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RESEARCH ARTICLE

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# Association of impulsivity with quality of life and well-being after alcohol withdrawal treatment

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## Abstract

**Objectives:** Impulsivity is related to a higher risk of relapse in alcohol use disorders. However, besides drinking behavior, other recovery outcomes like physical and mental health-related quality of life are at least as important. The present study aimed to fill a research gap regarding the association of different impulsivity facets with health-related quality of life and well-being in alcohol use disorder.

**Methods:** Individuals with a primary alcohol use disorder diagnosis ($n = 167$) were interviewed with standardized self-report measures at the progressed stage of their withdrawal treatment and 6 weeks thereafter. Multiple regression models were calculated to examine the association of impulsivity, craving, and drinking patterns with health-related quality of life and well-being 6 weeks after withdrawal treatment, as well as the predictive role of impulsivity assessed during withdrawal for these two outcomes.

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**Results:** Craving was associated with health-related quality of life and well-being 6 weeks after withdrawal. Likewise, non-planning and attentional impulsivity were associated with well-being 6 weeks after withdrawal. Motor impulsivity during withdrawal treatment predicted health-related quality of life 6 weeks thereafter.
**Conclusion:** Impulsivity seems to be negatively related to health-related quality of life and well-being in the first weeks after alcohol withdrawal treatment, probably to a higher extent than drinking patterns, but differentiating between its facets seems to be important. These findings emphasize the importance of treatment approaches aiming at reduced impulsivity in the early recovery process.

**KEYWORDS**
alcohol use disorder, impulse control, attentional, motor, non-planning

## 1 | INTRODUCTION

Alcohol use disorders belong to the most prevalent psychiatric diseases around the world, especially in higher-income countries (Carvalho et al., 2019) with about 3.5% prevalence for alcohol dependence and 2.8% for misuse of alcohol (Seitz et al., 2019) in Germany.

One factor that has repeatedly been associated with lower rates of abstinence (Sliedrecht et al., 2020)— and, thus, might be an important leverage point for treatments—is self-reported impulsivity. Self-reported impulsivity seems to be a multidimensional construct (MacKillop et al., 2016), including a) immediate, thoughtless reactions to cues, b) not being able to stay focused on a (complex) task, and c) not considering potential consequences or planning-ahead, especially in light of emotional experience. From a neurobiological perspective, impulsivity is often ascribed to a hyperactivity of the bottom-up network evoking reflexive responses (e.g., automated approaching to substance cues in expectation of reward) and the antagonistic hypoactivity of the top-down network responsible for reflective processes (e.g., considering longitudinal consequences, inhibiting automated responses; see e.g., Kozak et al., 2019). These processes may result in a lack of inhibition of substance-seeking behavior and may, thus, account for the relation of impulsivity to craving (Coates et al., 2020), relapse (Sliedrecht et al., 2020, 2019), and substance use (Hershberger et al., 2017). Excessive substance use, in turn, may increase the imbalance of bottom-up and top-down processes described above (Volkow et al., 2019). In line with this assumption, impulsivity can decrease with abstinence (Schmidt et al., 2017), even though there is still a lack of longitudinal studies (Crowe et al., 2020).

While abstinence is the (gold) standard therapeutic principle in German addiction services (Mann et al., 2017), patient-centered outcomes like one's subjective evaluation of physical and mental health (health-related quality of life) or well-being seem to be at least equivalently if not more essential to the recovery process (Kirouac & Witkiewitz, 2019; Witkiewitz & Tucker, 2020). Evidence on the role of drinking patterns for health-related quality of life and well-being is diverging. Despite a positive association of health-related quality of life and well-being with abstinence (Vederhus et al., 2016), as well as a reduction of drinking (Macfarlane et al., 2019; Witkiewitz et al., 2021), it may even for heavily drinking individuals be possible to display above-average physical and mental health-related quality of life (Witkiewitz et al., 2020). Besides actual drinking behavior, alcohol craving seems to be negatively related to mental health-related quality of life (Herrold et al., 2017).

Overall, patient-centered outcomes are essential indicators of successful recovery in alcohol use disorders, but, to the best of our knowledge, no studies exist, so far, that investigate the association of impulsivity with health-related quality of life and well-being. Besides evidence from nonclinical samples (Chamberlain & Grant, 2019), the first evidence comes from inpatients with methamphetamine use disorder. Wang et al. (2020), for example, showed a relation between impulsivity and physical as well as mental health-related quality of life. Rubenis et al. (2018), for example, found that impaired inhibition of motor reactions in a task negatively predicts the recovery of mental health-related quality of life.

On the basis of that, we hypothesized that impulsivity is related to health-related quality of life and well-being in individuals recovering from alcohol dependence, even when controlling for craving and drinking patterns. In line with Rubenis et al. (2018), we examined health-related quality of life and well-being of former patients 6 weeks after withdrawal treatment. This early recovery period seems to be characterized by a particular risk of relapse (Czapla et al., 2016). Given that one may expect changes in impulsivity during the recovery process (Schmidt et al., 2017), we also investigated if impulsivity assessed during withdrawal treatment can predict health-related quality of life and well-being after withdrawal treatment.

## 2 | MATERIALS and METHODS

### 2.1 | Procedure

The data used in the present study were derived from the control group of a randomized controlled trial on the efficacy of an app intervention with telephone coaching for individuals with alcohol use disorder. Participants were recruited by psychologists during their inpatient withdrawal programs. In the eight participating treatment units, withdrawal treatments lasted 10–28 days, depending on the complexity of the treatment program. After completing a baseline assessment conducted by blinded diagnostic raters, they were randomly assigned (ratio = 1:1; block size = 4) to the waitlist control group (access to treatment as usual after withdrawal as provided by the German healthcare system, e.g., self-help groups, counseling, or rehabilitation treatment) or the intervention group (access to treatment as usual + app intervention with telephone coaching). All participants provided their written informed consent to the study procedure and data processing before inclusion. To answer the research question of this manuscript, we used data from the screening, the baseline assessment (during withdrawal treatment, after the phase of medical detoxification), and the 6-week postassessment (approximately 6 weeks after release from withdrawal treatment) of the control group. A detailed description of the intervention and the evaluation procedure including outcomes can be found in the study protocol (Saur et al., n.d). The main trial was approved by the local ethics review board and preregistered in the German clinical trials register.

### 2.2 | Participants

The participants were adult patients with the primary diagnostic and statistical manual of mental disorders, 5th edition (American Psychiatric Association, 2013) alcohol use disorder diagnosis. A former diagnosis of schizophrenia or treatment of psychosis lasting longer than 4 weeks, acute suicidality, language or cognitive barriers, court order, or a seamless transition to medical rehabilitation led to study exclusion.

According to an a priori power-analysis ($1 - \beta = 0.90$; $\alpha = 0.025$) with *Gpower* (Faul et al., 2007), $n = 117$ individuals are needed to detect an $R^2$ of 0.186 (based on the effect sizes for physical and mental quality of life in

Rubenis et al., 2018) in a multiple regression model with 11 predictors. Expecting an attrition rate of 30% (see Rubenis et al., 2018), we included data of the first 167 participants of the control group (Figure 1). The data are not publicly available due to privacy restrictions (the main trial is still in progress). The data to support the findings of this study are available on request from the corresponding author by the end of the main trial.

## 2.3 | Assessments

During withdrawal treatment, sociodemographic data (age, gender [male, female, diverse], ethnicity, highest education, and psychiatric diagnoses) were assessed in face-to-face interviews with clinical psychologists. Additionally, alcohol dependence severity was assessed at baseline using the severity scale of alcohol dependence (John et al., 2001). A higher total score of the first 28 items (range: 0–100; $\alpha = 0.93$) indicated greater severity.

Drinking behavior in the time between release from withdrawal treatment and postassessment was assessed by the timeline follow-back method (Sobell & Sobell, 1992). At the postassessment, we asked for relapse (yes vs. no)

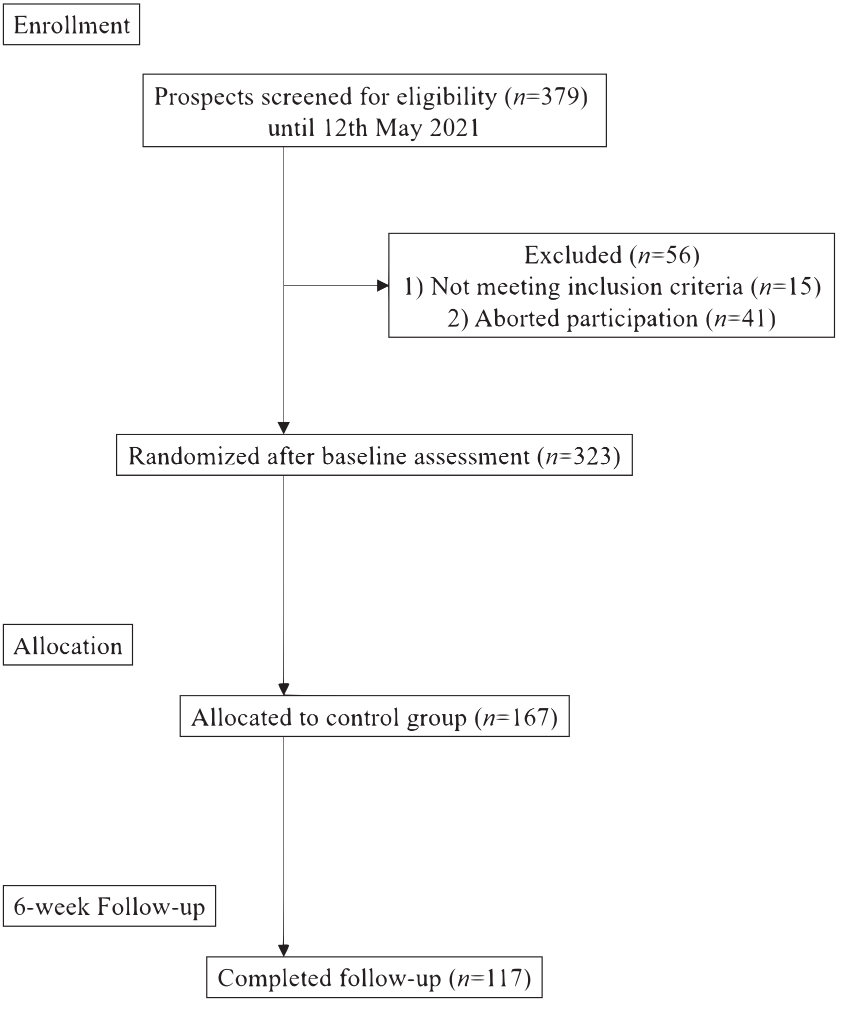


**FIGURE 1** Study flow for the sample of the present study (167 participants of the project control group)

since the baseline conduction (approximately the last 6 weeks). In case of relapse, alcohol volume was assessed by a half-standardized guideline, and the mean alcohol volume (grams) per day was calculated.

Furthermore, we assessed if, and which aftercare treatment participants had been using in the time between release from withdrawal treatment and postassessment.

To measure craving, the five-item short version (Wildt et al., 2005) of the German obsessive-compulsive drinking scale (original: Anton et al., 1995; German: Mann & Ackermann, 2000) was used at the postassessment. A higher score (range: 0–20; $\alpha = 0.89$) indicated stronger craving during the last week.

Information about health-related quality of life was provided by the EQ-5D-5L (EuroQol Research Foundation, 2019) at the baseline and postassessment. According to answers on five dimensions/items, a country-specific index (for the present study: Germany) was calculated (range: −0.21 = *worse than death* to 1 = *full health)* that represented the actual health-related quality of life. Well-being was assessed by the World Health Organization (WHO) well-being index (WHO-5; Bech, 2004) at the baseline and postassessment. A higher sum score of the five items (range: 0–25, $\alpha = 0.91$) indicated higher well-being during the last 2 weeks. Together, these two instruments cover physical and mental quality of life, while being very economical.

Impulsivity was assessed by the German 15-item short version of the Barratt impulsiveness scale-15 (German: Meule et al., 2011; original: Spinella, 2007) at baseline and postassessment, asking the participants for their current general evaluation of themselves. Higher scores on the three subscales indicate stronger motor (acting immediately, not deliberately), attentional (not staying focused in the present moment), and non-planning impulsivity (no engagement in planning ahead and solving complex tasks), respectively (range: 5–20; $\alpha = 0.74$, $\alpha = 0.80$, $\alpha = 0.77$).

## 2.4 | Data analysis

We examined the hypotheses with step-wise multiple regression models in *IBM SPSS Statistics 28*. The following models were calculated for both health-related quality of life and well-being: In Model 1, we first included control variables (age, gender, alcohol dependence severity, and comorbid depressive disorder), as well as craving and drinking patterns after release from the withdrawal treatment. In a second step, we entered the impulsivity facets from the postassessment. In Model 2, we, again, first included control variables (age, gender, alcohol dependence severity, comorbid depressive disorder, and baseline health-related quality of life/baseline well-being), craving, and drinking patterns after release. In the second step, we entered baseline impulsivity facets (assessed during withdrawal treatment). We chose this approach as it allowed us to account for potential changes, without calculating difference scores, and while providing sufficient power within the available sample size.

All regression analyses were conducted for full cases (listwise deletion). For some participants, missing data regarding drinking patterns and aftercare could be reconstructed based on later assessments. Additionally, to control for a bias due to drop-out, the models were re-run accounting for missing values by Full Information Maximum Likelihood (*R* package *lavaan*). We will report the full case analyses and meaningful deviations after these re-analyses. We observed no major multi-collinearity of the predictors (variance inflation factors <2.00, correlations <.50) or violations of other assumptions. Given that we calculated two models for each outcome, we adapted the $\alpha$-level to 5%/2 = 2.5%.

# 3 | RESULTS

## 3.1 | Sample characteristics

Life-time diagnoses of additional psychiatric disorders were reported by 113 (67.7%) participants (depressive: 93 [55.7%], anxiety: 22 [13.2%], obsessive-compulsive: 4 [2.4%], posttraumatic stress: 19 [11.4%]: substance use: 5

[3.0%], eating: 6 [3.6%], bipolar: 9 [5.4%], attention deficit hyperactivity: 7 [4.2%], and personality: 13 [7.8%]). The use of aftercare between baseline and postassessment was reported by 61 (36.53%) participants, including (multiple choice possible): medical rehabilitation (7 outpatient [5.1%] and 6 inpatient [4.3%]), counseling (59 [42.8%]), other outpatient treatment, for example, self-help groups (41 [29.7%]) and residential (care) home (3 [2.2%]). Further characteristics are displayed in Table 1.

The mean alcohol dependence severity corresponds to a percentile rank of 58 (norm sample: inpatients in a withdrawal treatment; John et al., 2001).

## 3.2 | Association of impulsivity with health-related quality of life

In Model 1, higher craving, $\beta = -0.345$, $p = 0.001$, and depression, $\beta = -0.256$, $p = 0.005$, were related to lower health-related quality of life in the first step (control variables and drinking patterns; $n = 117$, adjusted $R^2 = 0.180$, $p < 0.001$). $R^2$ increased from Step 1 to 2 (adding postimpulsivity, $p = 0.004$), but no additional statistical predictors were significant (Table 2). In Model 2, higher craving, $\beta = -0.263$, $p = 0.006$, and lower baseline values, $\beta = 0.449$, $p < 0.001$, were related to lower health-related quality of life in the first step (control variables and drinking patterns and baseline health-related quality of life; $n = 116$, adjusted $R^2 = 0.372$, $p < .001$). $R^2$ increased from Step 1 to 2 (adding (baseline impulsivity $p, = 0.007$), and baseline motor impulsivity was an additional significant predictor

**TABLE 1** Sample characteristics

| | *N* | *M* | *SD* |
|---|---|---|---|
| Age (years) | 167 | 44.34 | 11.81 |
| The severity of alcohol dependence (0–100) | 167 | 48.49 | 20.13 |
| Well-being (0–25) | 117 | 12.24 | 6.24 |
| Health-related quality of life (−0.21–1) | 117 | 0.86 | 0.17 |
| Craving (0–20) | 117 | 5.42 | 4.02 |
| Alcohol amount/day (g)[a] | 121 | 12.97 | 33.78 |
| Motor Impulsivity (5-20) baseline [post] | 167 [117] | 11.08 [10.53] | 3.13 [2.96] |
| Non-Planning (5-20) baseline [post] | 166 [117] | 10.90 [10.75] | 3.57 [3.53] |
| Attentional (5-20) baseline [post] | 167 [117] | 9.99 [9.52] | 3.52 [3.53] |
| | ***N*** | ***n*** | **%** |
| Gender (male/female) | 167 | 111/56 | 66.47/33.53 |
| Abstinent (after release; yes)[a] | 126 | 76 | 60.32 |
| Ethnicity | | | |
| Caucasian | 167 | 162 | 97.0 |
| Arabian/African American/Asian/Indian | 167 | 2/1/1/1 | 1.2/.6/.6/.6 |
| Highest education | | | |
| Lower secondary/secondary/higher secondary | 167 | 49/75/15 | 29.3/44.9/9.0 |
| Academic | 167 | 23 | 13.8 |
| None | 167 | 5 | 3.0 |

[a]Some data could be reconstructed using information from later assessments.

(Table 2). When accounting for missing values, baseline motor impulsivity just missed significance ($p = 0.026$), but after exclusion of one outlier (standardized residual <−3), it was a significant predictor ($p = 0.016$).

## 3.3 | Association of impulsivity with well-being

In Model 1, higher craving, $\beta = -0.436$, $p < 0.001$, and depression, $\beta = -0.303$, $p < 0.001$, were related to lower well-being in the first step (control variables and drinking patterns; $n = 117$, adjusted $R^2 = 0.412$, $p < 0.001$). $R^2$ increased from Step 1 to 2 (adding postimpulsivity$p$, < 0.001), and attentional and non-planning impulsivity were additional significant correlates (Table 3). In Model 2, higher craving, $\beta = -0.425$, $p < 0.001$, and depression, $\beta = -0.247$, $p = 0.002$, were related to lower well-being in the first step (control variables and drinking patterns and baseline well-being; $n = 116$, adjusted $R^2 = 0.431$, $p < 0.001$). $R^2$ did not increase from Step 1 to 2 (adding baseline impulsivity$p$, = 0.531), and no additional statistical predictors were significant (Table 3). There were no outliers. Accounting for missing values made no difference.

## 3.4 | Exploratory analysis: Changes in impulsivity

Changes in the three impulsivity facets were investigated using a repeated-measures multivariate analysis of variance (factors time [baseline vs. post] and relapse [yes vs. no]). The main effects of time, $F(3, 112) = 3.266$,

**TABLE 2** Relation impulsivity facets to health-related quality of life

| Predictors | Model 1 (postimpulsivity) Adjusted $R^2 = 0.256$, $p < 0.001$, $n = 117$ | | | | Model 2 (baseline impulsivity) Adjusted $R^2 = 0.424$, $p < 0.001$, $n = 116$ | | | |
|---|---|---|---|---|---|---|---|---|
| | β | p | 95% CI for B | | β | p | 95% CI for B | |
| Age | −0.182 | 0.044* (0.032) | −0.005 | 0.000 | −0.097 | 0.235 (0.173) | −0.004 | 0.001 |
| Gender | 0.072 | 0.409 (0.384) | −0.035 | 0.085 | 0.114 | 0.134 (0.246) | −0.012 | 0.092 |
| Alcohol dependence severity | 0.066 | 0.440 (0.416) | −0.001 | 0.002 | 0.096 | 0.208 (0.229) | 0.000 | 0.002 |
| Depressive comorbidity (yes) | −0.231 | 0.009* (0.005) | −0.134 | −0.020 | −0.122 | 0.119 (0.058) | −0.091 | 0.011 |
| Baseline health-related quality of life | | | | | 0.367 | <0.001* (<0.001) | 0.220 | 0.581 |
| Relapse (yes) | 0.051 | 0.612 (0.593) | −0.050 | 0.085 | 0.110 | 0.227 (0.584) | −0.024 | 0.098 |
| Craving | −0.282 | 0.007* (0.004) | −0.020 | −0.003 | −0.332 | <0.001* (0.003) | −0.021 | −0.006 |
| Volume (grams per day) | −0.063 | 0.527 (0.505) | −0.001 | 0.001 | −0.113 | 0.205 (0.261) | −0.001 | 0.000 |
| Motor impulsivity | −0.178 | 0.054 (0.040) | −0.020 | 0.000 | −0.244 | 0.005* (0.026)** | −0.022 | −0.004 |
| Attentional impulsivity | −0.191 | 0.062 (0.047) | −0.018 | 0.000 | −0.021 | 0.822 (0.611) | −0.010 | 0.008 |
| Non-planning impulsivity | −0.055 | 0.578 (0.557) | −0.012 | 0.007 | −0.055 | 0.522 (0.496) | −0.011 | 0.006 |

*Note*: $p$-values after accounting for missing values in brackets.

Abbreviation: CI, confidence interval.

*$p < 0.025$; **$p = 0.016$ after exclusion of one outlier.

**TABLE 3** Relation impulsivity facets to well-being

| Predictors | Model 1 (postimpulsivity) Adjusted $R^2 = 0.515$, $p < 0.001$, $n = 117$ | | | | Model 2 (baseline impulsivity) Adjusted $R^2 = 0.427$, $p < 0.001$, $n = 117$ | | | |
|---|---|---|---|---|---|---|---|---|
| | $\beta$ | $p$ | 95% CI for B | | $\beta$ | $p$ | 95% CI for B | |
| Age | 0.052 | 0.468 (0.444) | −0.047 | 0.101 | 0.055 | 0.486 (0.491) | −0.053 | 0.111 |
| Gender | 0.025 | 0.727 (0.713) | −1.509 | 2.157 | 0.091 | 0.229 (0.269) | −0.772 | 3.193 |
| Alcohol dependence severity | 0.122 | 0.081 (0.064) | −0.005 | 0.081 | 0.124 | 0.103 (0.093) | −0.008 | 0.086 |
| Depressive comorbidity (yes) | −0.234 | 0.001* (<0.001) | −4.662 | −1.183 | −0.238 | 0.003* (0.001) | −4.961 | −1.014 |
| Baseline well-being | | | | | 0.135 | 0.125 (0.169) | −0.040 | 0.324 |
| Relapse (yes) | −0.140 | 0.085 (0.068) | −3.844 | 0.255 | −0.123 | 0.182 (0.068) | −3.915 | 0.751 |
| Craving | −0.303 | <0.001* (<0.001) | −0.727 | −0.213 | −0.433 | <0.001* (<0.001) | −0.955 | −0.397 |
| Volume (grams per day) | 0.044 | 0.588 (0.568) | −0.021 | 0.038 | 0.024 | 0.784 (0.722) | −0.028 | 0.037 |
| Motor impulsivity | 0.052 | 0.481 (0.457) | −0.198 | 0.418 | −0.044 | 0.612 (0.839) | −0.435 | 0.257 |
| Attentional impulsivity | −0.217 | 0.009* (0.005) | −0.671 | −0.097 | −0.063 | 0.489 (0.353) | −0.442 | 0.213 |
| Non-planning impulsivity | −0.253 | 0.002* (0.001) | −0.727 | −0.169 | −0.038 | 0.662 (0.633) | −0.399 | 0.254 |

*Note*: *p*-values after accounting for missing values in brackets.
Abbreviation: CI, confidence interval.
$^*p < 0.025$.

$p = 0.024$, $\eta^2 = 0.080$), and relapse, $F(3, 112) = 4.198$, $p = 0.007$, $\eta^2 = 0.101$, were significant. We found a reduction only in motor impulsivity from baseline to postassessment, $p = 0.008$. Furthermore, relapsed individuals displayed higher overall non-planning impulsivity, $M_1 = 11.802$, $SD_1 = 0.439$, $M_2 = 9.890$, $SD_2 = 0.337$, $p < 0.001$.

## 4 | DISCUSSION

### 4.1 | Summary and interpretation

We aimed to clarify the role of impulsivity for health-related quality of life and well-being, in comparison to recent drinking patterns (volume and abstinence) and craving.

Our results indicate that motor impulsivity during withdrawal treatment is a predictor for lower health-related quality of life after release from withdrawal. This generally fits research in methamphetamine use disorders (Rubenis et al., 2018; Wang et al., 2020). Disinhibited behavior, which aims at immediate pleasure (motor impulsivity), may lead to a lack of engagement in long-term health-promoting behaviors and may result in impeded health-related quality of life. In contrast to Rubenis et al. (2018), motor impulsivity was not predictive of mental quality of life in particular (in terms of well-being). These differences may be accounted to differences in the measurement (self-report vs. tasks), sample (alcohol vs. methamphetamine), and statistical models (we controlled for drinking patterns).

Attentional and non-planning impulsivity assessed after release from withdrawal treatment were associated with lower well-being. Not planning ahead and getting engaged in complex tasks (non-planning impulsivity) could make it difficult for individuals to choose goal-directed decisions and to regain a solid overall level of functioning (e.g., employment and financial security). A lack of focus (attentional impulsivity) could make it difficult for individuals to be mindful of the present moment and to stop rumination. However, given the correlational nature of these findings, future studies should try to verify this assumption.

Importantly, the role of impulsivity during versus after withdrawal treatment differed. This effect can unlikely be ascribed to changes in impulsivity, which were only found for the motor facet. Instead, the use of aftercare treatments may play a moderating role, which warrants further research. And, even if we found no influence of abstinence on changes in self-reported impulsivity (Schmidt et al., 2017), abstinence may reduce the imbalance of bottom-up and top-down processes (Volkow et al., 2019), and is also a potential moderator.

Another important finding of the present study is that abstinence and drinking patterns since release from withdrawal treatment did not significantly relate to health-related quality of life and well-being. This supports the assumption that abstinence is not necessary for improvements in health-related quality of life (Macfarlane et al., 2019), and that even heavy drinking individuals with alcohol use disorder can display above-average levels (Witkiewitz et al., 2020). Only craving was a negative correlate of health-related quality of life and well-being, in line with previous studies (Herrold et al., 2017). However, the present results cannot tell us anything about the differential role of craving in abstinent versus relapsed individuals. They are also of correlational nature. Thus, it may be that craving – eliciting negative affect – impedes well-being, but also vice versa, namely that lower well-being – eliciting negative affect – increases craving, given that substance use may serve as an emotion regulation strategy (Aurora & Klanecky, 2016).

## 4.2 | Limitations and strengths

When interpreting the findings, a number of limitations have to be considered.

The follow-up period of 6 weeks was rather short. Even if this early recovery period seems to be characterized by a particular risk of relapse (Czapla et al., 2016), the long-term relation between impulsivity and health-related quality of life or well-being has to be investigated.

Furthermore, regarding the composition of the sample, gender was distributed unequally, which, however, corresponds to the prevalence in other studies (Grant et al., 2017). Additionally, the participants displayed a rather low educational level and were mainly of Caucasian ethical background. This should be taken into account when comparing the results to other research. We only controlled for depressive symptoms (depressive disorders were the most prevalent psychiatric comorbidity), so future studies may control for other, particularly impulsivity-related comorbidities (e.g., attention deficit hyperactivity disorder).

We also only used self-report measures, which are easier to assess and, thus, probably more relevant for the daily treatment practice. However, they may, in contrast to behavioral measures, be confounded by social desirability and require fundamental self-reflectiveness.

## 4.3 | Implications for research and practice

The relation of impulsivity to not only abstinence but also patient-centered recovery outcomes supports the importance of research on treatment approaches to reduce impulsivity. Computerized inhibitory control training, which trains individuals to inhibit their reaction to alcohol-related stimuli, may help to reduce motor impulsivity (Strickland et al., 2019). However, self-reported motor impulsivity seems to conceptually differ from motor inhibition assessed by behavioral tasks (MacKillop et al., 2016), and its relation to the quality of life could not be supported in a nonclinical sample (Chamberlain & Grant, 2019). Another approach is mindfulness-based interventions, which may strengthen reflective processes and foster natural reward processes (which seem both to be impaired; Kozak et al., 2019) by training to focus attention and, thus, reduce automated substance-seeking behavior (Priddy et al., 2018). Attentional impulsivity may also be addressed by combining inhibitory control training with transcranial direct-current stimulation (electrical brain stimulation), which has been shown to promote brain activity related to attentional processes in binge drinking individuals (Dormal et al., 2020), and prevent relapse in alcohol use disorders (Dubuson et al., 2021).

Besides research on treatment approaches, future studies should aim at a better understanding of the role of impulsivity for recovery by investigating potential interaction effects with drinking patterns or comparing the influence of different assessment tools of impulsivity, given that self-reported impulsivity with regard to everyday life may differ from tasks that assess, for example, impulsive decision-making and inhibitory control (MacKillop et al., 2016). Additionally, given that substance use may serve as an emotion regulation strategy (Aurora & Klanecky, 2016), the impulsivity facet urgency (reacting impulsively to intense emotions) may be of special interest in this regard (Carver & Johnson, 2018).

## 5 | CONCLUSION

Together with craving, impulsivity seems to be related to the recovery of health-related quality of life and well-being in the first weeks after alcohol withdrawal treatment, being probably even more important than drinking patterns. This finding emphasizes the importance of treatment approaches that aim at reduced impulsivity in the early recovery process.

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### CONFLICT OF INTERESTS

The authors declare that there are no conflict of interests.

### DATA AVAILABILITY STATEMENT

The data are not publicly available due to privacy restrictions (the main trial is still in progress). The data to support the findings of this study are available on request from the corresponding author by the end of the main trial.

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### PEER REVIEW

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### REFERENCES

American Psychiatric Association. (2013). *Diagnostic and statistical manual of mental disorders* (5th ed).

Anton, R. F., Moak, D. H., & Latham, P. (1995). The obsessive compulsive drinking scale: A self-rated instrument for the quantification of thoughts about alcohol and drinking behavior. *Alcoholism, Clinical and Experimental Research*, *19*(1), 92–99. https://doi.org/10.1111/j.1530-0277.1995.tb01475.x

Aurora, P., & Klanecky, A. K. (2016). Drinking motives mediate emotion regulation difficulties and problem drinking in college students. *American Journal of Drug and Alcohol Abuse*, *42*(3), 341–350. https://doi.org/10.3109/00952990.2015.1133633

Bech, P. (2004). Measuring the dimension of psychological general well-being by the WHO-5. *Quality of Life Newsletter*, *32*, 15–16.

Carvalho, A. F., Heilig, M., Perez, A., Probst, C., & Rehm, J. (2019). Alcohol use disorders. *The Lancet*, *394*(10200), 781–792. https://doi.org/10.1016/S0140-6736(19)31775-1

Carver, C. S., & Johnson, S. L. (2018). Impulsive reactivity to emotion and vulnerability to psychopathology. *American Psychologist*, *73*(9), 1067–1078.

Chamberlain, S. R., & Grant, J. E. (2019). Relationship between quality of life in young adults and impulsivity/compulsivity. *Psychiatry Research*, *271*, 253–258. https://doi.org/10.1016/j.psychres.2018.11.059

Coates, J. M., Gullo, M. J., Feeney, G. F. X., Young, R. M., Dingle, G. A., Clark, P. J., & Connor, J. P. (2020). Craving mediates the effect of impulsivity on lapse-risk during alcohol use disorder treatment. *Addictive Behaviors*, *105*, 106286. https://doi.org/10.1016/j.addbeh.2019.106286

Crowe, S. F., Cammisuli, D. M., & Stranks, E. K. (2020). Widespread cognitive deficits in alcoholism persistent following prolonged abstinence: An updated meta-analysis of studies that used standardised neuropsychological assessment tools. *Archives of Clinical Neuropsychology*, *35*(1), 31–45. https://doi.org/10.1093/arclin/acy106

Czapla, M., Simon, J. J., Richter, B., Kluge, M., Friederich, H. -C., Herpertz, S., Mann, K., Herpertz, S. C., & Loeber, S. (2016). The impact of cognitive impairment and impulsivity on relapse of alcohol-dependent patients: Implications for psychotherapeutic treatment. *Addiction Biology*, *21*(4), 873–884. https://doi.org/10.1111/adb.12229

Dormal, V., Lannoy, S., Bollen, Z., D'Hondt, F., & Maurage, P. (2020). Can we boost attention and inhibition in binge drinking? Electrophysiological impact of neurocognitive stimulation. *Psychopharmacology*, *237*(5), 1493–1505. https://doi.org/10.1007/s00213-020-05475-2

Dubuson, M., Kornreich, C., Vanderhasselt, M. -A., Baeken, C., Wyckmans, F., Dousset, C., Hanak, C., Veeser, J., Campanella, S., & Chatard, A. (2021). Transcranial direct current stimulation combined with alcohol cue inhibitory control training reduces the risk of early alcohol relapse: A randomized placebo-controlled clinical trial. *Brain Stimulation*, *14*(6), 1531–1543. https://doi.org/10.1016/j.brs.2021.10.386

EuroQol Research Foundation. (2019). EQ-5D-5L user guide. https://euroqol.org/publications/user-guides

Faul, F., Erdfelder, E., Lang, A. -G., & Buchner, A. (2007). G* Power 3: A flexible statistical power analysis program for the social, behavioral, and biomedical sciences. *Behavior Research Methods*, *39*(2), 175–191.

Grant, B. F., Chou, S. P., Saha, T. D., Pickering, R. P., Kerridge, B. T., Ruan, W. J., Huang, B., Jung, J., Zhang, H., & Fan, A. (2017). Prevalence of 12-month alcohol use, high-risk drinking, and DSM-IV alcohol use disorder in the United States, 2001-2002 to 2012-2013: Results from the National Epidemiologic Survey on Alcohol and Related Conditions. *JAMA Psychiatry*, *74*(9), 911–923. https://doi.org/10.1001/jamapsychiatry.2017.2161

Herrold, A. A., Pape, T. L.-B., Li, X., & Jordan, N. (2017). Association between alcohol craving and health-related quality of life among veterans with co-occurring conditions. *Military Medicine*, *182*(7), e1712–e1717. https://doi.org/10.7205/MILMED-D-16-00360

Hershberger, A. R., Um, M., & Cyders, M. A. (2017). The relationship between the UPPS-P impulsive personality traits and substance use psychotherapy outcomes: A meta-analysis. *Drug and Alcohol Dependence*, *178*, 408–416. https://doi.org/10.1016/j.drugalcdep.2017.05.032

John, U., Hapke, U., & Rumpf, H.-J. (2001). *SESA: Skala zur erfassung der schwere der alkoholabhängigkeit*. Hogrefe.

Kirouac, M., & Witkiewitz, K. (2019). Predictive value of non-consumption outcome measures in alcohol use disorder treatment. *Addiction*, *114*(6), 1086–1092. https://doi.org/10.1111/add.14553

Kozak, K., Lucatch, A. M., Lowe, D. J. E., Balodis, I. M., MacKillop, J., & George, T. P. (2019). The neurobiology of impulsivity and substance use disorders: Implications for treatment. *Annals of the New York Academy of Sciences*, *1451*(1), 71–91. https://doi.org/10.1111/nyas.13977

Macfarlane, V. F. H., Prentice, D. A., & Walsh, M. S. (2019). The Auckland alcohol detoxification outcome study: Measuring changes in quality of life in individuals completing a medicated withdrawal from alcohol in a detoxification unit. *Drug and Alcohol Dependence*, *202*, 156–161. https://doi.org/10.1016/j.drugalcdep.2018.11.035

MacKillop, J., Weafer, J., Gray, J. C., Oshri, A., Palmer, A., & Wit, H. de (2016). The latent structure of impulsivity: Impulsive choice, impulsive action, and impulsive personality traits. *Psychopharmacology*, *233*(18), 3361–3370. https://doi.org/10.1007/s00213-016-4372-0

Mann, K., & Ackermann, K. (2000). Die OCDS-G: Psychometrische kennwerte der deutschen version der obsessive compulsive drinking scale. *Sucht*, *46*(2), 90–100. https://doi.org/10.1024/suc.2000.46.2.90

Mann, K., Batra, A., & Hoch, E. (2017). S3-Leitlinie "Screening, diagnose und behandlung alkoholbezogener störungen". *Sucht*, *63*(1), 7–24. https://doi.org/10.1024/0939-5911/a000464

Meule, A., Vögele, C., & Kübler, A. (2011). Psychometric evaluation of the German Barratt impulsiveness scale-short version (BIS-15). *Diagnostica*, *57*(3), 126–133. https://doi.org/10.1026/0012-1924/a000042

Priddy, S. E., Howard, M. O., Hanley, A. W., Riquino, M. R., Friberg-Felsted, K., & Garland, E. L. (2018). Mindfulness meditation in the treatment of substance use disorders and preventing future relapse: Neurocognitive mechanisms and clinical implications. *Substance Abuse and Rehabilitation*, *9*, 103–114. https://doi.org/10.2147/SAR.S145201

Rubenis, A. J., Fitzpatrick, R. E., Lubman, D. I., & Verdejo-Garcia, A. (2018). Impulsivity predicts poorer improvement in quality of life during early treatment for people with methamphetamine dependence. *Addiction*, *113*(4), 668–676. https://doi.org/10.1111/add.14058

Saur, S., Weisel, K. K., Lang, C., Fuhrmann, L., Steins-Loeber, S., Enewoldsen, N., Reichl, D., Zink, M., Jakobi, F., Rudolph, M., Ahnert, A., Braunwarth, W.-D., Falkai, P., Koller, G., Behle, N., Hager, L., Hillemacher, T., Heepe, P., Müller, F.-N., Kraus, T., Kiderman, Y., Horn, N., Kornhuber, J., Lins, S., Spitzer, P., Bönsch, D., Counot, C., Stemmler, M., Hildebrand, A., Amelung, V., Kerkemeyer, L., & Berking, M. (n. d.). App-based maintenance treatment for alcohol use disorder after acute inpatient treatment: Study protocol for a multicentre randomized controlled trial. *Internet Interventions*. Manuscript submitted for publication.

Schmidt, T. P., Pennington, D. L., Cardoos, S. L., Durazzo, T. C., & Meyerhoff, D. J. (2017). Neurocognition and inhibitory control in polysubstance use disorders: Comparison with alcohol use disorders and changes with abstinence. *Journal of Clinical and Experimental Neuropsychology*, *39*(1), 22–34. https://doi.org/10.1080/13803395.2016.1196165

Seitz, N.-N., Lochbühler, K., Atzendorf, J., Rauschert, C., Pfeiffer-Gerschel, T., & Kraus, L. (2019). Trends in substance use and related disorders: Analysis of the epidemiological survey of substance abuse 1995 to 2018. *Deutsches Ärzteblatt International*, *116*(35–36), 585–591. https://doi.org/10.3238/arztebl.2019.0585

Sliedrecht, W., Roozen, H. G., Witkiewitz, K., Waart, R. de, & Dom, G. (2020). The association between impulsivity and relapse in patients with alcohol use disorder: A literature review. *Alcohol and Alcoholism*, *56*, 637–650. https://doi.org/10.1093/alcalc/agaa132

Sliedrecht, W., Waart, R., de, Witkiewitz, K., & Roozen, H. G. (2019). Alcohol use disorder relapse factors: A systematic review. *Psychiatry Research*, *278*, 97–115.

Sobell, L. C., & Sobell, M. B. (1992). Timeline follow-back. In R. Z. Litten, & J. P. Allen (Eds.), *Measuring alcohol consumption: Psychosocial and biochemical methods* (pp. 41–72). Humana Press. https://doi.org/10.1007/978-1-4612-0357-5_3

Spinella, M. (2007). Normative data and a short form of the Barratt impulsiveness scale. *International Journal of Neuroscience*, *117*(3), 359–368. https://doi.org/10.1080/00207450600588881

Strickland, J. C., Hill, J. C., Stoops, W. W., & Rush, C. R. (2019). Feasibility, acceptability, and initial efficacy of delivering alcohol use cognitive interventions via crowdsourcing. *Alcoholism, Clinical and Experimental Research*, *43*(5), 888–899. https://doi.org/10.1111/acer.13987

Vederhus, J.-K., Birkeland, B., & Clausen, T. (2016). Perceived quality of life, 6 months after detoxification: Is abstinence a modifying factor? *Quality of Life Research*, *25*(9), 2315–2322. https://doi.org/10.1007/s11136-016-1272-z

Volkow, N. D., Michaelides, M., & Baler, R. (2019). The neuroscience of drug reward and addiction. *Physiological Reviews*, *99*(4), 2115–2140. https://doi.org/10.1152/physrev.00014.2018

Wang, Y., Zuo, J., Hao, W., Shen, H., Zhang, X., Deng, Q., Liu, M., Zhao, Z., Zhang, L., & Zhou, Y. (2020). Quality of life in patients with methamphetamine use disorder: Relationship to impulsivity and drug use characteristics. *Frontiers in Psychiatry*, *11*, 579302. https://doi.org/10.3389/fpsyt.2020.579302

Wildt, W. A., de, Lehert, P., Schippers, G. M., Nakovics, H., Mann, K., & van den Brink, W. (2005). Investigating the structure of craving using structural equation modeling in analysis of the obsessive-compulsive drinking scale: A multinational study. *Alcoholism, Clinical and Experimental Research*, *29*(4), 509–516. https://doi.org/10.1097/01.ALC.0000158844.35608.48

Witkiewitz, K., Kranzler, H. R., Hallgren, K. A., Hasin, D. S., Aldridge, A. P., Zarkin, G. A., Mann, K. F., O'Malley, S. S., & Anton, R. F. (2021). Stability of drinking reductions and long-term functioning among patients with alcohol use disorder. *Journal of General Internal Medicine*, *36*(2), 404–412. https://doi.org/10.1007/s11606-020-06331-x

Witkiewitz, K., Pearson, M. R., Wilson, A. D., Stein, E. R., Votaw, V. R., Hallgren, K. A., Maisto, S. A., Swan, J. E., Schwebel, F. J., Aldridge, A., Zarkin, G. A., & Tucker, J. A. (2020). Can alcohol use disorder recovery include some heavy drinking? A replication and extension up to 9 years following treatment. *Alcoholism, Clinical and Experimental Research*, *44*(9), 1862–1874. https://doi.org/10.1111/acer.14413

Witkiewitz, K., & Tucker, J. A. (2020). Abstinence not required: Expanding the definition of recovery from alcohol use disorder. *Alcoholism, Clinical and Experimental Research*, *44*(1), 36–40. https://doi.org/10.1111/acer.14235

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