTING INFORMATION

Additional supporting information may be found online in the Supporting Information section at the end of the article.

density latent variable was significantly and robustly associated with drinks per week and AUDIT total score.

Conclusions: These findings provide further support for the BASDA as a valid and efficient measure of social network alcohol density for understanding social influences on alcohol misuse.

Keywords

Alcohol; Alcohol Misuse; Social Density; Social Network Analysis; Motives

DESPITE THE SHORT - and long-term effects of alcohol misuse, approximately 20% of Canadians who drink alcohol exceed the Canadian Low-Risk Alcohol Drinking Guidelines (i.e., >15 drinks a week for males, >10 drinks a week for females; Canadian Centre on Substance Use and Addiction, 2018). Alcohol use disorder (AUD) is the most common substance use disorder in Canada, with a lifetime prevalence of 18.1% (Pearson et al., 2013). Beyond excessive alcohol consumption and AUD, alcohol use itself is a major risk factor for a multitude of chronic health risks (Shield et al., 2017).

Contemporary biopsychosocial approaches to alcohol misuse (e.g., MacKillop and Ray, 2017) emphasize multifarious motivational influences, including social influences and an individual's social network in particular. Indeed, many studies show the strong effect of social influences on alcohol use (Bank et al., 1985; Bullers et al., 2001; Galea et al., 2004; Prescott and Kendler, 1999; Stout et al., 2012). Formal social network analysis (SNA) refers to a robust methodological framework to systematically identify interrelationships within a person's social network (Borgatti et al., 2009). SNA is particularly important in studying addiction (Christakis and Fowler, 2008), in part due to the intrinsic social qualities of substance use. While a relatively new methodology, SNA for substance use behaviors is a growing field. For example, 1 study, conducted by Rosenquist and colleagues (2010), observed a 50% increase in heavy drinking patterns in individuals who were directly connected to another heavy drinker. This influence on drinking behavior continued up to 3 degrees apart from the individual; however, the further away the social network member was, the smaller the association was (Rosenquist et al., 2010). In an earlier study, applying SNA in an adolescent population, Ennett and colleagues (2006) observed 3 factors significantly associated with individual substance use. Specifically, increased social proximity to peers using substances, less embeddedness in the network, and higher social status were positively associated with substance use. In a clinical example, if an individual's social network contains at least 1 drinker, the risk of relapse increases significantly (Havassy et al., 1991). In these examples, networks appear to exert a powerful influence on the individual, whereby the individual modifies their drinking behavior approach to that of her close social associates (Snijders et al., 2017). This may reflect modeling behavior, the added reinforcing properties of substance use in a social context, or the interaction of the 2.

Despite its relevance, the application of SNA to alcohol misuse remains relatively uncommon. A likely contributor to this may be the assessment burden and atypical analytic requirements (Ben itez-Andrades et al., 2018). For example, formal egocentric SNA involves collecting detailed information from a focal individual about numerous relationships at various levels of influence (i.e., friends, family, and neighbors), as well as the

interrelatedness of each of the members in the network. Therefore, applying SNA to an individual's extended relationships requires extensive measurement and can be highly time consuming.

To address these methodological challenges, studies have investigated the validity of shorter, more efficient measures. For example, the Important People Instrument-5 (IP-5; Hallgren and Barnett, 2016) was recently adapted from the longer version, the Important People Instrument (IP; Longabaugh et al., 2010). While the IP-5 was intended to attenuate the completion time by half, it still includes 65 questions, which may potentially pose a time constraint when used in a clinical battery. Furthermore, to our knowledge, this instrument has only been validated in a sample of college students (Hallgren and Barnett, 2016).

Another brief measure of social density (i.e., the number of interpersonal connections a person has within their closest social circle) was adapted from traditional SNA to assess the relationship between an individual's social groups and smoking, drinking, and gambling behaviors (Fortune et al., 2013). In a sample of 128 frequent gamblers, Fortune and colleagues (2013) found significant positive associations between network density and severity of all 3 behaviors. With respect to alcohol, level of drinking was estimated for the 5 closest social associates using the Alcohol Use Disorders Identification Test-C (AUDIT-C; Bush et al., 1998) items for that individual. Subsequently, the subset of items related to alcohol, known as the Brief Alcohol Social Density Assessment (BASDA), was validated in a population of university student drinkers against other well-validated measures of drinking (MacKillop et al., 2013). Notably, MacKillop and colleagues (2013) pared the BASDA down further to probe only one's 4 closest associates. In this case, the BASDA demonstrated excellent convergent, criterion-related, and incremental validity compared with other well-validated measures of drinking. Collectively, these initial findings suggest that the BASDA may validly measure the density of alcohol use in a person's proximal social network.

Beyond the 2 studies previously validating the BASDA in samples of gamblers and university student drinkers, the current study sought to validate the BASDA further in a sample of adults recruited from the general community. This subsequent validation study was intended to address the generalizability of the measure to a general population sample, to assess whether the BASDA is applicable in a variety of contexts. Specifically, the aim of the study was to validate the BASDA in 4 ways: (i) to assess convergent validity (i.e., the degree to which constructs that are expected to be related are in fact related; Cunningham et al. 2001) by examining the relationship of the BASDA to social motives for drinking; (ii) to determine criterion-related validity (i.e., how well 1 measure is related to an outcome; Jenkinson et al. 1994) by assessing the relationship between the mean BASDA score and individual scoring at or above a hazardous drinking cutoff score on the validated AUDIT (Babor et al., 1992); (iii) to examine incremental validity (i.e., whether a new measure increases the predictive ability above and beyond established predictors of an outcome; Haynes and Lench 2003) by exploring whether the BASDA predicts drinking severity above and beyond drinking quantity and drinking motives; and (iv) to assess internal validity (i.e., whether the anticipated factor structure is present; Kayes 2005) by examining the unidimensional factor structure of the BASDA using confirmatory factor analysis (CFA), and subsequently using the single latent construct to assess the relationship with the Daily

Drinking Questionnaire (DDQ) and AUDIT. The rationale for selecting drinking motives in relation to the BASDA was 2-fold. First, within the current literature, drinking motives have been well documented as determinants of drinking (Kuntsche et al., 2005; Lyvers et al., 2010). Second, social motives are conceptually associated with alcohol-related social density; people who report drinking to enhance social experiences would logically be expected to have denser alcohol-related social networks. Establishing the validity of the BASDA in the context of drinking motives and other established measures of alcohol involvement in a community sample of adult drinkers for the first time would substantively advance the psychometric validation of the measure.

MATERIALS AND METHODS

Participants

The data used in this analysis are from the Peter Boris Centre for Addiction Research's research registry, a cohort of adults (18 to 65) from the greater Hamilton, Ontario area. Eligibility to join the registry was based on age and at least ninth-grade education (to ensure adequate literacy). For the current study, only participants who reported alcohol use over the last year were included ($n = 903$). See Table 1 for demographic information.

Assessments

AUDIT.—The AUDIT, developed by the World Health Organization, is a 10-item screening tool designed to assess alcohol use severity. The items are divided into 3 categories, alcohol intake (items 1 to 3), alcohol dependence (items 4 to 6), and adverse consequences (items 7 to 10), with a total score range from 0 to 40. It is a well-validated measure with an empirically supported cutoff score of 8 that has been associated with hazardous drinking behavior (Babor et al., 1992). The measure demonstrated excellent internal reliability ($\alpha = 0.93$) in the sample.

Drinking Motives Questionnaire (DMQ).—The DMQ (Cooper, 1994) is a 20-item questionnaire designed to assess drinking frequency across 4 different motives: enhancement (e.g., “how often do you drink because you like the feeling?”), coping (e.g., “how often do you drink to forget your worries?”), social (e.g., “how often do you drink because it makes social gatherings more fun?”), and conformity (e.g., “how often do you drink to fit in with a group you like?”). Each question refers to all the times the individual has consumed alcohol, asking them to indicate how often they drink for each motive. The items are on a 5-point scale, ranging from 1 (never) to 5 (almost always), with a total score range from 1 to 100. The scale demonstrated good internal reliability ($\alpha = 0.82$) as well as for each subscale: social motives ($\alpha = 0.73$), coping motives ($\alpha = 0.77$), enhancement motives ($\alpha = 0.74$), and conformity motives ($\alpha = 0.83$) in the sample.

DDQ.—The DDQ (Collins et al., 1985) measures the amount and frequency of alcohol use per week. Number of standard drinks typically consumed on each day of the week is assessed, permitting calculation of total average weekly consumption.

BASDA.—The BASDA (Fortune et al., 2013) measures estimated alcohol consumption in the individual's 4 closest nonbiological relationships. It begins with the closest relationship in the social network of the individual, followed by the second, third, and fourth closest relationship. For each person in the network, the respondent is asked 5 questions. The first 3 are the AUDIT quantity-frequency items (AUDIT-C) that have been established as measures of alcohol quantity frequency (Bush et al., 1998): "How often does this person have a drink containing alcohol?" (0 = never, 4 = 4 times per week), "How many drinks containing alcohol does this person have on a typical day when they are drinking?" (0 = 1 or 2, 4 = 10 or more), and "How often does this person have six or more drinks on one occasion?" (0 = never, 4 = daily or almost daily). The final questions ask the gender and the type of relationship (spouse/significant other or friend) for each individual in the network. The sum of the first 3 items for each close relationship is calculated separately and then added together to reflect a total BASDA score.

Data Analysis

To assess convergent validity (i.e., assessing the degree to which constructs that are expected to be related are in fact related; Cunningham et al. (2001)), we used Pearson *r* correlations to measure the linear associations between the BASDA total score, the DDQ total score, the AUDIT total score, and all of the DMQ subscales individually. Subsequently, we used a multiple regression analysis to determine the independent contributions of each subscale of the DMQ to the overall variance in the BASDA total score. To examine criterion-related validity (i.e., assessing how well 1 measure is related to an outcome; Jenkinson et al. (1994)), we applied a 1-way ANCOVA to determine whether the mean BASDA score was significantly different for subjects scoring above or below an AUDIT hazardous drinking cutoff score, controlling for both gender and age. Next, we used a multiple regression analysis to assess incremental validity (i.e., assessing whether a new measure will increase the predictive ability above and beyond an existing measure; Haynes and Lench (2003)), with the DMQ subscales, gender, and age, entered in the first block, and the BASDA total score entered in the second block. The AUDIT total score served as the dependent variable. The DDQ was not included in the model, as the AUDIT contains questions regarding drinking frequency. The change in R^2 was examined after adding the BASDA total score to the regression model to determine the incremental value of adding the BASDA to the model. Finally, to assess the internal validity of the BASDA, we conducted a CFA using structural equation modeling (SEM) in Mplus 7.3 (Muthén & Muthén, Los Angeles, CA; Muthén and Muthén, 1998, 2014). The arithmetic mean of the items for each of the 4 individuals was used as manifest indicators. Then, CFA was used to test the factor structure dimensionality of the BASDA. Model fit was evaluated across 4 goodness-of-fit indices: comparative fit index (CFI), Tucker Lewis index (TLI), root mean square error of approximation (RMSEA), and the root mean square residual (SRMR). The model was accepted or rejected based on the following criteria: good model fit defined by a CFI cutoff of >0.90 (Ullman et al., 2001), a TFI cutoff of >0.95 (Hu and Bentler, 1999), an RMSEA cutoff of <0.08 (MacCallum et al., 1996), and an SRMR cutoff of <0.10 (Hu and Bentler, 1999), factor loading strength with values between 0.40 and 0.80, and the *p* values for each of the items. Beyond a measurement model, SEM was used to examine a structural model to determine the relationships between the BASDA latent factor structure with the DDQ and AUDIT.

RESULTS

Convergent Validity

For convergent validity, Pearson r correlations were calculated using all scale total scores (Table 1). Significant positive correlations were found between the BASDA total score and all the DMQ subscales, with medium effect sizes for Social ($r = 0.39$, $p < 0.0001$) and Enhancement ($r = 0.40$, $p < 0.0001$), and small effect sizes for Coping ($r = 0.26$, $p < 0.0001$) and Conformity ($r = 0.21$, $p < 0.0001$). Significant positive correlations were also found between the BASDA and total drinks per week on the DDQ ($r = 0.44$, $p < 0.0001$), as well as the AUDIT ($r = 0.51$, $p < 0.0001$).

The overall model for the multiple regression analysis was significant, $p < 0.0001$, $R^2 = 0.18$, with both Social, $\beta = 0.238$, $p < 0.0001$, and Enhancement, $\beta = 0.283$, $p < 0.0001$, demonstrating significant independent contributions to the overall variance in the BASDA total score. In contrast, Conformity, $\beta = 0.050$, and Coping motives, $\beta = -0.026$, were not significantly associated with the BASDA total score.

Criterion-Related Validity

The results from the ANCOVA suggested that individuals who scored at or above the AUDIT cutoff also scored significantly higher on the BASDA ($n = 167$, mean = 23.05, SE = 0.53), as compared to individuals scoring below the cutoff, $n = 736$, mean = 16.43, SE = 0.20; $F(1, 899) = 161.18$, $p < 0.0001$, $d = 1.06$, adjusting for age and gender.

Incremental Validity

Results from linear regression analysis with the AUDIT total score as the dependent variable are in Table 2. When the BASDA was included in the model, it was significantly associated with the AUDIT total score, above and beyond known predictors of alcohol use severity (i.e., drinking motives subscales, spouse, age, and gender). The addition of the BASDA to the model accounted for an additional 9% of the variance compared with Model 1 ($R^2 = 0.09$, $p < 0.0001$), and the total model accounted for almost half of the variance. For exploratory purposes, we conducted the same regressions for individuals who listed a significant other and individuals who did not list a significant other on the BASDA. The results indicated that the incremental contribution of the observed relationships between the 2 (i.e., listing a significant other on the BASDA) was not associated with a stronger relationship to alcohol severity. The results including the presence of a significant other are reported in Table S1.

Internal Validity

Results from the CFA confirmed the unidimensional factor structure of the BASDA. The model demonstrated excellent fit on each of the indices: CFI = 0.98; TLI = 0.94; RMSEA = 0.06; and SRMR = 0.02. Each item significantly loaded onto a single factor with standardized parameter estimates ranging from 0.42 to 0.57 (all $ps < 0.0001$); standardized factor loadings with standard errors are presented in Table 3. The relationship between the BASDA, DDQ, and AUDIT on the single latent factor is presented in Fig. 1. The final structural equation model demonstrated excellent fit on each of the indices: CFI = 0.99; TLI

= 0.97; RMSEA = 0.04; and SRMR = 0.02. The latent construct was significantly associated with both measures of alcohol involvement.

DISCUSSION

The BASDA is a brief measure of estimated social network density of alcohol involvement and the aim of this study was to validate it further in an adult community sample of drinkers. The BASDA was well supported in each of the validation analyses. In particular, the BASDA was significantly correlated with other putatively similar constructs (i.e., drinking quantity, drinking severity), broadly demonstrating convergent validity. In particular, with regard to motives, there was further evidence of convergent validity insofar as the BASDA was associated with social motives, which is the most conceptually related to social network drinking. Furthermore, in the combined models, coping and conformity motives, which are not conceptually related to social network drinking, were not associated with the BASDA. This indicates conceptual selectivity when it comes to motives and, although not the original focus of the study, can be thought of as a form of discriminant validity. Using the criterion of 8+ on the AUDIT, significant differences in the BASDA score were present, suggesting criterion-related validity. In addition, there was a significant additive value of including the BASDA in a regression model in relation to alcohol misuse. In other words, estimated drinking among close social relationships was associated with alcohol use severity above and beyond motives for use and covariates. This provides evidence for incremental validity. Finally, a set of SEM analyses provided overall support for the BASDA's internal validity. Specifically, the single-factor structure of the BASDA was confirmed using CFA and the latent factor was significantly associated with drinking and alcohol misuse.

Consistent with a previous BASDA validation study (MacKillop et al., 2013), the regression model containing both the BASDA, and the enhancement and coping motives accounted for substantial variance in alcohol misuse. However, the effect size for the final model was of medium magnitude compared with a large magnitude in previous research. Among the zero-order correlations, the effect size was slightly larger for enhancement motives compared with social motives, whereas in previous work in a younger population (MacKillop et al., 2013), the opposite pattern was observed. This may be due, in part, to the heightened influence of social environments in younger populations, increasing the likelihood that drinking will occur primarily in social settings (Cooper et al., 2015). Alternatively, as the individual ages, social settings may not be a necessary condition for their drinking to occur. In fact, enhancement motives have been demonstrated to be independent of social settings (Cooper et al., 2015). Similarly, conformity motives were weakly related to alcohol use severity and may also reflect the attenuated impact of an individual's social environment in adulthood. As a nuance to the previous validation studies, the results from the SEM suggest that drinking within an individual's social network may predict drinking quantity (DDQ) and drinking severity. Collectively, the results are generally consistent with both MacKillop and colleagues (2013) and Fortune and colleagues (2013), supporting the BASDA as a robust measure of estimated social density of alcohol use, but also suggest important nuances across different samples.

For exploratory purposes, we decided to examine whether listing a significant other as 1 of the 4 relationships was significantly related to alcohol severity. The rationale for this additional analysis is that an individual's drinking behavior has been found to be related to the drinking behavior of their significant others (Gleiberman et al., 1991; McLeod, 1993). That is, individuals who drink more heavily are more likely to have a significant other with similar drinking patterns. However, the results suggest that listing a significant other among the 4 closest relationships was not significantly differentially related to drinking severity.

There are several methodological factors to take into account when considering the validity of this measure. The first pertains to the accuracy of individual's ratings of their social network drinking behavior. Although the 4 individuals within their social network are assumed to be their closest nonbiological relationships, it is unclear how accurate their reports are. The results may therefore need to be interpreted with some level of caution. Future studies are needed to address this issue to further validate the use of the BASDA. For example, studies could assess the accuracy in the individual's perceptions of their social network drinking by directly assessing the 4 individuals in their social network. This method is closely in line with SNA methodology, the gold standard evaluation that involves directly interviewing each individual within the social network, allowing for a more objective analysis of social influences. A second limitation may be the lack of diversity of the sample, which was predominantly of European ancestry. Further work is needed in order to assess the generalizability of this measure. Specifically, the validity of the BASDA should be examined in a more racially and ethnically diverse population and in languages other than English. Of note, however, this is also the first investigation to validate the BASDA outside the United States, and although there are robust cultural similarities with Canada, it nonetheless represents further evidence of generalizability.

In order to further establish the potential benefits of the BASDA, future studies should understand the validity of the BASDA in longitudinal research designs. As an individual's social network and drinking behavior are subject to change (Britton et al., 2015), it is likely relevant to capture these changes over an extended period of time. If the BASDA is sensitive to changes in social environments, it would further increase its utility in understanding longitudinal trajectories of alcohol use and misuse. Another consideration that may be important to address in future validation analyses is whether the BASDA predicts alcohol use severity above and beyond other established measures of social network drinking. For example, comparing the BASDA to the IP (Longabaugh et al., 2010) or IP-5 (Hallgren and Barnett, 2016) would further illuminate the value of the measure. However, it remains an open question as to whether or not a longer measure of alcohol social density, formal egocentric SNA, has more predictive power over shorter measures.

These considerations notwithstanding and given the potential of SNA in alcohol and other substance use research, the BASDA may be a practical, time efficient alternative to more extensive SNA assessments. Though further validation is needed, this study demonstrates the cross-sectional validity of the BASDA as a measure of drinking in an individual's social network in adult drinkers from the general community.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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Fig. 1.

Structural equation model reflecting alcohol social density, as measured by the Brief Alcohol Social Density Assessment, in relation to weekly drinking (Drinking Days Questionnaire) and alcohol severity (Alcohol Use Disorder Identification Test).

Table 1.

Pearson r Correlations Among Demographics, BASDA Total, AUDIT, DDQ, and All DMQ Subscales ($N = 903$)

Variables	%/M (SD)	1.	2.	3.	4.	5.	6.	7.
Gender, % female	56.3	-0.13**	-0.21**	-0.20**	-0.09**	-0.12**	0.005	-0.04
Age	35(12.8)	-0.10**	-0.11**	0.03	-0.23**	-0.18**	-0.10**	-0.18**
Race, % white	84.6	-0.08**	-0.14**	-0.12**	-0.03	-0.08*	-0.03	-0.03
Spouse, % yes	77.2	-0.02	-0.09**	-0.04	-0.06	-0.08*	-0.15**	-0.11**
1. BASDA	17.66 (6.36)							
2. AUDIT, M(SD)	4.9 (4.06)	0.51**	-					
3. DDQ, M(SD)	7.22 (9.14)	0.44**	0.64**	-				
4. DMQ_Social	10.92 (5.56)	0.39**	0.41**	0.27**	-			
5. DMQ_Enhance	7.83 (5.61)	0.40**	0.55**	0.36**	0.70**	-		
6. DMQ_Coping	4.16(4.50)	0.26**	0.49**	0.30**	0.51**	0.63**	-	
7. DMQ_Conform	2.91 (3.83)	0.21**	0.20**	0.06**	0.48**	0.33**	0.44**	-

AUDIT, Alcohol Use Disorders Identification Test; BASDA, Brief Alcohol Social Density Assessment; DDQ, Daily Drinking Questionnaire; DMQ, Drinking Motives Questionnaire.

** $p < 0.001$; race coding: 0 = white, 1 = nonwhite; sex coding: male = 0, female = 1.

Table 2.

Linear Regression Analyses of DMQ Subscales and BASDA Total Score in Relation to Total AUDIT Score

Variables	<i>B</i> (SE)	β	<i>p</i>	<i>R</i> ²
Model 1				
Sex	−1.378(0.226)	−0.165	<0.001	0.365
Age	−0.002 (0.008)	−0.007	0.807	
DMQ _{Social}	0.028 (0.030)	0.038	0.352	
DMQ _{Coping}	0.249 (0.033)	0.276	<0.001	
DMQ _{Enhancement}	0.254(0.031)	0.351	<0.001	
DMQ _{Conformity}	−0.074 (0.034)	−0.069	0.030	
Model 2				
Sex	−1.139(0.211)	−0.137	<0.001	0.454
Age	−0.002 (0.008)	−0.002	0.817	
DMQ _{Social}	−0.022 (0.028)	−0.029	0.421	
DMQ _{Coping}	0.251 (0.031)	0.273	<0.001	
DMQ _{Enhancement}	0.198(0.029)	0.274	<0.001	
DMQ _{Conformity}	−0.083(0.031)	−0.080	0.008	
BASDA _{Total}	0.212(0.018)	0.332	<0.001	

AUDIT, Alcohol Use Disorders Identification Test; BASDA, Brief Alcohol Social Density Assessment; DMQ, Drinking Motives Questionnaire.

Table 3.

Single-Factor Structure Standardized Parameter Estimates for Each of the 4 Closest Relationships on the BASDA

Indicators	Estimates	Standard errors	<i>p</i>
BASDA _{First Closest}	0.418	0.041	<0.001
BASDA _{Second Closest}	0.537	0.040	<0.001
BASDA _{Third Closest}	0.574	0.040	<0.001
BASDA _{Fourth Closest}	0.497	0.040	<0.001

BASDA, Brief Alcohol Social Density Assessment.