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RESEARCH ARTICLE

Improvement in quality of life among women and men aged 60 years and older following treatment for alcohol use disorder

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Abstract

Background: Previous studies have yielded mixed results on the association between gender and alcohol use disorder (AUD) treatment outcomes. Thus, additional research is needed to determine the effect of gender on AUD treatment outcomes, including quality of life (QoL), particularly among older adults.

Aims: In a clinical sample of older adults with DSM-5 AUD, we examined changes in QoL from the beginning of AUD treatment through 1 year of follow-ups. We also examined the effect of gender and explored interaction effects with gender on QoL.

Methods: We utilized data from the "Elderly Study," a multi-national, single-blind, randomized, controlled trial of 693 adults aged 60+ with DSM-5 AUD. Alcohol use was assessed with the Form-90, and QoL with the brief version of the World Health Organization QoL measure. Information was collected at treatment initiation and at 4-, 12-, 26-, and 52-week follow-ups. Multilevel mixed-effects logistic and linear regression models were used to examine QoL changes and the effect of gender on changes in QoL.

Results: Following treatment, small, but significant improvements were seen over time in overall perceived health ($p < 0.05$). Improvements that persisted over the 1-year follow-up period were seen in the QoL domains of physical health (β: 2.6, 95% CI: 1.4–3.9), psychological health (β: 3.5, 95% CI: 3.3–3.8), social relationships (β: 4.0, 95% CI: 2.5–5.6), and environmental health (β: 1.4, 95% CI: 0.4–2.4). No significant changes were seen over time in overall perceived QoL ($p = 0.58$). Gender was not associated with changes in any of the QoL outcome measures (all $p \geq 0.05$).

Conclusions: Among 60+ year-old adults receiving treatment for DSM-5 AUD, improvements in QoL were achievable and maintained over time, but were not associated with gender.

KEYWORDS
alcohol treatment, alcohol use disorder, gender, older adults, quality of life

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BACKGROUND

The 12-month and lifetime prevalence rates of older adults (60+ years) with alcohol use disorder (AUD) are of considerable size in both the United States (Breslow et al., 2017; Han et al., 2019) and Europe (Muñoz et al., 2018; World Health Organization, 2018). Furthermore, the prevalence of older adults in these populations is increasing (Division, 2002; U.S. Department of Health and Human Services, 2018), and consequently, the prevalence of older adults with current AUD is expected to increase further (Han et al., 2017, 2019; Muñoz et al., 2018).

Older adults are more vulnerable to the negative health effects of alcohol consumption compared to younger adults, for example, increased incidence of hip fractures often explained by falling while intoxicated (Bikle et al., 1993). Alcohol sensitivity is greater in older women compared to older men (Beresford & Lucey, 1995), but also other gender differences in drinking patterns seem to be particularly pronounced among older adults. Older men are reported to drink more often and in higher quantities than older women (Geels et al., 2013; Han et al., 2017, 2019; Rosendahl et al., 2022), resulting in higher rates of hospitalization and more deaths in men (Hallgren et al., 2009). Furthermore, binge drinking, which leads to the greatest level of harm, is much more frequent among older men than women (Blow, 2000; Geels et al., 2013; Han et al., 2017, 2019; Rosendahl et al., 2022). Additionally, prevalence estimates of older adults suffering from AUD are higher in men than in women (Han et al., 2017). However, among older adults, suffering from AUD may be considered more stigmatizing and shameful for women than for men (Epstein et al., 2007). In recent years, however, the gender gap in alcohol use has been reduced, mainly due to older women drinking more often and in higher quantities, including binge drinking (Han et al., 2017, 2019). Despite all this, older adults are at high risk of not receiving AUD treatment or other substance use disorder treatment (Choi et al., 2014). Studies have shown that although AUDs are common among older adults, they are often under detected, misdiagnosed and undertreated, possibly due to, among other factors, therapeutic nihilism regarding older adults' ability to change or gain improvements in quality of life (QoL; O'Connell et al., 2003; Wadd & Dutton, 2018).

Various factors related to gender may at different times influence AUD and treatment outcomes such as QoL. For instance, representative treatment samples show that older women who enter AUD treatment are more likely to have had a late onset of AUD (Dauber et al., 2018). On the other hand, the consequences of AUD appear to be more negative for women than for men (Nolen-Hoeksema, 2004). Furthermore, older adults may experience widowhood, living alone, retirement, and a dwindling social network. Specifically, older women have been found to be more frequently widowed, living alone, and showing higher rates of retirement compared to older men (Dauber et al., 2018). Thus, gender potentially interacts with other factors on treatment outcomes. Exploring these interactions could help clarify the complexity of how gender operates in relation to other factors and how these factors effect AUD treatment outcomes.

Overall, it seems that the likelihood of positive outcomes (e.g., decreased alcohol consumption) in treatment of AUD increases with age (Bhatia et al., 2015; Kuerbis & Sacco, 2013). At the same time, studies using gender as a potential predictor of alcohol treatment outcomes have shown mixed results. In a review from 2009, Adamson et al. (2009) identified 18 studies that used gender as a potential predictor of alcohol-consumption-related treatment outcomes. Of these, eight studies found that a better outcome was predicted by the female gender and only one study found it to be the male gender. However, these studies did not report on the specific results of an older population. Results from a recent, large clinical trial of 60+-year-old patients suffering from DSM-5 AUD supported previous findings by reporting considerable improvements in terms of improved drinking behavior and higher QoL scores after AUD treatment of older adults (Andersen et al., 2020). However, the study also found that the female gender was associated with a higher probability of treatment failure, defined as having a blood alcohol concentration of >0.05% during the past 30 days up to a 26-week follow-up, compared to the male gender. This is contrary to findings from previous, older, studies in this age group (Satre et al., 2007), and emphasizes the need for more studies comparing genders on alcohol treatment outcomes among older adults.

In general, QoL measures refer to patients' perceptions of well-being across different domains of functioning, for example, within physical, mental health, social, and environmental domains (Laudet, 2011; Luquiens et al., 2012). Several studies have recommended QoL as a primary or secondary outcome measure in AUD and other substance use disorder treatments (Picci et al., 2014; Ugochukwu et al., 2013; Witkiewitz et al., 2015). Improved drinking measures have generally been shown to be positively associated with QoL in clinical studies of patients receiving treatment for AUD (Andersen et al., 2020; Andersson & Nordfjærn, 2020; Bold et al., 2017; Frischknecht et al., 2013). Some mixed results do, however, appear on the association between specific drinking measures and QoL after treatment for AUD, which is probably due to the use of different drinking measures and definitions of QoL. Women with AUD have been found to report significantly lower QoL scores before treatment than men suffering from similar AUD severity (Armoon et al., 2022; Peters et al., 2003), and older women have shown significantly lower QoL scores than older men (Armoon et al., 2022; Borglin et al., 2005). However, little is still known about gender's impact on alcohol treatment outcomes, including QoL, among older adults suffering from AUD.

To the best of our knowledge, no studies have focused on the effect of gender on QoL as an AUD treatment outcome among older adults. Thus, there is a need to do so in a clinical sample of 60+-year-old patients receiving treatment for AUD.

The aims of this study were to (1) explore patient-reported outcomes of QoL changes from treatment start throughout up to 1-year follow-ups in a clinical population of 60+-year-olds receiving treatment for AUD, (2) determine the effect of gender on QoL, while controlling for other relevant covariates, and (3) explore the possibility of interactions with gender on QoL.

METHODS

Design and setting

We utilized data from the Elderly Study; a single-blind multi-site multi-national randomized controlled clinical trial (Clinical Trials gov database: NCT02084173), conducted from January 2014 to May 2016 (Andersen et al., 2015, 2020). The study was conducted on six different sites in three different countries: Denmark (Copenhagen, Aarhus, and Odense), Germany (Munich and Dresden), and the United States (Albuquerque, New Mexico). The inclusion criteria were (i) age 60 years or over, and (ii) fulfilling the DSM-5 criteria for AUD (American Psychiatric Association, 2013). Exclusion criteria were (i) the inability to give at least 8 of 10 correct answers in an informed consent comprehension quiz, and therefore indicating failure to fully understand the implications of participation or even cognitive impairment, (ii) psychotic symptoms at the time of inclusion, (iii) severe depression at the time of inclusion, (iv) a lifetime diagnosis of bipolar disorder, (v) suicidal thoughts or behavior at the time of inclusion, (vi) the use of illicit opioids or stimulants (however, other types of medication were allowed, e.g., medically prescribed opioids), (vii) participation in other alcohol treatment within 30 days prior to the time of inclusion, however, not applied for treatments with the sole purpose of detoxification, and (viii) patients with legally authorized representatives. The study was approved by the ethics committees at the research centers and participants provided written informed consent before baseline.

The study compared two psychosocial interventions aimed at treating AUD in older adults aged 60 years and older. Intervention (A) a manualized, brief, out-patient treatment based on motivational enhancement therapy (MET, $n=351$; Arkowitz et al., 2015), was compared with intervention (B) the same brief MET intervention plus an additional up to eight sessions of community reinforcement approach (Miller et al., 1999), age-adapted to seniors (CRA-S, $n=342$). MET consisted of four sessions that lasted between 60 and 90 min: one session per week. The content of the four MET sessions consisted of Motivational Interviewing (MI), a functional analysis, development of a personal change plan, and, if possible, involvement of a significant other in the fourth and final session. Patients in intervention B were offered up to eight additional treatment sessions. These involved one or more modules aimed at learning skills or strategies to support a positive, rewarding, alcohol-free lifestyle, in order to implement the change plan. Each module and sessions were thoroughly described in the manuals for the Elderly Study, which are available at webcitation.org: MET alone (Moyers et al., 2013b) and MET + CRA-S (Moyers et al., 2013a). Fidelity ratings of MI given in the Elderly Study met benchmarks for good MI, indicating high levels of therapist fidelity (Schmidt et al., 2019). The study design, settings, and primary results of the study have been described in detail elsewhere (Andersen et al., 2015, 2020; Søgaard Nielsen et al., 2016).

The baseline sample in the Elderly Study consisted of $n=693$ patients. Since the statistical analyses in the present study allowed for the use of all available data including those patients who had missing information on one or multiple assessment points, our final sample also consisted of $n=693$ patients. At each follow-up, patients were excluded if they had missing information on all the QoL outcome measures. Thus, relative to the baseline sample, response rates were 90.0% (4 weeks; $n=624$), 84.7% (12 weeks; $n=587$), 77.3% (26 weeks; $n=536$), and 72.4% (52 weeks; $n=502$) at each follow-up, respectively.

Baseline assessments and follow-ups

Patients were assessed at screening, and at baseline (start of treatment), and followed up at the end of MET treatment (T1, i.e., 4 weeks after baseline), at the end of MET + CRA-S treatment (T2, i.e., 12 weeks after baseline), 6 months after baseline (T3), and 12 months after baseline (T4). The baseline assessment included, among other things, the collection of socio-demographic factors using a questionnaire. The Form 90-AI/F (Miller & del Boca, 1994) was used to assess different aspects of alcohol consumption at baseline and across all follow-ups (T1–T4). Follow-up interviews also included information on therapy compliance (completed after every session during MET- and CRA-S-treatment, weeks 1–12) and treatment satisfaction (custom-made questionnaire).

Outcome measures

Self-reported QoL was assessed using the brief version of the World Health Organization Quality of Life measure (WHOQOL-BREF; The WHOQoL Group, 1995, 1998; WHOQOL Group, 1998; World Health Organization, 1996), which is considered an appropriate measure to use in samples with AUD (Kirouac et al., 2017). The WHOQOL-BREF is a 26-item instrument used to measure an individual's perception of overall QoL, overall health, and QoL in four different domains:

1. Physical health (seven items, e.g., activities of daily living, energy and fatigue, pain, and discomfort),
2. Psychological health (six items, e.g., self-esteem, positive and negative feelings),
3. Social relationships (three items, e.g., personal relationships and social support), and
4. Environmental health (eight items, e.g., financial resources, participation in and opportunities for recreation, and home environment).

Each individual item was scored on a 5-point Likert scale, with higher scores reflecting better QoL. The two items that are not a part of the four domains, assess overall perception of QoL, ranging from 1 = *Very poor* to 5 = *Very good*, and overall perception of health, ranging from 1 = *Very dissatisfied* to 5 = *Very satisfied*. We then dichotomized this information and categorized overall perceived QoL as *Poor* (Very poor or Poor) and *Neutral/Good* (Neither poor nor good, Good, or Very Good), and overall perceived health

as *Dissatisfied* (Very dissatisfied, Dissatisfied) and *Neutral/Satisfied* (Neither satisfied nor dissatisfied, Satisfied, or Very satisfied). We also used the remaining items to calculate the four domain scores, which were then transformed linearly to a 0–100 scale, according to standard guidelines (World Health Organization, 1996). Thus, for the present study, we have two binary outcomes (overall perceived QoL and overall perceived health), and four domain scores ranging from 0 to 100 with higher scores reflecting better QoL.

Socio-demographic factors

Information on socio-demographic factors was collected using a tailor-made questionnaire and included, among other things, information on age, gender, country, employment status (type of job, retired, unemployed, etc.), current marital status, and previous treatment episodes. Patients' employment status was dichotomized as *Working* (Full time work or Part time work) and *Not working* (Homemaker, Retired, Unemployed, or Disability). Current marital status was dichotomized as *Single* (Single—never been married, Separated, but still married, Divorced, or Widowed) and *Cohabiting* (Legally married or Cohabiting with partner (but not married)). Lastly, previous treatment episodes were assessed using the question "Have you ever been in treatment (inpatient or outpatient) for addiction problems?" and were dichotomized as *No* and *Yes* (1 or more times).

Alcohol consumption measures

Self-reported alcohol consumption was assessed as the number of daily standard drinks (one standard drink equivalent to 12 g of pure alcohol) in the 90 days leading up to baseline as well as in the 30 days leading up to each follow-up point (T1–T4) by means of the Form 90 (Miller & del Boca, 1994). Alcohol consumption measures from days 60–31 prior to baseline were defined as *Pre baseline* and days 30–1 prior to baseline were defined as *Baseline*. We used this information to measure and calculate drinking measures as described below.

- Percentage of days abstinent was calculated as the percentage of days with self-reports of no alcohol consumption over the last 30 days leading up to the assessment point (baseline or follow-up, and days 60–31 for pre-baseline), that is, 0 = self-reported alcohol consumption on every single of the last 30 days and 100 = no days with alcohol consumption within the last 30 days. Patients who had increased their percent days abstinent from baseline to a given follow-up by any percentage were categorized as *Improved drinking measure*, no change was categorized as *Unchanged*, and reduced percent days abstinent was categorized as *Reduced*.
- Drinks per day was calculated as the mean number of standard drinks (12 g of pure alcohol) over the last 30 days leading up to the assessment point (baseline or follow-up).
- Drinks per drinking day was calculated as the mean number of standard drinks (12 g of pure alcohol) on days with self-reported alcohol consumption over the last 30 days leading up to the assessment point (baseline or follow-up).
- Percentage of heavy drinking days was calculated as the percentage of days with self-reports of heavy drinking (with "heavy" defined as four or more standard drinks in a day for women and five or more drinks for men) over the last 30 days leading up to the assessment point (baseline or follow-up), that is, 0 = no days with heavy drinking within the last 30 days and 100 = self-reports of heavy drinking on every single of the last 30 days.

Statistical analyses

For descriptive statistics and to describe sample characteristics, we used Pearson's chi-square and Fisher's exact tests to compare categorical covariates at baseline across genders. The Wilcoxon rank-sum test (Mann–Whitney) was used to compare continuous covariates.

Next, we used multilevel mixed-effects logistic regressions to examine the effect of gender on overall perceived QoL and on overall perceived health during and after treatment in both crude analyses (only adjusted for the baseline value of the outcome variable) and while controlling for age, employment status, marital status, previous treatment episodes, drinks per day, time (assessment points), and the baseline value of the outcome variable. Since the Elderly Study found no significant outcome differences between intervention groups at the 6-month follow-up, we did not include treatment group as a covariate. Sensitivity analyses including treatment group as a covariate confirmed that treatment group did not meaningfully alter the results. Since we included the baseline value of the outcome variable in our models, results show the effect of gender relative to each other (females relative to males) and not the difference in QoL scores between the two genders. Thus, we are isolating the change in QoL outcome by gender, rather than looking at the endpoint QoL difference between genders. Multilevel mixed-effects linear regressions were used to examine the crude and adjusted effect of gender on each of the four QoL domains. These modeling approaches allow for the use of all available data including those patients who had missing data on one or multiple assessment points. Our models examined both linear, quadratic, and cubic trends of continuous covariates (e.g., age) by including the covariate, the covariate-squared, and the covariate to the third power as fixed effects. We also adjusted for clustering within treatment sites, by nesting patients by country. Since alcohol consumption was measured on all assessment points, this covariate was entered as a time-varying covariate accounting for variation in alcohol consumption across the entire study period. All models included both random intercepts and slopes, unstructured covariance matrix, and maximum likelihood (ML) estimation. Inclusion of a random intercept accounts for individual baseline differences in QoL scores and random slopes allows for variation in individual QoL score trajectories over time (i.e., changes in QoL scores). Likelihood-ratio tests were used to provide a *p*-value for a possible effect of time in the models. Lastly, all models were tested

for the possibility of an interaction between time and gender, marital status and gender, treatment group and gender, alcohol consumption and gender, and between time and treatment group. This was done by including the respective interaction term as a fixed effect in each adjusted model and performing likelihood-ratio tests to compare each model with and without each interaction term. We hypothesized that treatment would be positively associated with improved QoL outcome measures, and that these improvements would be greater for the female gender.

Sensitivity analyses were conducted for both the multilevel mixed-effects logistic and linear regression models in a sub-sample ($n = 320$, 60.3% male) where patients who reported having abstained from alcohol at all time points were excluded from the models. The sensitivity analyses were performed as abstainers in some way may be different from other patients in the final sample, and these differences could potentially affect the study results. For example, the demographic and lifestyle characteristics of abstainers may be different from those who consume alcohol. Excluding abstainers from the analyses helps to eliminate the potential confounding effects of these differences and provides a more accurate representation of the relationship between treatment and QoL outcomes. The same procedure as the one described above was used for the sensitivity analyses.

We also examined if gender was predictive of missingness in the outcome variable at T4 by comparing a logistic regression model, with all explanatory variables included and the missingness status of each patient as a response, with a model where gender had been removed. The two models were compared using a likelihood ratio test for each outcome. We did not find that gender was predictive for missingness in any of the outcomes at T4 (results not shown), and we could therefore conclude that it is possible for information on outcome variables to be missing at random.

Statistical analyses were carried out using STATA version 17.0 and $p = 0.05$ was used as the significance level.

RESULTS

Sample characteristics

Most of the patients were men (59.7%), and the mean age of patients was 65.6 (SD = 4.6). Female patients had a mean age of 66.0 (SD = 4.6) and were slightly older than the male patients ($p = 0.04$) who had a mean age of 65.3 (SD = 4.6). Statistically significant baseline differences between genders were also found on country and marital status: the Danish site had the smallest proportion of women (35.8%), the German site had the largest (47.8%), and more women (62.7%) than men (46.6%) were single (Table 1). At baseline, male patients reported significantly higher means of drinks per day (*mean* (SD); 6.3 (5.5)) and more drinks per drinking day (*mean* (SD); 9.4 (7.0)) compared to female patients (*mean* (SD); 4.3 (3.9) drinks per day and 6.7 (4.8) drinks per drinking day, respectively; both $p < 0.01$). The Wilcoxon rank-sum tests showed no significant baseline differences between genders in percent days abstinent nor percent heavy drinking days (both $p > 0.05$). At pre baseline, results concerning alcohol consumption were the same, except a significant difference was seen in percent heavy drinking days (Table 1), with male patients having a higher mean percentage of 60.1% compared to female patients ($p < 0.05$) who had a mean percentage of 55.5%. Improved drinking measures based on percent days abstinent were reported among 71.0% of the patients at T4, whereas 14.1% and 14.9% reported reduced or unchanged percent days abstinent, respectively. At T4, male patients reported significantly higher means of drinks per day (*mean* (SD); 3.1 (3.8)) and more drinks per drinking day (*mean* (SD); 4.5 (4.5)) compared to female patients (*mean* (SD); 2.1 (2.9) drinks per day and 3.5 (3.6) drinks per drinking day, respectively; both $p \leq 0.01$). Male patients reported a mean of percent days abstinent at 51.8 (SD; 41.1), while for female patients it was 59.2 (SD; 38.8). The Wilcoxon rank-sum tests showed no significant differences at T4 between genders in percent days abstinent nor percent heavy drinking days (both $p \geq 0.05$). Mean percent heavy drinking days was 26.5 (SD; 37.4) for male patients and 20.7 (SD; 33.6) for female patients. There was a greater proportion of female patients (73.8%) who had improved their percent days abstinent at T4 compared to the proportion of male patients (69.1%).

Gender differences in QoL

Table 2 presents QoL measures at all assessment point, stratified by gender. At baseline, male patients had significantly greater QoL scores in the psychological health ($p = 0.02$) compared to females, while they had significantly lower scores in the social relationship domain ($p = 0.04$). The Wilcoxon rank-sum tests showed no significant baseline differences between genders in the physical health and environmental health domains. Also, chi-square tests showed no significant baseline differences on overall perceived QoL and overall perceived health.

Figure 1 shows the predicted probabilities for both overall perceived QoL and overall perceived health, across all time points and stratified by gender. Specifically for overall perceived QoL, we found a significant improvement from baseline to T1 (OR: 1.36, 95% CI: 1.02–1.81, $p = 0.04$), however, the improvement was not statistically significant at any of the subsequent follow-ups. The likelihood-ratio test showed no effect of time in a model with time included as a factor compared to a model without time as a factor ($p = 0.58$). In overall perceived health, we did not find any significant changes from baseline to any of the subsequent follow-ups (all $p \geq 0.05$), as illustrated in Figure 1. However, the likelihood-ratio test showed an effect of time in a model with time included as a factor compared to a model without ($p < 0.05$).

Figure 2 shows the linear prediction of each QoL domain score, across all time points and stratified by gender. During and following treatment, small, but statistically significant improvements were seen over time and after 52 weeks in the physical health domain scores (β: 2.6, 95% CI: 1.4–3.9, $p < 0.01$), psychological health domain

TABLE 1 Demographic characteristics and alcohol consumption measures at baseline and 60–1 days prior to baseline by gender.

	Male	Female	Total	*p*-value[a]
Patients, *n* (%)	414 (59.7)	279 (40.3)	693 (100.0)	
Age, median (iqi)	64.0 (62.0; 68.0)	65.0 (62.0; 69.0)	64.0 (62.0; 68.5)	0.04
Country, *n* (%)				
Danish site	219 (52.9)	122 (43.7)	341 (49.2)	
New Mexico site	89 (21.5)	60 (21.5)	149 (21.5)	
German site	106 (25.6)	97 (34.8)	203 (29.3)	0.02
Employment status, *n* (%)				
Working	86 (20.8)	56 (20.1)	142 (20.5)	
Not working	328 (79.2)	223 (79.9)	551 (79.5)	0.82
Marital status, *n* (%)				
Single	193 (46.6)	175 (62.7)	368 (53.1)	
Cohabiting	221 (53.4)	104 (37.3)	325 (46.9)	<0.01
Previous treatment episodes for AUD, *n* (%)				
No	221 (53.4)	168 (60.2)	389 (56.1)	
Yes	193 (46.6)	111 (39.8)	304 (43.9)	0.08
Alcohol consumption days 30–1 before baseline				
Percent days abstinent, median (iqi)	30.0 (0.0; 70.0)	36.7 (3.3; 76.7)	30.0 (0.0; 70.0)	0.20
Drinks per day, median (iqi)	5.1 (2.4; 8.8)	3.7 (1.5; 6.0)	4.3 (1.9; 7.6)	<0.01
Drinks per drinking day, median (iqi)	7.8 (4.8; 12.6)	5.8 (3.9; 9.1)	6.9 (4.4; 11.1)	<0.01
Percent heavy drinking days, median (iqi)	46.7 (10.0; 90.0)	43.3 (10.0; 83.3)	46.7 (10.0; 86.7)	0.28
Alcohol consumption days 60–31 before baseline				
Percent days abstinent, median (iqi)	10.0 (0.0; 52.1)	13.3 (0.0; 50.0)	10.0 (0.0; 50.9)	0.22
Drinks per day, median (iqi)	6.1 (3.3; 11.2)	4.5 (2.2; 7.3)	5.5 (2.7; 9.5)	<0.01
Drinks per drinking day, median (iqi)	8.3 (5.2; 13.6)	6.0 (4.0; 9.6)	7.4 (4.7; 11.8)	<0.01
Percent heavy drinking days, median (iqi)	70.0 (19.3; 100.0)	63.3 (13.3; 96.7)	66.7 (16.7; 100.0)	0.05

Note: Alcohol consumption measures were assessed by means of the Form 90. A standard drink = 12 g of pure alcohol. A heavy drinking day = 4 or more drinks in a day for women and 5 or more drinks for men.

Abbreviation: *iqi*, interquartile interval.

[a]Pearson's chi-square tests for categorical variables and Wilcoxon rank-sum tests for continuous covariates.

scores (β: 3.5, 95% CI: 3.3–3.8, $p < 0.01$), social relationships domain scores (β: 4.0, 95% CI: 2.5–5.6, $p < 0.01$), and in environmental health domain scores (β: 1.4, 95% CI: 0.4–2.4, $p < 0.01$). For QoL domain scores, the most substantial growth increase happened between baseline and T1 (Figure 2).

Gender effects on QoL changes

To examine the effect of gender on QoL measures, a crude model was first tested including gender, and linear and quadratic baseline outcome values as fixed effects (Table 3, Model 1). The model showed no effect of gender on any of the QoL measures, except for the social relationship domain where the female gender had a small negative effect on this outcome ($\beta = 0.99$). Since this warranted further exploration, we tested the fully adjusted model, including socio-demographic- and treatment-related factors as fixed effects, and time as random effect. As shown in Table 3 (Model 2), we found that gender was not associated with any of the QoL outcome measures during and after treatment when controlling for other relevant factors, including alcohol consumption trajectories. Neither did we, when adding interaction terms to the model, find any significant interactions between gender and alcohol consumption, between gender and treatment assignment, nor between gender and marital status.

Sensitivity analyses

When running sensitivity analyses, excluding patients who reported abstinence at all time points, we still did not observe an effect of gender on any of the QoL outcome measures, as results were consistent with findings from the primary analyses. These results are available upon request.

TABLE 2 Overall perceived quality of life (QoL), overall perceived health, and quality of life domain scores at all assessment points by gender.

	Baseline		4 weeks (T1)		12 weeks (T2)		26 weeks (T3)		52 weeks (T4)	
	Male ($n = 414$)	Female ($n = 279$)	Male ($n = 382$)	Female ($n = 242$)	Male ($n = 365$)	Female ($n = 222$)	Male ($n = 326$)	Female ($n = 210$)	Male ($n = 301$)	Female ($n = 201$)
Overall perceived QoL										
Poor, *n* (%)	150 (36.2)	111 (39.9)	95 (24.9)	64 (26.3)	80 (21.9)	58 (26.1)	69 (21.2)	48 (22.9)	64 (21.3)	47 (23.4)
Neutral/good, *n* (%)	264 (63.8)	167 (60.1)	287 (75.1)	179 (73.7)	285 (78.1)	164 (73.9)	257 (78.8)	162 (77.1)	237 (78.7)	154 (76.6)
Overall perceived health										
Dissatisfied, *n* (%)	189 (45.7)	120 (43.0)	159 (41.6)	95 (39.1)	153 (41.9)	87 (39.2)	132 (40.5)	85 (40.5)	126 (41.9)	71 (35.3)
Neutral/satisfied, *n* (%)	225 (54.3)	159 (57.0)	223 (58.4)	148 (60.9)	212 (58.1)	135 (60.8)	194 (59.5)	125 (59.5)	175 (58.1)	130 (64.7)
Physical health domain										
Mean (SD)	54.9 (11.5)	54.4 (11.8)	57.4 (10.5)	57.5 (11.8)	58.3 (11.1)	57.9 (12.0)	58.0 (10.2)	57.4 (12.0)	59.1 (10.0)	57.5 (11.1)
Psychological health domain										
Mean (SD)	57.8 (12.6)	55.1 (12.8)	59.9 (12.0)	58.4 (13.3)	61.0 (12.2)	59.8 (12.7)	61.2 (12.1)	59.4 (13.4)	62.6 (11.5)	60.7 (12.3)
Social relationships domain										
Mean (SD)	60.2 (18.1)	62.3 (20.6)	64.0 (17.9)	66.3 (21.4)	63.4 (18.0)	66.6 (20.4)	66.0 (17.9)	67.8 (19.7)	65.9 (17.8)	67.2 (19.5)
Environmental health domain										
Mean (SD)	74.1 (12.2)	74.1 (14.4)	75.1 (12.0)	75.7 (15.1)	75.5 (12.2)	75.8 (14.5)	76.0 (12.1)	76.5 (13.4)	76.6 (12.2)	76.5 (13.0)

Note: Quality of life domain scores have been transformed linearly to a 0–100 scale with higher scores reflecting better quality of life.

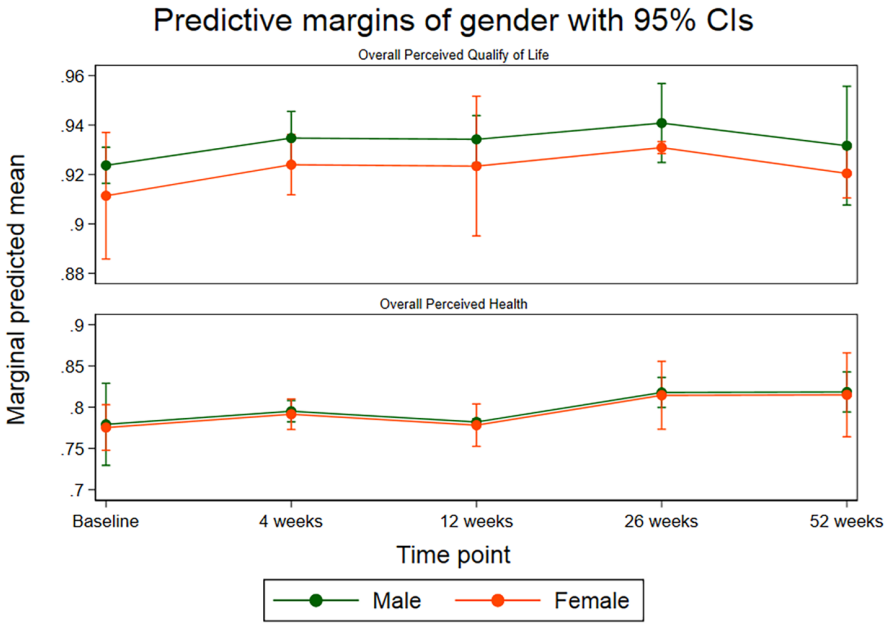

FIGURE 1 Predicted probabilities (estimated marginal effects) of having *Neutral/good* or *Neutral/satisfied* Overall Perceived QoL and Health, respectively, by gender and time points.

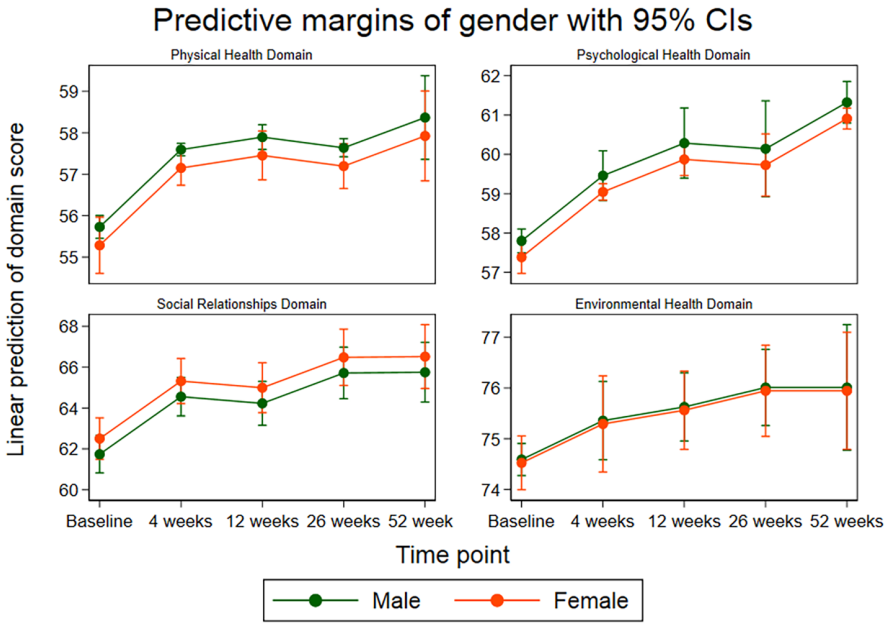

FIGURE 2 Estimated marginal effects of QoL domains by gender and time points.

DISCUSSION

In the present study, we examined QoL changes in a population of 60+-year-old patients suffering from DSM-5 AUD, receiving 4 to up to 12 weeks of treatment, and followed for up to 1 year after treatment start. We also sought to determine whether gender affected these QoL changes, while controlling for other relevant covariates. Lastly, we sought to explore the potential influence of interactions between gender and various other factors on QoL changes in older adults following AUD treatment. As hypothesized, we found general significant increases in various QoL measures over time, but no differences were seen between genders, and no significant interactions were discovered. Excluding abstainers from the analyses did not change the results. To the best of our knowledge, this is the first study to examine QoL changes and the effect of gender during and after treatment for AUD, in a population of older adults.

The results from the present study are consistent with previous findings showing that patients in other age groups improve their QoL outcome measures after receiving treatment for AUD (Andersson & Nordfjærn, 2020; Bold et al., 2017), and

TABLE 3 Female gender odds ratios and regression coefficients for quality of life outcome measures from crude and adjusted multilevel mixed-effects logistic and linear regressions over time.

	Model 1 (crude)				Model 2 (adjusted)			
	OR	SE	*p*-value	95% CI	OR	SE	*p*-value	95% CI
Overall perceived quality of life	0.88	0.10	0.25	0.71; 1.10	0.74	0.19	0.24	0.45; 1.22
Overall perceived health	1.05	0.09	0.55	0.89; 1.25	0.96	0.17	0.80	0.67; 1.36
	B	SE	*p*	95% CI	*B*	SE	*p*	95% CI
Physical health domain	−0.30	0.28	0.28	−0.85; 0.25	−0.44	0.27	0.11	−0.98; 0.09
Psychological health domain	−0.14	0.58	0.81	−1.28; 1.00	−0.41	0.37	0.26	−1.13; 0.30
Social relationships domain	0.99	0.33	0.00	0.34; 1.64	0.76	0.57	0.18	−0.36; 1.89
Environmental health domain	0.16	0.15	0.29	−0.14; 0.46	−0.07	0.20	0.74	−0.45; 0.32

Note: Adjusted models are controlled for age, employment status, marital status, previous treatment episodes, drinks per day, time (assessment points), and the baseline value of the outcome variable.

Abbreviations: *B*, parameter estimate (regression coefficient); OR, odds ratio, SE, standard error.

All reference groups are *Male*.

that these improvements are maintained over time (Frischknecht et al., 2013). The present study extends these findings by providing evidence that these improvements also can be found in older adults (60+). Gender has sometimes been found to be a predictor of other AUD treatment outcomes, albeit results have varied (Adamson et al., 2009). In the present study, we did not find gender to influence QoL outcome measures after receiving treatment for AUD in the given population.

Limitations and strengths

In the present study, we utilized data from the Elderly Study with specific inclusion and exclusion criteria, and with data stemming from three countries. Whether our findings can be generalized to older adults from other countries and cultures, older adults with less problematic alcohol use, non-treatment-seeking individuals, inpatients, or patients with different comorbidities, cannot be determined by the present study. For this, studies with a higher degree of external validity will need to be conducted on populations of older adult.

The WHOQOL-BREF utilizes domain scores that encompass multiple questions and provide a more comprehensive assessment of specific areas of life. These domain scores allow for a detailed evaluation of the changes in QoL within these specific areas. On the other hand, the binary overall QoL measure is a single question that may be challenging to interpret and might not capture the nuanced changes experienced by the participants. By emphasizing changes in domain scores, we aimed to capture the multidimensionality of QoL and provide a more nuanced understanding of the impact of treatment. We believe that the use of domain scores offers a more comprehensive evaluation of the changes in QoL within specific areas, compared to a binary overall QoL indicator.

Using mixed-effects regression models is considered a strength, since they allow for the use of all available data, including information from patients who were lost to follow-up at a later time point (Peters et al., 2012; Thabane et al., 2013). Thus, they allow analyzing patient information that would otherwise have undergone listwise exclusion for missing values. Another strength is that data were collected across three different countries and since the models used were adjusted for these clusters, our findings are consistent and robust within each country.

Clinical implications

The observed improvements in various QoL measures are small, but statistically significant. Thus, our findings present an argument against therapeutic nihilism that has otherwise been associated with AUD in older adults (O'Connell et al., 2003; Wadd & Dutton, 2018). Studies have shown that healthcare professionals may be tempted to not address excessive alcohol use in the older population based on the assumption that the pleasure of drinking alcohol should not be removed from older men and women, since they may not have much pleasure left in life (Christiansen & Nielsen, 2023; O'Connell et al., 2003). However, in our study, the QoL of older adults suffering from AUD does not decline following treatment. On the contrary, it improves, at least slightly, both overall and within the various domains. These improvements are not only maintained over time but also keep increasing in up to 1 year after initiating treatment. Thus, QoL measures are still significantly greater 1 year after treatment entry compared to baseline measures. These improvements are highly relevant as the baseline scores observed in our study are considerably lower than QoL norms observed in studies of general populations, older adults, and individuals with problematic alcohol use (Barros da Silva Lima et al., 2005; Hawthorne et al., 2006; Noerholm et al., 2004). This suggests that the participants in our study may have been experiencing difficulties and lower QoL prior to treatment. Since our findings were confirmed when excluding abstainers from our analyses, it seems that these improvements might also be

achievable in patients with a reduction goal as a treatment outcome and not only for patients who obtain abstinence after treatment. This knowledge is highly relevant for healthcare professionals who tend to believe that either there is no perspective in offering AUD treatment for older adults late in life or that alcohol reduction is not a feasible goal for the older adults who aim for it. Addressing the reluctance among healthcare professionals is particularly important, since it is probably a part of the explanation of why older adults are less likely to receive treatment compared to other age groups (Choi et al., 2014; Mack et al., 2014; O'Connell et al., 2003; Wadd & Dutton, 2018). Overall, our results indicate that it would be highly beneficial to convert this attitude of reluctance to treat older adults for their excessive alcohol use and further improve AUD treatment options for older populations. Furthermore, it may also be relevant to continuously convey to patients that improvements in QoL continue over time to help prevent a feeling of hopelessness.

Implications for future research

The use of QoL measures in alcohol research is an important aspect of understanding not only the impact of alcohol use but also the impact of alcohol treatment on individuals and patients. QoL measures may help to identify the specific areas of life that may be most affected by alcohol use, and thus further inform treatment goals and interventions. Measuring QoL may also help to identify subgroups of individuals who may benefit from targeted interventions or alcohol treatment in general, such as in the present study. Thus, we recommend using QoL measures in alcohol research, beyond just measures of alcohol consumption or substance use disorder symptoms.

Currently, a series of different assessment instruments are used to assess QoL in alcohol research. Using different assessment instruments and outcomes have consequences, for example, it becomes difficult to compare findings and identify the most important factors across studies. It is important for researchers to carefully consider their outcome measures and to use standardized measures whenever possible. For future research, we recommend following the recommendations for design and analysis of alcohol treatment trials given by Witkiewitz et al. in a critical review from 2015 (Witkiewitz et al., 2015).

CONCLUSION

Older adults suffering from AUD improve their QoL following treatment. Improvements increase over time and persist up to 1-year post-treatment. Gender does not have an impact on improvements in QoL following AUD treatment. These results emphasize that older adults, regardless of gender, should be offered treatment for AUD.

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CONFLICT OF INTEREST STATEMENT

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DATA AVAILABILITY STATEMENT

The data that support the findings of this study are available from the corresponding author upon reasonable request.

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