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RESEARCH ARTICLE

Who benefits from brief motivational intervention among young adults presenting to the emergency department with alcohol intoxication: A latent-class moderation analysis

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Abstract

Background: Research has not identified which patients optimally benefit from brief Motivational Interviewing (bMI) for heavy drinking when delivered to young adults in the Emergency Department (ED).

Methods: We conducted secondary analyses of data from a randomized controlled trial in which 344 young adults (18–35 years) presenting to the ED with alcohol intoxication received either bMI or Brief Advice (BA, control group). We used Latent Class Analysis to derive participants' profiles from baseline characteristics (i.e., sex, age, severity of alcohol use disorder, attribution of ED admission to alcohol use, importance, and confidence to change, cognitive discrepancy, anxiety, depression, and trait reactance). We then conducted a moderation analysis to assess the number of heavy drinking days at short-term (1-month) and long-term (12-month) follow-up using negative binomial regressions with interactions between the intervention and derived classes.

Results: Fit statistics indicated that a 4-class solution best fit the data. Class 3 (high severity, importance and discrepancy, and low confidence and anxiety) benefitted more from bMI than BA at short- and long-term follow-up than Class 1 (younger; lowest severity, importance, discrepancy, reactance, anxiety and depression, and highest confidence). Class 2 (older; highest severity, importance, discrepancy, reactance, anxiety and depression, and lowest confidence) also benefitted more from bMI than BA than did Class 1 at short-term follow-up. In these significant contrasts, Class 1 benefitted more from BA than bMI. There were no significant interactions involving Class 4 (more likely to be women; low severity; high levels of anxiety, depression, and reactance).

Conclusions: This study identified the patient profiles that benefitted more from bMI than BA among nontreatment-seeking young adults who present intoxicated to the ED. The findings have implications for intervention design and argue for the importance of research aimed at developing intervention content tailored to patient profiles.

KEYWORDS
alcohol intoxication, brief motivational interviewing, emergency department, latent class analysis, moderation analysis

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INTRODUCTION

Alcohol use is one of the leading causes of premature death among adolescents and young adults worldwide (World Health Organization, 2021). Heavy episodic drinking (i.e., drinking six standard drinks or more on a single occasion) and acute alcohol intoxication are associated with an increased risk of injuries, trauma, violence, risky sexual behaviors, and other negative health outcomes, especially in early adulthood (McCambridge et al., 2011; Rehm, 2011). Emergency department (ED) admissions related to alcohol intoxication have increased over the last decade, particularly among young adults (Bertholet et al., 2014; Mullins et al., 2017; Piccioni et al., 2020; Wicki & Stucki, 2014). Furthermore, ED admission with alcohol intoxication is related to high likelihood of ED readmission and poorer psychiatric, substance use, and social outcomes over time (Adam et al., 2016, 2020; Herbert et al., 2015; Hoy, 2017).

Brief interventions are among the few efficacious preventive strategies and the most cost-effective strategy among person-centered approaches targeting unhealthy alcohol use (Babor et al., 2010; Kaner et al., 2018). However, brief interventions for young adults in the ED have shown promising but inconsistent results (Newton et al., 2013; Taggart et al., 2013; Tanner-Smith & Lipsey, 2014; Wicki et al., 2014). Brief Motivational Interviewing (bMI) is a brief adaptation of Motivational Interviewing (MI). MI combines an empathic and collaborative person-centered counseling approach with a behavioral focus on resolving ambivalence in the direction of change (Miller & Rollnick, 2013). Targeting alcohol problems with high quality MI as a brief intervention has been proposed as a promising route for further study (McCambridge & Rollnick, 2014). However, more advanced research is needed to optimize this secondary prevention opportunity, notably research on which particular subgroups are most likely to experience benefit from these interventions (Longabaugh & Magill, 2011).

To reduce this knowledge gap, we designed a 3-phase research project. In the first phase of the project, we developed the bMI model based on recent research findings and theory advances on MI and bMI and pretested this model using an iterative qualitative design comprising experimental sessions and semi-structured interviews to evaluate clinicians' and patients' perceptions of the intervention's acceptability and feasibility, as well as a consultation meeting with nine international experts (Gaume et al., 2021). The model focused on achieving a high level of relational skills (e.g., empathy, alliance, and avoidance of confrontation) to engage young adults in discussing their alcohol use, enhance discrepancy and evoke change talk while softening sustain talk, and eventually complete a change plan as concretely as possible. Important additional features included guidance on which information to provide, how to provide it while supporting patient's autonomy, as well as extending the intervention to maintain change efforts over time (e.g., booster letter, phone booster sessions, and offer potential referral to treatment). In the second phase, we conducted a randomized controlled trial (RCT) which showed that bMI helped young adults with alcohol intoxication to maintain a lower number of heavy drinking days (HDD, i.e., days with 60 g of pure alcohol or more) over 1 year, compared to a Brief Advice (BA) control group (Gaume et al., 2022). Specifically, there was a significant increase of 1.8 HDD per month in the control group between 1-month and 12-month follow-up, while this was much smaller and nonsignificant in the bMI group (+0.4 HDD per month). In the third phase, we aim at investigating the mechanisms of the intervention effects. In this line of analyses, examining the variability of treatment responses based on individual patients' characteristics is an important first step (Kraemer, 2016).

Moderation analysis in the context of clinical trials, also known as interaction analysis, examines how participant characteristics may impact treatment response (Paz Castro et al., 2017). There have been several studies looking at moderators of alcohol interventions, such as sex, age, alcohol use disorder (AUD) severity or drinking level, mental health status, baseline motivation, attribution of injury or ED admission to alcohol, or trait reactance. These studies have provided contradictory results for sex (Barnett et al., 2010; Chiauzzi et al., 2005; Frohlich et al., 2022; Grossbard et al., 2016; Henson et al., 2015; LaBrie et al., 2009; Lau-Barraco et al., 2018) and age (Fernandez et al., 2019; Henson et al., 2015; Lau-Barraco et al., 2018). In contrast, severity of alcohol use consequences or AUD have consistently shown moderation effects in relation to bMI outcomes over control conditions among young adults (Daeppen et al., 2011; Walters & Neighbors, 2005) and adults admitted in the ED (Blow et al., 2009; Fernandez et al., 2019; Field & Caetano, 2010). More severe alcohol use patterns may help develop a discrepancy between the individuals' current behavior and their desired goals, hence leading to behavior change. Resolution of discrepancy is a core feature of MI (Miller & Rollnick, 2013) and has been empirically observed to be related to change in alcohol use among young adults (McNally et al., 2005).

Individual's baseline motivation has also been studied as a moderator and yielded mixed results. Some studies showed better outcomes for bMI or MI compared to control condition when participants had low motivation to change (Barnett et al., 2010; Project Match Research Group, 1997), while others found no significant effects (Frohlich et al., 2022; Walton et al., 2008). Two studies investigated attribution of ED admission or of injury to alcohol use and again findings were inconsistent. There were better effects of bMI compared to control condition for patients with low/medium attribution of ED admission to alcohol use in Barnett et al. (2010), versus for patients attributing the injury to alcohol use in Walton et al. (2008).

There is evidence that greater severity of mental health symptoms (e.g., depression and anxiety disorders) negatively affects intervention outcomes (Amati et al., 2018). In a recent online alcohol treatment study (Frohlich et al., 2022), young adults' profiles combining higher levels of severity of alcohol problems, executive functioning, depression, and anxiety had poorer response to treatment than a psychoeducation control condition. On the other hand, another study found a significant interaction showing that when depressive symptoms were higher, receipt of MI reduced drinking relative to no therapy among adults with AUD (Kuerbis et al., 2018).

Finally, in the larger field of AUD treatment, interactions were observed between patients' level of trait reactance (i.e., the extent to which an individual generally resists being influenced by others) and therapists' use of confrontation and structure (Karno & Longabaugh, 2005a, 2005b). It could thus be hypothesized that patients high in reactance would better react to bMI, which rely on avoiding confrontation and building a relationship based on collaboration between client and therapist (Miller & Rollnick, 2013).

Overall, findings regarding bMI effect moderators have been mixed. One reason could be that, in most studies, moderators were tested in isolation when there are very likely combinations of clinical factors that drive response to specific interventions. Therefore, Latent Class Analysis (LCA) might provide a more optimal fit for informing clinical decision making because it considers multiple factors and multiple levels of factors simultaneously. In this study, we used LCA to identify patient's profiles based on potential baseline intervention moderators (i.e., sex, age, AUD severity, attribution of ED admission to alcohol use, importance and confidence to change, cognitive discrepancy, anxiety, depression, and trait reactance). We then evaluated which patient profiles benefitted more from bMI than from BA through interaction analysis. We hypothesized that patients' baseline characteristic profiles would moderate bMI effects on heavy drinking at short-term (1-month) and long-term (12-month) follow-up. Given the mixed evidence and exploratory nature of the LCA approach, these hypotheses were nondirectional.

MATERIALS AND METHODS

Sample and study procedures

This study was a secondary analysis of data collected from a RCT (Gaume et al., 2022) that examined the effects of a bMI for young adults presenting to the ED with alcohol intoxication. This trial was registered in the ISRCTN registry (http://www.isrctn.com/ISRCTN13832949) and approved by the Ethics Committee of Canton Vaud, Switzerland (protocol 2016-01476). The aim of this study (i.e., moderation analysis) was prespecified in the study protocol (see supplement 1 in Gaume et al. (2022)) and all moderator measures were collected for this purpose. However, the analytical approach was not specified and this analysis was not registered.

Details on the parent study procedures are described elsewhere (Gaume et al., 2022). Briefly, all patients between 18 and 35 years old presenting to the ED of Lausanne University Hospital between December 2016 and August 2019 with an alcohol intoxication (blood alcohol concentration >0.5 g/L or clinical indication of intoxication) were eligible ($N = 2108$). Patients were excluded if they presented with life-threatening conditions, psychiatric or medical contraindications, were detainees or presented for medico-legal reasons, were not fluent in French, currently receiving alcohol or substance use treatment, were not well enough to sign consent, or refused participation. A total of 344 participants granted informed consent to participate in the study, completed the baseline assessment administered by a research clinician, and were randomly assigned to bMI (intervention group, $N = 171$) or to BA (control group, $N = 173$). All participants were contacted by phone for follow-up assessments after 1, 3, 6, and 12 months, by research assistants not involved in baseline procedures and blinded to patients' group allocation and prior data. In this study, we used only data from the 1-month and 12-month follow-up, to highlight short- and long-term results.

Intervention

Both bMI and BA were provided by the same research clinicians. These were seven psychologists trained in MI and supervised throughout the study. As described in Gaume et al. (2022), both interventions were delivered with high fidelity.

As presented in the introduction, bMI was adapted from MI (Miller & Rollnick, 2013). The development of the intervention is described in detail elsewhere (Gaume et al., 2021). Briefly, the bMI included three strategies and three steps. The strategies comprised (1) a focus on relational factors (e.g., empathy, acceptance, and collaboration), (2) technical skills for enhancing patient's change talk and softening sustain talk, and (3) guidance on the provision of information and advice regarding alcohol use, alcohol related consequences, and ED admission, while supporting patient's autonomy. The three steps included (1) exploring patient's current situation while raising patient's discrepancy between ideal and actual alcohol consumption, (2) evoking change in a hypothetical future, and (3) planning concrete steps favoring behavioral change. The average duration of bMI was 38.3 min (standard deviation (SD) = 13.6). Additionally, participants in the bMI group were offered booster sessions by phone 1 week, 1 month, and 3 months after the baseline intervention. Based on the MI principle of participants' autonomy support, booster sessions were offered to all participants, who accepted or refused them as they preferred. Among the 171 participants in the bMI group, 133 received booster at 1 week, 111 at 1 month, and 87 at 3 months.

Within the control group, participants received a standardized BA session, including information about alcohol risks, as well as advice to reduce alcohol consumption. The average duration was 3.5 min (SD = 1.5). There was no booster session for BA.

Measures

Moderators

Age and sex were retrieved from the hospital admission record. Other moderator variables were measured in the baseline questionnaire.

Alcohol use disorder severity was assessed using the Alcohol Use Disorder Identification test (AUDIT), a 10-question screening instrument developed to identify unhealthy alcohol use or any AUD over the last 12 months (Babor et al., 2001). In this study, we used

the total AUDIT score (Cronbach's α = 0.77), which may range from 0 to 40, with scores from 0 to 7 indicating low-risk drinking, 8 to 14 unhealthy alcohol use, and above 15 probable AUD.

Attribution of ED admission to alcohol use (Longabaugh et al., 1995) was evaluated with a single question "To what degree do you think that your alcohol consumption is responsible for your admission to the ED today" using a scale ranging from 1 ("Not at all") to 7 ("The only reason for the admission").

Importance to change and confidence to change was measured using the Readiness Rulers (Gaume et al., 2017; Miller & Rollnick, 2013). Participants answered the following questions: "To what extent is it important for you to change something in your alcohol use?," using a 10-point scale ranging from 1 ("Not at all important") to 10 ("Extremely important"); and "Suppose that you've decided to change your drinking, what confidence do you have in your ability to actually do it?" using a 10-point scale ranging from 1 ("Not at all confident") to 10 ("Extremely confident").

Cognitive discrepancy was assessed using a single item developed to evaluate actual-ideal discrepancy of alcohol consumption (McNally et al., 2005). Patients were asked to indicate how close or far their current drinking patterns were from their personal "ideal" given their values, interests, and life circumstances, using a 10-point scale ranging from 1 ("I am now at my ideal") to 10 ("I am extremely far from my ideal").

Anxiety and depression levels were evaluated with the Patients Health Questionnaire (PHQ–4) (Kroenke et al., 2009). This brief screening instrument includes two items for anxiety and two items for depression to which participants answer on a 4-point Likert scale ranging from 0 (never) to 3 (almost every day). Two composite scores are derived (anxiety, α = 0.76, and depression, α = 0.69), each ranging from 0 to 6.

Trait reactance was measured with the Hong Psychological Reactance Scale (Shen & Dillard, 2005). The questionnaire includes 14 items where participants indicate their agreement on a 5-point Likert scale from 1 ("completely disagree") to 5 ("completely agree"). The total score is measured as the average of the 14 items (α = 0.79). Unlike all other moderator variables, this trait was assessed only at 1-month follow-up in order to minimize the impact of research procedures on clinical care.

Outcome

The primary outcome was the number of HDD over the last month. This measure was one of the two a priori primary outcomes of the parent RCT. The second primary outcome (alcohol-related problems assessed using the Short Inventory of Problems) was not evaluated in this study since the RCT did not show any effects of bMI on this measure (Gaume et al., 2022).

Heavy drinking day was defined as days with 60 g of pure alcohol or more (World Health Organization, 2018). At follow-up, HDD was derived from a 30-day timeline follow-back (TLFB), a calendar method widely used to measure alcohol use (Sobell & Sobell, 1995). At baseline, HDD was estimated using a single item asking how many HDD happened over the last month to minimize assessment reactivity and lower the impact of research procedures on clinical care.

Statistical analysis

We first compared baseline variables between intervention and control groups using standard tests (Pearson χ^2 for categorical variables and Student *t* test for continuous variables, except for baseline HDD for which we used Wilcoxon rank-sum test since the distribution was over-dispersed).

Second, in order to identify homogenous subgroups of participants with different patterns of baseline characteristics, we conducted a LCA in Mplus 8.3 (Muthén & Muthén, 1998–2017). We first estimated a 2-class model and then added successive classes and used statistical criteria to determine the optimal number of classes to retain. Statistical criteria included Akaike's information criterion (AIC), Bayesian information criterion (BIC), and sample size adjusted BIC (ABIC), for which lower values indicate a better fit. Entropy, a classification statistic (ranging from 0 to 1) was used to assess how well the model works to classify cases in classes; values close to 1 indicate better fit and values ≥0.80 are considered as desirable (Asparouhov & Muthén, 2014). Finally, we calculated the Vuong-Lo–Mendell–Rubin likelihood ratio test (VLMR-LRT), the Lo–Mendell–Rubin likelihood ratio test (LMR-LRT), and the bootstrap likelihood ratio test (BLRT), which test whether two competing models (i.e., a k-class model vs. k-1 class model) provide identical fit. Significant *p* values suggest the rejection of the k-1 class in favor of the k-class model (Nylund et al., 2007). After having identified the optimal number of classes, we used conditional probabilities to determine participants' most likely class membership. For each latent class, average posterior class probabilities ($AvePP_k$) provide a measure of classification accuracy; values ≥0.70 have been proposed as desirable (Masyn, 2013). Moderator variables were then graphically compared across classes using Z-standardization for readability (i.e., all variables transformed to have mean = 0 and SD = 1).

Third, to test our hypothesis of the moderating role of patient's characteristics on the effect of bMI on HDD, we analyzed interactions between intervention group and latent class membership. We estimated one model for 1-month follow-up (short-term outcome) and one for 12-month follow-up (long-term outcome). We did not test models at 3- and 6-month follow-up for parsimony (i.e., to avoid repeating tests). Each model was adjusted for HDD at baseline. Intervention was entered as a dichotomous variable (bMI = 1, BA = 0). Latent classes were dummy coded, that is, each level of the variable is compared to the level set as reference. To allow comparisons between each class, we repeated our models with each class as the reference level. As HDD was over-dispersed, we used negative binomial regression. To illustrate interactions, we computed margin plots, that is, plots of the predictive margins of the number of outcome events (HDD) at values of the independent variables (intervention and latent classes), while controlling for baseline HDD.

Finally, we used multiple imputation (Little & Rubin, 2002) to replace missing values. Multivariate imputation using chained equations were computed with 10 imputations and negative binomial distributions. We then replicated our regression models using the generated complete set of data ($N=344$, vs $N=284$ at 1-month and $N=271$ at 12-month follow-up). Regression models, marginal predictions, and multiple imputation were computed using Stata BE 17.0 (StataCorp., 2021). The significance level was set at 5% ($p<0.05$) for all analyses.

RESULTS

Baseline characteristics are presented in Table 1. There were no significant differences between intervention and control groups on any of the baseline measures examined. The fit statistics for the 2- to 6-class solutions are reported in Table 2. AIC, BIC, ABIC, and entropy indicated that each additional class improved fit. The significance level of the BLRT test indicated that each additional class improved fit, but both VLMR-LRT and LMR-LRT indicated that models with less than four classes provided more parsimonious fit to the data. We selected the 4-class solution as providing the best balance between fit and parsimony, as well as clinical interpretability. Average posterior class probabilities ($AvePP_k$) were 0.92 for Class 1, 0.90 for Class 2, 0.87 for Class 3, and 0.89 for Class 4, indicating good classification accuracy.

Figure 1 depicts the four classes using z-standardized values of the moderating variables. Class 1 members ($N=155$) were younger, more likely to be male, and had the lowest scores on AUD severity, attribution of ED admission to alcohol use, seeing importance to change, less discrepancy, lower levels of depression, anxiety, and reactance; and they had the highest confidence in their ability to change. Class 2 members ($N=35$) were older, had the highest scores on AUD severity, attribution of ED admission to alcohol use, saw more importance in change, had more discrepancy, higher levels of depression, anxiety, and reactance; they had the least confidence in their ability to change. Class 3 members ($N=85$) had a profile similar to Class 2 but with attenuated values; an important difference was that anxiety and depression were low and reactance in the average. Class 4 members ($N=69$) were more likely to be female, had lower AUD severity, but high levels of anxiety, depression, and reactance; their other scores were mostly in the average range. There was no significant difference when comparing class membership by intervention and control groups ($\chi^2=2.45$, $p=0.48$).

At 1-month follow-up, there were significant interactions when comparing Class 2 to Class 1 (B [95% confidence interval] = −1.41 [−2.46 to −0.36], $p=0.009$) and when comparing Class 3 to Class 1 ($B=-0.90$ [−1.63 to −0.16], $p=0.02$). The other interactions were not significant (see Supporting Information for the full models). Figure 2 displays the interactions between intervention and classes on predicted HDD, while controlling for baseline HDD. As can be seen in panel A, bMI had more beneficial effect than BA among Class 2 and Class 3 (2.2 and 1.4 HDD less in the bMI group, respectively) in contrast to Class 1. On the other hand, bMI had less beneficial effects among Class 1 (2.8 HDD more in the bMI group).

At 12-month follow-up, there was a significant interaction when comparing Class 3 to Class 1 ($B=-1.20$ [−1.95 to −0.45], $p=0.002$). The other interactions were not significant (see Supporting Information). As can be seen in Figure 2, panel B, bMI had more beneficial effects than BA among Class 3 (3.2 HDD less in the bMI group) in contrast to Class 1. On the other hand, bMI had less beneficial effects among Class 1 (1.3 HDD more in the bMI group).

TABLE 1 Baseline descriptive characteristics by intervention group.

	bMI	BA	All	Test[a]	*p*
Age, mean (SD)	24.2 (4.7)	24.2 (4.7)	24.2 (4.7)	0.11	0.91
Gender—Female, *N* (%)	130 (75.1)	130 (76.0)	260 (75.6)	0.04	0.85
Gender—Male, *N* (%)	43 (24.9)	41 (24.0)	84 (24.4)		
AUDIT score [0–40], mean (SD)	14.4 (7.1)	13.6 (6.8)	14 (6.9)	−1.11	0.27
Attribution [1–7], mean (SD)	4.7 (2.2)	5.0 (2.0)	4.8 (2.1)	1.07	0.28
Importance [1–10], mean (SD)	5.3 (3.0)	5.3 (3.2)	5.3 (3.1)	−0.19	0.85
Confidence [1–10], mean (SD)	8 (2.1)	8 (2.1)	8 (2.1)	0.13	0.90
Discrepancy [1–10], mean (SD)	5.1 (2.8)	5 (2.7)	5.1 (2.7)	−0.34	0.74
Anxiety [0–6], mean (SD)	2.4 (2.1)	2.2 (2.1)	2.3 (2.1)	−0.80	0.42
Depression [0–6], mean (SD)	1.9 (1.8)	1.7 (1.9)	1.8 (1.8)	−0.69	0.49
Trait reactance [1–5], mean (SD)	2.9 (0.6)	2.8 (0.6)	2.9 (0.6)	−1.29	0.20
Heavy drinking days, median (IQR)	2 (1–4)	1 (1–4)	2 (1–4)	−0.98	0.33

Note: $N=344$ (171 in bMI and 173 in BA), except for trait reactance measured at 1 month ($N=285$, 137 in bMI and 148 in BA).

Abbreviations: AUDIT, Alcohol Use Disorder Identification Test; BA, brief advice; bMI, brief motivational interviewing; IQR, Interquartile range; SD, standard deviation.

[a]Pearson χ^2 for categorical variables and Student *t* test for continuous variables, except for heavy drinking days for which we used Wilcoxon rank-sum test (overdispersed count variable).

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TABLE 2 Fit indices of the 2- to 6-class LCA solutions.

Number of classes	AIC	BIC	ABIC	Entropy	VLMR-LRT *p* value[a]	LMR-LRT *p* value[a]	BLRT *p* value[a]
2 classes	14,130.9	14,246.1	14,150.9	0.782	0.023	0.024	<0.001
3 classes	14,030.7	14,188.2	14,058.1	0.795	0.036	0.038	<0.001
4 classes	13,931.8	14,131.5	13,966.6	0.823	0.215	0.220	<0.001
5 classes	13,887.2	14,129.2	13,929.3	0.842	0.226	0.230	<0.001
6 classes	13,840.2	14,124.4	13,889.7	0.857	0.235	0.239	<0.001

Abbreviations: ABIC, sample size adjusted BIC; AIC, Akaike's information criterion; BIC, Bayesian information criterion; BLRT, bootstrap likelihood ratio test; LCA, latent class analysis; LMR-LRT, Lo–Mendell–Rubin likelihood ratio test; VLMR-LRT, Vuong-Lo–Mendell–Rubin likelihood ratio test.
[a]*p* value for the k versus k − 1 class solution.

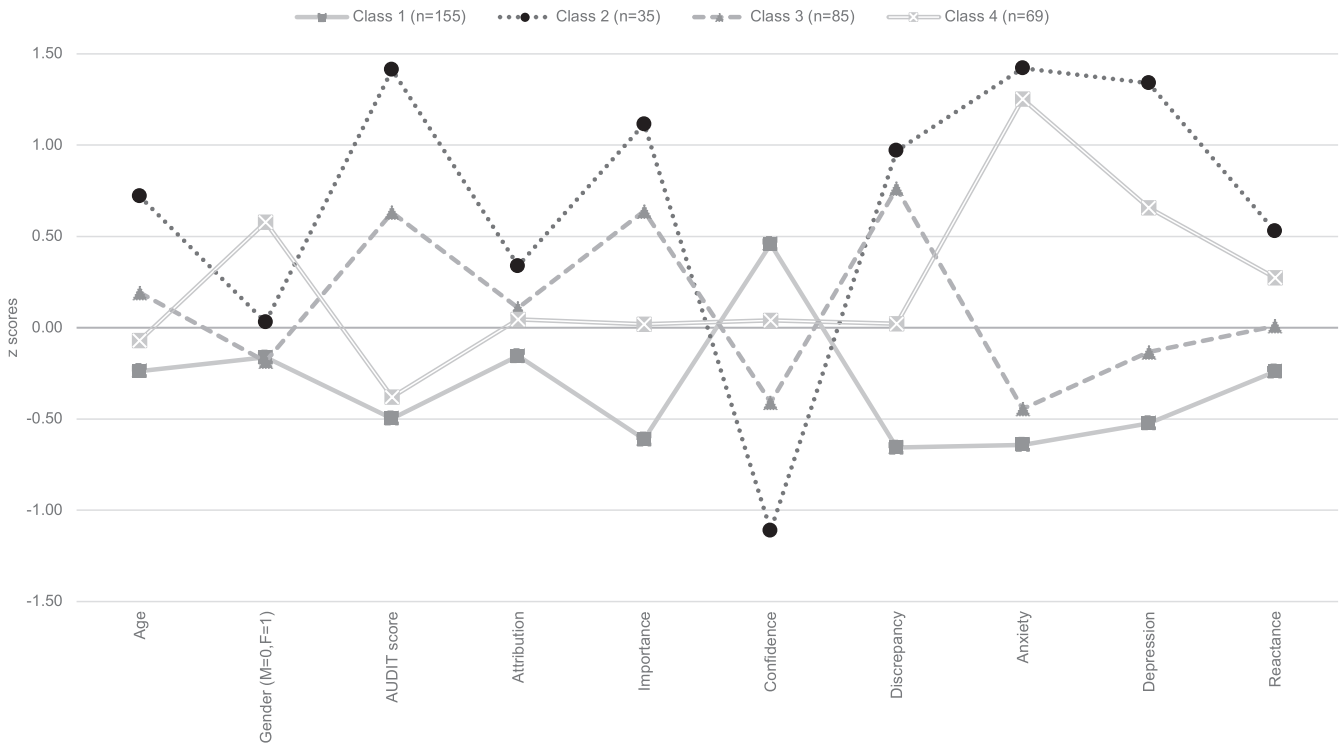

FIGURE 1 Graphical representation of latent classes. Moderator variables were Z-standardized for readability (i.e., all variables mean = 0 and standard deviation = 1).

When replicating models with multiple imputation of missing data, all findings had similar patterns of significance and effect size (see Supporting Information).

DISCUSSION

The main finding of our study is that the relative benefits of bMI over BA among young adults presenting to the ED with alcohol intoxication depended on their baseline characteristics. Using LCA, four participants' profiles could be derived. Class 1 members were typically young men, with low severity AUD, with high confidence to change but did not see change as something of high importance. Class 2 members were older, with high AUD severity, depression, anxiety, attributed their ED admission to alcohol use, but despite seeing change as important, had a low confidence to change. Class 3 members were similar to Class 2 but with low anxiety and depression. Class 4 members were more likely to be women, with low AUD severity, but high levels of anxiety, depression, and reactance. In regression models, we found significant interactions between these profiles and intervention groups.

Participants in Class 3 consistently had more beneficial effects from bMI compared to BA at both short- and long-term follow-up. These participants were concerned about their alcohol use, wanted to change, but felt unable to do it. MI aims to support patients' autonomy and to enhance their self-efficacy to change, by helping them being in action (Miller & Rollnick, 2013), and might thus have been particularly helpful for this participants' profile. Furthermore, MI aims to develop and resolve cognitive discrepancy (Miller & Rollnick, 2013). Results from empirical studies supported

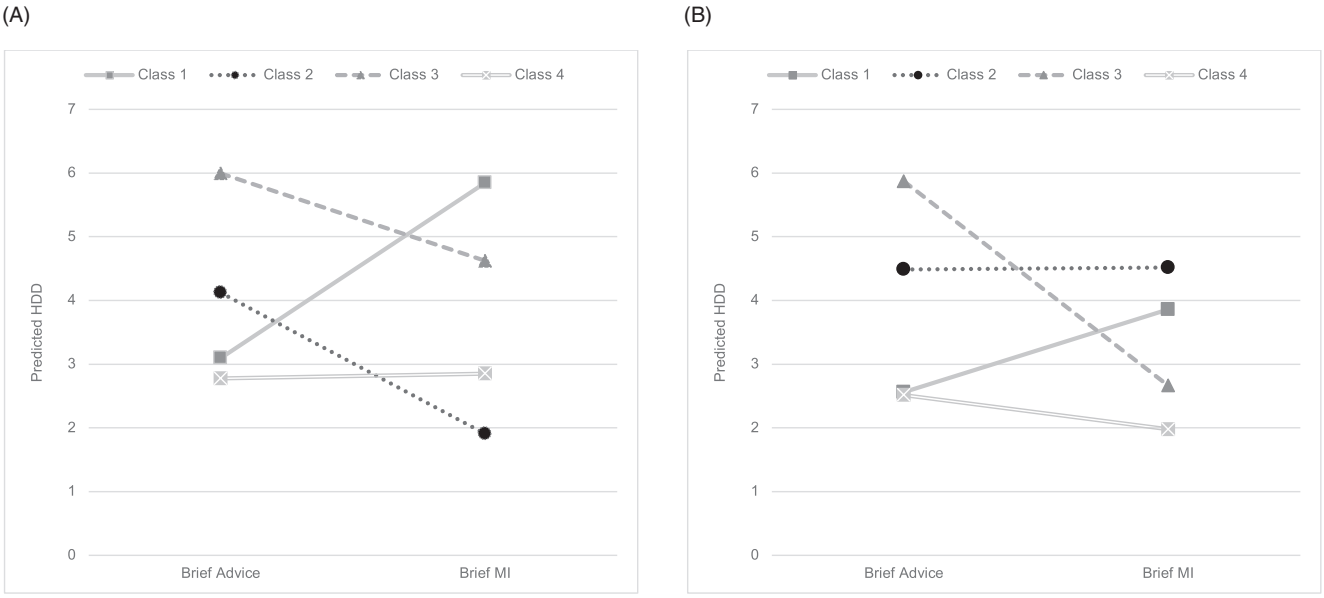

FIGURE 2 Graphical representation of interaction between intervention and moderator latent classes. (A) HDD at 1 month (adjusting for baseline HDD). (B) HDD at 12 months (adjusting for baseline HDD). HDD, Heavy drinking days per month. Y-axis represents predicted number of HDD based on predictive margins of the negative binomial model.

this component among heavy drinking college students (McNally et al., 2005) and within an ED-based brief intervention study (Walton et al., 2008).

Participants in Class 2 showed better bMI effects, but only at short term. The intervention might have had short-term effects on these participants in a similar way as participants in Class 3 (see above), but their higher severity on AUD and poorer mental health might indicate the need for additional or more intensive treatment to maintain long-term effects (Frohlich et al., 2022). This is also in line with other studies. Walters and Neighbors (2005) found greater effects of brief intervention at short-term (3-month) follow-up among students with higher severity of alcohol use. On the other hand, Frohlich et al. (2022) showed poorer outcomes among patients with higher severity and mental health issues compared with patients with low risk, but only at long-term follow-up (6-month) and not at the end of treatment. In addition, Amati et al. (2018) indicated that greater severity of mental health symptoms negatively affected treatment outcomes.

On the other hand, Class 1 participants seemed to benefit more from BA relative to bMI when compared with Class 3 at 1 and 12 months and with Class 2 at 1 month. They were younger, had low AUD severity, as well as low discrepancy and importance to change, indicating that they did not see alcohol use as much of an issue for them despite ending up in the ED. This would be in line with recent research which suggested that a lack of ambivalence to be resolved might explain the smaller effect sizes for MI among adolescents and younger adults (Feldstein Ewing et al., 2016). In addition, other studies have suggested potential iatrogenic effects of bMI components under particular circumstances. For instance, Gaume et al. (2016) found that more open questions and simple reflections (which are the most frequent MI-consistent therapist behaviors) were related to an increase in client sustain talk and alcohol use among nontreatment seeking young men. This was particularly observed in those drinking at a lower level of risk and having received bMI from therapists with low experience in MI. Other studies found similar unfavorable outcomes for these therapist's behaviors among students having low level of readiness to change (Tollison et al., 2008, 2013). These findings suggest that very skillful MI might be needed for young adults drinking at lower levels of risk and showing low ambivalence or readiness to change. An alternative explanation might rely on the fact that Class 1 also showed the lowest level of reactance. Information on alcohol-related risks and advice to cut down and avoid HDD might have been better received by these individuals who tend not to resist being influenced by others. In conjunction with the inherent motivating effect of ED presentation (Castro et al., 2021; Longabaugh et al., 1995), BA might have been sufficient to raise awareness of alcohol use consequences and promote behavior change. These findings would be consistent with Frohlich et al. (2022) and Del Boca et al. (2017) who indicated that lower risk individuals might benefit more from briefer interventions.

Finally, we found no significant results involving Class 4. This class was mostly comprised of female participants, exhibiting low severity, average motivational dimensions, but high anxiety and depression scores. Further research would be needed to find effective preventive measures for this particular patient profile.

This study has several strengths. First, the present investigation of intervention mechanisms was set as a primary aim of the parent project; moderation analyses were planned ahead, and all necessary variables were collected prospectively. Second, the sample size was

rather large for such analyses and included young adults presenting to the ED in routine practice, thus supporting external validity. Third, this study is a secondary analysis of a RCT with significant effects on HDD over 1 year (Gaume et al., 2022), and thus constitutes an important next step in the clinical field by determining which patients' profiles benefitted more from an effective bMI.

This study comes also with limitations. First, the study was conducted in a single site, in a French-speaking university hospital, which might limit generalizability. Second, the intervention model was developed for the present project (Gaume et al., 2021), and it may possess features that differ somewhat from other bMI models in the literature. "Brief intervention" is an umbrella term for a multitude of interventions which can differ in duration, approach, and content (e.g., Beyer et al., 2019), as well as in the extent to which MI is integrated or not. In this study, our intervention model was a brief adaptation of MI, embedding its recent empirical and theoretical developments. In the same vein, the bMI model comprised booster sessions, which were offered to all bMI participants, who accepted or refused them as they preferred. The intervention duration received could therefore vary importantly, and this could not be considered in the analyses since boosters were not randomized and may have introduced postrandomization selection bias if received by participants with particular characteristics. Third, moderator variables were assessed using brief measures in order to lower the impact of research procedures on clinical care and to minimize assessment reactivity. While we used empirically supported measures, these precluded us from conducting more nuanced analyses. Finally, the data from this study were drawn from a RCT for which strict inclusion and exclusion criteria were applied, resulting in a low participation rate (see Sample, above).

From a clinical standpoint, this study identified the patient profiles that benefitted more from bMI than BA among nontreatment seeking young adults who present intoxicated to the ED. The present findings have implications for intervention design, with a next stage in research to develop further intervention content tailored to patient profiles. In the case of our bMI model, it would seem appropriate to allocate more time and/or to intensify treatment with high level of MI to secure long-term effects among people with high AUD severity and mental health issues. On the other hand, relying on short BA for those with low AUD severity, reactance, and discrepancy might be reasonable. Finally, young adults with medium AUD severity, high importance to change and discrepancy, but low confidence to change may be the optimal group to target with bMI. Further studies should replicate these findings in other contexts and further investigate how intervention effects translate into actual behavior change.

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CONFLICT OF INTEREST STATEMENT

The authors have no conflict of interest to declare.

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SUPPORTING INFORMATION

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

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