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Do words matter? Incongruent responses to inconsistently worded AUDIT-C alcohol screening instruments

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Abstract

The first three questions of the Alcohol Use Disorders Identification Test (AUDIT-C) are often used as a brief alcohol screening instrument. However, the implications of common modifications made to the original AUDIT questions and response options have not been considered. We examined existing data from a randomized controlled trial of 310 persons with HIV/AIDS which was testing the efficacy of two antiretroviral medication adherence interventions. Logistic regression was used to model the probability of participants having inconsistent AUDIT-C item responses. Three patterns of conflicting responses to the AUDIT-C items were identified. Common item modifications resulted in 14% (n=48) of the parent study sample reporting conflicting responses across related AUDIT-C items. The odds of having conflicting data were three times greater in opioid users [OR=3.139, 95%CI=(1.267–7.777), p=0.01] and greater in persons with higher levels of conscientiousness [OR=1.053, 95%CI=(1.006–1.103), p=0.03]. Inconsistent question format and response options may impede proper scoring and interpretation of the AUDIT-C. Further discussion and consensus-building is needed on the psychometrically ideal version of the AUDIT-C.

Keywords

Mass screening; Alcohol consumption; Alcohol-related disorders; Psychometrics

INTRODUCTION

The first three alcohol consumption questions of the ten-item Alcohol Use Disorders Identification Test (AUDIT), termed the AUDIT-C, comprise a derived form of the AUDIT questionnaire developed by the World Health Organization as a screening tool for hazardous and harmful drinking among primary care patients. The AUDIT instrument is intended to assess three conceptually distinct factors associated with hazardous and harmful drinking:

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alcohol consumption, alcohol dependence, and alcohol-related consequences. In turn, the AUDIT-C is intended to be a more efficient but equally valid tool consisting of only the three consumption-related items and is widely recommended for alcohol screening.^{1,2}

Investigators and clinicians can modify the AUDIT-C. Modifying the instrument typically attempts to improve clarity and item response rates, and can be based on pre-testing or early participant feedback.^{3–6} For example, Gordon and colleagues removed the full AUDIT's command to skip Questions 2 and 3 if answering "never" to Question 1, but then replaced it, as its omission limited the number of responses to other alcohol instruments in the study.⁶ Perhaps most importantly, the original AUDIT-C contains a "0 drinks" response item for Question 2, which the original AUDIT does not.^{5,7} Other investigators examining the AUDIT-C have altered this "0 drinks" response option to "none" or "I do not drink".^{3,4}

This particular modification allows for potential confusion of the study participant and potential generation of incongruent responses to questions 1–3. For example, a patient or subject may acknowledge alcohol use in Question 1 but indicate "0 drinks" in Question 2. The issue of inconsistent questionnaire wording leading to incongruent results of a screening instrument has heretofore been unaddressed, but it carries important potential implications for data quality and cohesion, as well as the validity of the AUDIT-C in both research and clinical practice environments. We wondered whether inadvertent changes in the wording of the AUDIT-C imparted different subject responses regarding their alcohol consumption. As part of a larger study on the predictive value of positive alcohol screening results on antiretroviral adherence in HIV/AIDS, this analysis aimed to explore factors associated with incongruent responses arising from common modifications made to the AUDIT-C.

METHODS

Parent Study Overview

This study used data from a randomized controlled trial of 354 adults with HIV/AIDS which tested the efficacy of two cognitive-behavioral antiretroviral (ART) adherence interventions over time. Medication-taking was tracked using electronic event monitors (EEM), computerized medication caps which record the date and time of bottle openings.⁸ Alcohol use was assessed using the ten-item Alcohol Use Disorders Identification Test (AUDIT),⁷ and frequency of illicit drug and tobacco use was assessed through questions added to the AUDIT. Drug use for each of the following were then separately dichotomized as use or no use of marijuana, cocaine, crack, heroin, opioids, ecstasy, "poppers," stimulants, hallucinogens, and inhalants. Additional parent study variables included: depressive symptoms (Beck Depression Inventory-II [BDI-II]);⁹ personality characteristics (NEO Five Factor Inventory [NEO-FFI]),¹⁰ self-efficacy for ART adherence (HIV Self-efficacy Scale [HIV-SES]),¹¹ and various socio-demographic and disease-specific clinical data (e.g., viral load level).

Procedures

Data extraction—Our study used data from two time points of the parent study: baseline and three months after baseline (i.e., "Time 2," immediately after the adherence intervention), and was approved by the University of Pittsburgh Institutional Review Board. In addition to baseline BDI-II, NEO-FFI, HIV-SES, socio-demographic, and disease-specific clinical data, we extracted AUDIT-C data from the full AUDIT at both time points. Only individuals with complete AUDIT-C data at baseline and/or Time 2 were included in the current analysis (n=345).

Of particular note, parent study investigators made two modifications to the AUDIT which are congruent with the AUDIT-C as originally developed.⁵ In Question 1, parent study investigators omitted the command to skip Questions 2 and 3 if the individual responded “never” to question 1 (Table 1). Additionally, a “0 drinks” response option was added to Question 2, which inquires about the quantity of alcohol typically consumed (Table 1).

These changes inadvertently allowed participants to generate incongruent responses to Questions 1–3; for example, a response of “never” to AUDIT-C Question 1 along with selecting a quantity *other than* “0 drinks” in response to AUDIT-C Question 2.⁵ Two other types of incongruent responses were also possible. Participants could indicate a “never” response to AUDIT-C Question 1 along with a response *other than* “never” for AUDIT-C Question 3. The other possibility involved identifying a response *greater than* “never” for AUDIT-C Question 1 along with selecting a “0 drinks” in response to AUDIT-C Question 2.⁵

In order to assess the frequency of these responses and explore associated factors, we created an ordinal-level code in which individuals were classified as having congruent data (0), incongruent data at baseline (1), incongruent data at Time 2 (2), or incongruent data at both (3). This code was then dichotomized as “incongruent Yes/No,” where those with “congruent” AUDIT-C data were coded 0 and individuals with incongruent data at either or both time points were coded 1.

Analytic plan

All data analysis was conducted using SPSS. Frequency distributions and measures of central tendency and variability were used to evaluate the demographic, clinical, substance use, and psychosocial characteristics of the sample. Chi square tests of independence (with Fisher’s exact test, where appropriate) and Mann Whitney U tests were used to assess for differences between individuals with and without incongruent AUDIT-C data. Although incongruent AUDIT-C responses impede valid scoring of the AUDIT-C, for the purposes of general comparison, we generated total AUDIT-C scores for individuals with and without incongruent AUDIT-C data. Across analyses, p-values of <.05 were considered statistically significant.

A series of bivariate logistic regression analyses were performed in order to develop a model for the prediction of having incongruent AUDIT-C data at either or both data collection points. Baseline socio-demographic and other variables determined a priori to potentially be associated with lack of question comprehension were then entered into simple logistic regression models for the prediction of having incongruent AUDIT-C data. Univariate logistic regression analysis was performed using the following variables: sex; race; age; years of formal education; total score on the BDI-II; the five subscale scores from the NEO-FFI (Neuroticism, Extraversion, Openness, Agreeableness, Conscientiousness); total score on the HIV-SES; and dichotomized drug use scores (yes/no). Variables reaching a significance level of $p \leq .10$ in these analyses were then simultaneously entered into a multivariate model for the derivation of odds ratios. Model fit was evaluated with the Hosmer-Lemeshow test where a good model is reflected by a nonsignificant ($>.05$) chi square statistic.¹² Nagelkerke’s R^2 statistic provided an estimate of the proportion of variance in having incongruent AUDIT-C data explained by the final model. Comparison of classification tables indicated the accuracy of group membership prediction.

RESULTS

Demographic, clinical, and psychosocial characteristics

Forty-eight individuals (14% of the parent study sample) had incongruent responses to the AUDIT-C. Individuals with incongruent AUDIT-C responses were 75% male and 63% nonwhite, with a median age of 45 years. The demographic, clinical, and psychosocial characteristics of individuals with and without incongruent AUDIT-C data are presented in Table 2. Individuals with incongruent AUDIT-C data were more likely to use opioids and had higher conscientiousness scores on the NEO-FFI (Table 2).

Individuals with incongruent AUDIT-C responses presented with three patterns of incongruent data. In the first pattern (81.3%), individuals acknowledged alcohol use in Question 1 (e.g., endorsed drinking “2 or 4 times a month”), but then selected the “0 drinks” option in Question 2, which asks about the number of drinks consumed on a typical drinking day. In the second pattern (9.3%), individuals denied alcohol use in Question 1 (e.g., responded “never”), but then selected a typical quantity in Question 2 and/or endorsed consuming six or more or more drinks per occasion in Question 3. In the third pattern (9.3%), individuals denied alcohol use in Question 1, but endorsed a frequency of consuming six or more drinks per occasion in Question 3.

In the regression models, three variables were associated with having incongruent AUDIT-C data. Opioid use was significantly associated with almost three times greater odds of having incongruent AUDIT data ($p = .021$), while higher conscientiousness scores (NEO-FFI) were significantly associated with slightly greater odds of having incongruent AUDIT-C data ($p = .041$). Hallucinogen use was also associated with greater odds of having incongruent data, though this association was not significant ($p = .073$).

Opioid use, conscientiousness score, and hallucinogen use were then entered into a multiple logistic regression model for the prediction of having incongruent AUDIT-C data. In the final model, opioid users again had more than three times greater odds of having incongruent AUDIT-C data [OR = 3.139, 95% CI (1.267 to 7.777) $p = 0.01$] while those with higher conscientiousness scores also had greater odds of having incongruent data compared to those with lower conscientiousness scores [OR = 1.053, 95% CI (1.006 to 1.103), $p = 0.03$]. The Hosmer-Lemeshow test indicated that the model was non-significant, indicating a good fit between the model and the data, $\chi^2 (7, n = 336) = 2.961, p = .889$. While the model correctly predicted 85.4% of the cases having incongruent AUDIT-C data, blindly estimating the percentage of cases would yield virtually the same percentage (85.7%).

DISCUSSION

Modifying screening questionnaires in research and in clinical practice may have implications regarding the consistency and legitimacy of results. The AUDIT-C, a widely used test to screen for alcohol consumption, can be modified, and we found that inconsistent wording of the AUDIT-C may lead to incongruent item responses. It is unclear why a sizable percentage of our study participants incongruently responded to the AUDIT-C items. Data on the incidence and nature of incongruent responses on unmodified versions of the AUDIT or AUDIT-C are unavailable in the literature for comparison. The results of our analysis suggest that having incongruent AUDIT-C data cannot actually be well differentiated on the basis of opioid use/nonuse and conscientiousness score alone.

There are several other possible explanations. Perhaps individuals with incongruent AUDIT-C data are different from those with congruent data based on an unobserved variable such as

health literacy or cognitive function status. (For example, participants who were using opioids may have had greater levels of cognitive impairment due to active drug use and/or more significant disease progression.) The potential presence of such confounding variables may also explain the unexpected finding that higher conscientiousness was related to greater odds of having incongruent AUDIT-C data. The NEO-FFI dimension of conscientiousness represents personality traits such as orderliness, organization, efficiency, dependability, competence, and deliberation.¹⁰ Thus, one might reasonably assume that individuals with high levels of conscientiousness would similarly possess high levels of carefulness, precision, and attention to detail--characteristics which would lend themselves to thorough reading and response selection. On the other hand, overly conscientious participants may have in fact been giving particular attention to each individual question in sequence, without attention to whether or not their responses were internally congruent overall.

Additionally, incongruent AUDIT-C responses threaten the validity of total AUDIT-C scores in the very group of individuals with incongruent data. It is possible that differences in total AUDIT-C scores do in fact exist between individuals with and without incongruent AUDIT-C data. More significant alcohol use in the group with incongruent data could, for example, reflect diminished cognitive function or self-consciousness about alcohol use, thus contributing to incongruent responses.

Alternatively, although participants completed questionnaires on their own, the large number of questionnaires may have contributed to participant fatigue and improper reading of the AUDIT-C questions. We are unable to determine which of the two parent study modifications to the AUDIT had a greater impact on the occurrence of incongruent AUDIT-C responses. However, the fact that the majority of incongruent AUDIT responses (81.3%) involved situations where individuals acknowledged alcohol use in Question 1 but then selected the "0 drinks" option in Question 2 (number of drinks on a typical *drinking* day) suggests that the wording of AUDIT-C question 2 may inadvertently lend itself to misunderstanding.

These results also suggest that researchers who make similar changes to the AUDIT-C or the full AUDIT may compromise the validity of the instrument, particularly in samples where individuals use illicit drugs. Certain ameliorative strategies are proposed for investigators who delete the "skip to" command in Question 1 and/or add a "0 drinks" option to Question 2. First we suggest that investigators (and practitioners) who opt to make these changes carefully verify the responses to Questions 1 to 3 for consistency and invalid responses. Researchers making modifications to Question 2 might also consider using an interview version of the AUDIT-C, which would allow for clarification of ambiguous or incongruent responses.⁷

A final consideration is whether modifications to AUDIT-C Question 2 itself might need to be made when adding a "0 drinks" option, e.g., moving the qualifier to the beginning of the question so that it asks, "*On a typical day when you are drinking*, how many drinks containing alcohol do you have?" Such modifications would also require psychometric evaluation.

The results of this study require consideration of several limitations. Nonwhite individuals in our sample were primarily African-American, and women comprised one-third of the sample; results may not generalize to other nonwhite groups or women. Individuals who abstain from alcohol use were included in all analyses. While previous studies of alcohol screening instruments have both included¹³ and excluded "abstainers" from their analyses¹⁴⁻¹⁶, their inclusion can artificially inflate rates of specificity for the AUDIT-C.¹⁶

Additionally, AUDIT-C data were derived from the full AUDIT; that is, data for these three items were extracted directly from responses to questions from the full AUDIT. While the AUDIT-C retains high levels of sensitivity and specificity for at-risk drinking and alcohol use disorders⁶, participant responses may have been different had these items been administered independently of the remaining AUDIT items.^{6,16} Our study used a derived form of the AUDIT-C, but like the original AUDIT-C, it omitted the skip command in Question 1 and included a “0 drinks” option for Question 2. Finally, due to the relatively small sample of participants with incongruent AUDIT-C data (n=48), we were unable to determine the potential factors associated with each of the three individual types of incongruency.

Despite these limitations, our study confirms that inconsistently worded AUDIT-C can incur incongruent subject responses. This inconsistent wording arises in the context that the “AUDIT-C” means slightly different things to different people, depending on the application of the instrument in research or clinical practice. For some researchers, AUDIT-C refers to a simple extraction of responses to the first three questions on the original ten-item AUDIT. Others may administer the original AUDIT-C, with its slightly different wording and response options. Still others may create a hybrid of the two. The results of this study suggest that these slight differences in item derivation, item wording, item response options, and other commands are not inconsequential. In short, these issues may inadvertently lead to inaccurate or questionably meaningful AUDIT-C total scores, impeding the proper identification of hazardous drinkers in both research and clinical practice arenas. Further discussion and consensus-building on the psychometrically ideal version of the AUDIT-C is needed.

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Table 1

Comparison of Item Wording and Response Options for the AUDIT and AUDIT-C

Original AUDIT questions: 10 items ^a	Original AUDIT-C questions: 3 items	AUDIT-C, Current study ^b
<i>How often do you have a drink containing alcohol?</i>	<i>How often did you have a drink containing alcohol in the past year?</i>	<u><i>How often do you have a drink containing alcohol?</i></u>
(0) Never (Skip to Q's 9-10)	Never (0 points)	<u>Never</u>
(1) Monthly or less	Monthly or less (1 point)	Monthly or less
(2) 2 to 4 times a month	2 to 4 times a month (2 points)	2 to 4 times a month
(3) 2 or 3 times per week	2 or 3 times per week (3 points)	2 or 3 times per week
(4) 4 or more times a week	4 or more times a week (4 points)	4 or more times a week
<i>How many drinks containing alcohol do you have on a typical day when you are drinking?</i>	<i>How many drinks did you have on a typical day when you were drinking in the past year?</i>	<u><i>How many drinks containing alcohol do you have on a typical day when you are drinking?</i></u>
	0 (0 points)	<u>None or 0</u>
(0) 1 or 2	1 or 2 drinks (0 points)	1 or 2
(1) 3 or 4	3 or 4 drinks (1 point)	3 or 4
(2) 5 or 6	5 or 6 drinks (2 points)	5 or 6
(3) 7, 8, or 9	7 to 9 drinks (3 points)	7 to 9
(4) 10 or more	10 or more drinks (4 points)	10 or more
<i>How often do you have six or more drinks on one occasion?</i>	<i>How often did you have 6 or more drinks on one occasion in the past year?</i>	<u><i>How often do you have six or more drinks on one occasion?</i></u>
(0) Never	Never (0 points)	Never
(1) Less than monthly	Less than monthly (1 point)	Less than monthly
(2) Monthly	Monthly (2 points)	Monthly
(3) Weekly	Weekly (3 points)	Weekly
(4) Daily or almost daily	Daily or almost daily (4 points)	Daily or almost daily

Note.

^a The original AUDIT instructs those completing the questionnaire to consider their alcohol use over the past year.^b The current study used a derived form of the AUDIT-C, i.e. the three items were extracted from the full AUDIT, thus individual items reflect wording used in the full AUDIT. Parent study investigators omitted the skip command in item 1 and added a "0 drinks" response option in item 2 (underlined).

Table 2**Main Demographic, Clinical, and Psychosocial Characteristics of the Sample**

Variables	Patients with congruent AUDIT-C (n=297)	Patients with incongruent AUDIT-C (n=48)	p
	n (%) or Median [range]	n (%) or Median [range]	
Sociodemographic			
Sex (Female)	97(33)	12(25)	.318
Race (Nonwhite)	175(59)	30(63)	.753
Age	44 [20-66]	45 [29-62]	.177
Education, years ^a	12 [3-26]	13 [8-20]	.445
Marital status: married/partnered	59(20)	14(29)	.266
Employed currently	53(18)	9(19)	.853
Active health insurance	279(94)	45(93)	1.00
Clinical & Substance Use			
Viral load undetectable ^b	168(57)	27(56)	1.00
AUDIT-C total score	2.0 [0-13]	2.0 [1-7]	1.00
Drug use:			
Marijuana	98(33)	18(38)	.624
Crack	45(15)	11(23)	.210
Cocaine	32(11)	5(10)	1.00
Poppers	26(8)	1(4)	.148
Opioids	19(6)	8(17)	.037 *
Stimulants	13(4)	0(0)	.228
Heroin	12(4)	2(4)	1.00
Hallucinogens	5(2)	3(6)	.089
Tobacco	187(63)	29(60)	.629
Psychosocial			
BDI-II, total score ^a	14 [0-54]	12 [0-60]	.469
ISEL, total score	78 [6-120]	78 [30-117]	.587
Neuroticism (NEO-FFI) ^c	24 [0-46]	24 [0-40]	.381
Extroversion (NEO-FFI) ^c	26 [2-44]	26 [14-44]	.637
Openness (NEO-FFI) ^c	26 [11-43]	27 [15-40]	.189
Agreeableness (NEO-FFI) ^c	30 [13-43]	30 [20-41]	.927
Conscientiousness (NEO-FFI) ^c	32 [15-48]	35 [18-45]	.026 *
HIV-SES, total score	224 [90-260]	234 [106-260]	.212

Note.

AUDIT-C: Alcohol Use Disorders Identification Test Consumption; BDI-II: Beck Depression Inventory II; HIV-SES: HIV Self Efficacy Scale; ISEL: Interpersonal Support Evaluation List; Neuroticism, Extroversion, Openness, Agreeableness, Conscientiousness: respective scales on NEO-Five-Factor Inventory (NEO-FFI).

^a
n=343.

^b
n=243.

^c
n=336.

*
p <.05