Under the Influence!

Alcohol and Drug Use as Predictors of Depressive Symptoms and Well-Being: The Impact of Age, Gender, Ethnicity, and Education

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Met opmerkingen [VH2R1]: Some last minor things I noticed:
- Check the manual for layout of first pages:
-Name of second assessor
-Total number of words of the thesis, excluding bibliography and appendices

Also:
- table of contents is still missing
- abstract (max 250 words) should be in Dutch as well

Abstract

The present study examines the relationship between substance use and mental health outcomes in young individuals. The study has two main objectives. Firstly, to assess whether alcohol and drug use are risk factors for mental health, and secondly, to identify demographic and contextual factors that might moderate this relationship. The central research questions are 'To what extent is alcohol and drug use a risk factor for the mental health of young people? And 'Are there specific demographic or contextual factors that moderate the relationship between alcohol and drug use, and mental health in youth?'. This study employed linear regression analyses to examine the association between substance use and youths' subsequent mental health, as well as the moderating effects of age, gender, education, and ethnicity. The hypotheses proposed that alcohol and drug use would negatively impact depressive symptoms and well-being at two (H1a, H2a) and eight (H1b, H2b) weeks later, and that these effects would be moderated by demographic factors, with stronger effects expected among younger individuals (H3a, H4a), those with higher education (H3b, H4b), females (H3c, H4c), and individuals of white ethnicity (H3d, H4d). The findings indicate that alcohol and drug use did not significantly predict depressive symptoms and well-being two and eight weeks later, and did not vary significantly across different demographic and contextual factors. Future research should consider utilising larger samples, longer observation periods to assess substance use, a longer timeframe for longitudinal research, and objective measurements of substance use.

Keywords; substance use, mental health, depressive symptoms, well-being

Samenvatting

Deze studie onderzoekt de relatie tussen middelengebruik en mentale gezondheid bij jongeren. Het onderzoek heeft twee hoofddoelen. Ten eerste om te beoordelen of alcohol- en drugsgebruik risicofactoren zijn voor depressieve symptomen en welzijn, en ten tweede om demografische of contextuele factoren te identificeren die deze relatie zouden kunnen matigen. De onderzoeksvragen die centraal staan in dit onderzoek zijn 'In hoeverre is alcohol- en drugsgebruik een risicofactor voor de mentale gezondheid van jongeren? En “Zijn er specifieke demografische of contextuele factoren die de relatie tussen alcohol- en drugsgebruik en mentale gezondheid bij jongeren matigen?”. Deze studie gebruikte lineaire regressieanalyses om het verband tussen alcohol- en drugsgebruik en de latere mentale gezondheid van jongeren te onderzoeken, evenals de modererende effecten van leeftijd, geslacht, opleiding en etniciteit. De hypothesen stelden dat alcohol- en drugsgebruik een negatieve invloed zouden hebben op depressieve symptomen en welzijn na twee (H1a, H2a) en acht (H1b, H2b) weken, en dat deze effecten zouden worden gemodereerd door demografische factoren, waarbij sterkere effecten werden verwacht bij jongere personen (H3a, H4a), personen met een hogere opleiding (H3b, H4b), vrouwen (H3c, H4c), en personen van blanke etniciteit (H3d, H4d). De bevindingen geven aan dat alcohol- en drugsgebruik de depressieve symptomen en het welzijn twee en acht weken later niet significant voorspelden, en niet significant varieerden tussen verschillende demografische en contextuele factoren. Toekomstig onderzoek moet overwegen gebruik te maken van grotere steekproeven, langere observatieperioden om middelengebruik te beoordelen, langer longitudinaal onderzoek, en objectieve metingen van middelengebruik.

Trefwoorden; middelengebruik, mentale gezondheid, depressieve symptomen, welzijn

Contents

Alcohol and Drug Use as Predictors of Depressive Symptoms and Well-Being: The Impact of Age, Gender, Ethnicity, and Education

Introduction

Mental health, encompassing both the absence of depressive symptoms and presence of well-being, is a significant concern in modern society due to its profound impact on individuals (Hakim et al., 2017; Marcus et al., 2012). Depressive symptoms may manifest in various ways, as outlined in the Diagnostic and Statistical Manual of Mental Disorders (DSM) classification. These include a dejected mood, a decreased interest and pleasure in everyday activities, difficulty concentrating, recurrent thoughts of suicide, feelings of guilt and meaninglessness, sleep problems, restlessness, an increase or decrease in body weight, and a lack of initiative (American Psychiatric Association, 2013). Depressive symptoms can significantly diminish the well-being of young people (Trimbos-instituut, 2022). The pursuit of well-being, which is characterized by positive emotions and life satisfaction, is essential for an individual's overall mental health and resilience (Keyes et al., 2011). There is a clear correlation between well-being and mental health. Empirical evidence indicates that individuals with higher levels of well-being are more likely to experience better mental health outcomes, including lower levels of stress, anxiety, and depression (Vermunt et al., 1989). Conversely, a lack of well-being is associated with an increased risk of mental health issues and psychological distress (Vermunt et al., 1989).

The present study examines the precise relationship between youths' substance use (alcohol/drugs) and their mental health (depressive symptoms/well-being) over a period of two to eight weeks. A considerable body of research has been conducted on the relationship between alcohol and drug use and mental health. However, the majority of these studies employ a cross-sectional design, (i.e., measured at the same time point) (Bellos et al., 2013; Chen et al., 2022).While there is some longitudinal research available, these studies often examine the relationship over shorter (e.g., hours) or longer (e.g., years) time frames (McKowen et al., 2013; Marmorstein, 2009). The distinctive contribution of our study lies in its examination of the effects of substance use on mental health in youth over an intermediate time frame of two to eight weeks. This time frame is of particular relevance, as it allows for the observation of the short-term impacts of substance use on mental health, which may prove crucial in the understanding and addressing of these issues in youth (Magee & Connell, 2021). This is an area that may be particularly pertinent to examine in the context of Dutch youth,

given the pervasiveness of alcohol consumption and the use of soft drugs in Dutch cultural practices (Van Hal & Dekker, 2010).

Despite the existing research on sociodemographic factors influencing the relationship between substance use and mental health, it remains unclear how gender, age, and education moderate this effect among youth. Existing studies, such as those by Tate (2021) and Henderson et al. (2004), have explored these factors, yet the influence of these factors on the relationship between depression symptoms and alcohol use remains consistent. De Looze et al. (2017) further emphasize the importance of considering these factors when analyzing adolescent alcohol use, particularly noting the need to scrutinize trends across different youth subgroups. Significant demographic differences have been observed, particularly in educational level. Adolescents in higher education tracks exhibit lower alcohol use compared to those in lower education tracks (De Looze et al., 2017). However, the specific moderating effects of gender, age, and education on the relationship between substance use and mental health in youth remain inadequately understood. In sum, while numerous studies have investigated the influence of sociodemographic variables on the impact of adolescents' substance use on mental health, the specific moderating effects of gender, age, and education on this relationship in youth remain inadequately understood, underscoring a significant gap in current research. This is an area that may be particularly pertinent to examine in the context of Dutch youth, given the pervasiveness of alcohol consumption and the use of soft drugs in Dutch cultural practices (Van Hal & Dekker, 2010).

Alcohol and drug use among young people in the Netherlands

Despite its liberal attitude towards alcohol consumption, the Netherlands faces a significant problem with alcohol use, particularly among young people. The country's ambivalent attitude towards alcohol consumption, inadequate focus on alcohol relative to other drugs, and a shortage of evidence-based prevention and care efforts represent significant issues (Garretsen, 2001). The Dutch social climate towards alcohol is characterised by moderation, increasing acceptance of responsible drinking, and disapproval of excessive drinking (Bongers et al., 1998). According to the Trimbos Institute's National Drug Monitor report, alcohol is the most frequently used substance among young people aged 15-24. Shockingly, approximately 70% of Dutch adolescents have consumed alcohol in the past month (Trimbos Instituut, 2020). The Health Council advises against alcohol consumption, recommending abstinence or no more than one glass per day due to evidence of its health risks. Since 2020, about 44% of adults have adhered to this advice. More women (53.3%)

than men (34.5%) follow these guidelines, and men are more likely to drink excessively (8.5% vs. 4.9%) (Castagna, 2024). In addition to alcohol, drug use is also a concern among Dutch youth, albeit to a lesser extent. Cannabis is the most commonly used illicit drug, with 13% of young people reporting its use in the past month (Trimbos Instituut, 2020). The Netherlands' policy of cannabis decriminalization and the existence of 'coffee shops' where cannabis can be legally purchased and consumed likely contribute to its high prevalence among young people. This is a clear indication of the challenges posed by the country's liberal drug policies (Trimbos Instituut, 2020). Despite these issues, the Netherlands maintains a distinctive approach to drug policy, differentiating between so-called "soft" and "hard" drugs. While the possession and sale of soft drugs, such as cannabis, are decriminalised under specific conditions, the use of hard drugs is strictly regulated. This approach aims to achieve a balance between public health and individual autonomy by promoting harm reduction while curbing drug abuse (Cohen et al., 2018).

Youths' alcohol and drug use in relation to their mental health

The consumption of alcohol and drugs has been identified as a significant factor influencing mental health, particularly among adolescents. The adolescent years are a crucial period marked by rapid physical, emotional, and cognitive development, making it a critical phase in an individual's life (Van den Broek et al., 2017). During this transitional period, individuals are more vulnerable to external influences, including alcohol and drug exploration. Adolescents frequently display problematic alcohol consumption patterns, consuming up to two to three times more per event than adults (Spear and Swartzwelder, 2014). Therefore, addressing substance use in adolescents is crucial to protect their mental health during this critical developmental period. A wealth of research has demonstrated a correlation between substance use, including alcohol and illicit drugs, and mental health related outcomes such as suicidal thoughts and behaviours in young individuals (Wilcox, 2004; Markowitz et al., 2002; Crumley, 1990; Zygo et al., 2020). It is therefore of the utmost importance to identify these risk factors and provide appropriate support in order to address the interplay between substance use and mental health in youth (Gart & Kelly, 2015). The consumption and experimentation of alcohol and drugs among university students is a significant concern, with a range of negative consequences (Benzi et al., 2023). Giftson (2017) and Gasa et al. (2022) both emphasize the immediate and long-term risks associated with alcohol consumption, including alcohol dependence, diminished academic performance, and risky behaviours.

In the field of substance use, there are numerous theories that seek to elucidate the patterns and motivations underlying alcohol and drug use. One such theory is the self-medication theory, which postulates that individuals who experience depressive symptoms may turn to alcohol as a coping mechanism (Hammerton et al., 2023). Conversely, it is also possible that adolescent alcohol use may precede the onset of depressive symptoms. The adverse social, psychological, and physical consequences of alcohol use may increase the risk of later depression (Hammerton et al., 2023). Research has demonstrated that university students frequently utilise alcohol as a means of managing academic stress and other pressures (Schick, 2020; Park, 2017; Mobach & Macaskill, 2011). This is particularly the case for individuals with higher levels of negative emotions (Lennings, 1998). However, the relationship between stress, alcohol consumption, and mental health is complex and not fully understood. Some studies have indicated that stress and positive emotions are not directly related to binge drinking, but are significantly correlated with coping motives (Schick, 2020). Other research has identified alcohol expectancy as a significant mediator in the relationship between stress and alcohol-related problems (Park, 2017). The self-medication hypothesis has been supported, particularly for women, suggesting that individuals with high levels of stress and anxiety are more likely to drink alcohol as a coping mechanism (Mobach & Macaskill, 2011). In conclusion, these theories and findings demonstrate the interrelationship between alcohol consumption, stress, and mental health. These findings emphasise the necessity of considering these factors in the context of the present study on alcohol and drug use as predictors of depressive symptoms and well-being. An understanding of these relationships can provide insights into the impact of age, gender, ethnicity, and education on substance use and mental health.

The consumption of cannabis, particularly among college students, represents a significant public health challenge due to its adverse effects on mental and physical health, academic achievement, and the potential for developing other substance use disorders (Wenzinger & Fayola, 2020). The meta-analysis on cannabis use in adolescence and its impact on mental health found that cannabis use during adolescence is associated with an increased risk of developing major depression in young adulthood, as well as an increased risk of suicidal behaviour, particularly suicidal ideation (Gobbi et al., 2019). Bataineh et al. (2023) found that cannabis use was associated with an earlier age of onset of depressive and anxiety symptoms, with the youngest cohort being the most affected. Despite the well-documented consequences of cannabis use, it remains popular among college students, with a high prevalence and regular use (Tabet et al., 2020). This trend is part of a broader increase in

substance use on college campuses, which is associated with lower academic performance and an increased risk of unemployment and sexual assault (Welsh et al., 2019). Despite the growing concern, there remains a significant gap in understanding the long-term effects of drugs on depressive symptoms and well-being. Given the serious consequences of cannabis use, including an increased risk of depression, suicidal behavior, and other negative outcomes, it is crucial to address this issue, particularly as social perceptions and attitudes continue to influence its prevalence among college students (Laanan & Coco, 2016).

Demographic factors are likely to have a significant impact on the level of substance use among youth, which in turn will affect the extent of overlap between mental health and alcohol or drug use. Research indicates that the absence of a high school diploma by the age of 21 is associated with an increased likelihood of later-life mental health and substance use issues (Tate, 2021), and are at a heightened risk of developing comorbid issues (Lee et al., 2013). Furthermore, gender differences have been identified, with women exhibiting a stronger correlation between depression and alcohol use than men. Initially, females tend to exhibit higher levels of depressive symptoms, while males demonstrate a more pronounced increase in alcohol-related issues over time (Marmorstein, 2009). The relationship between depressive symptoms and substance use behaviours is further complicated by racial and ethnic disparities (Adzrago et al., 2022), It can be observed that white individuals exhibit a greater propensity for this co-occurrence than black/African Americans. (Tate, 2021). White individuals report a higher prevalence of depressive symptoms compared to racial/ethnic minorities (Dir et al., 2021). Other research shows the importance of age with depression levels gradually declining from early adolescence to adulthood, in contrast to an increase in alcohol problems, particularly during adolescence (Marmorstein, 2009). There is some evidence from previous studies that indicates a potential influence of factors such as gender and age on the relationship between substance use and depressive symptoms among youth. It is, however, important to note that these studies have primarily focused on longer time frames, such as hours or years. Consequently, it remains uncertain whether gender and age influence the relationship between substance use and mental health outcomes over shorter periods, such as in the weeks following substance use. Further research is recommended into the moderating factors of education, age, ethnicity and gender over a two to eight-week time frame in order to fill this gap in research.

Present study

Given that the few longitudinal studies on the effect of youths' substance use (alcohol and drugs) on their mental health (depressive symptoms and wellbeing) not yet examined the effect over a two to eight weeks' time frame, and that there are significant gaps in the literature concerning its potential moderating factors, the present study aims to address this gap. The research questions guiding the present study are as follows: **'**To what extent is alcohol and drug use a risk factor for the mental health of young people? And 'Are there specific demographic or contextual factors that moderate the relationship between alcohol and drug use, and mental health in youth?**'**. This study focuses on Dutch adolescents, due to their wide acceptance of alcohol consumption. In comparison to those who abstain, adolescents who consume alcohol are more socially accepted in the Netherlands. This societal norm may exert a considerable influence on the behaviours related to substance use and mental health (Scholte et al., 2012).

Based on existing literature, with regard to the longitudinal association between youths' substance use and mental health, we hypothesized that

1. The level of alcohol and drug use is positively associated with the severity of *depressive symptoms* up to two H1a) and eight weeks later (H1b).
2. The level of alcohol and drug use is negatively associated with the amount of *well-being* up to two (H2a), and eight weeks later (H2b).

With regard to the moderating effects of age, education, gender and ethnicity, we hypothesized that:

3. The relationship between alcohol and drug use and the severity of *depressive symptoms* is stronger among younger individuals (H3a), those with higher levels of education (H3b), females (H3c), and individuals of white ethnicity (H3d).
4. The relationship between alcohol and drug use and the severity of *well-being* is stronger among younger individuals (H3a), those with higher levels of education (H3b), females (H3c), and individuals of white ethnicity (H3d).

Method

Design, procedure, and subsample description

The present study employs a longitudinal research design to examine the relation between substance use and subsequent mental health. Data come from the larger 'No Fun No Glory' (NFNG) study. The NFNG study was approved by the Dutch Central Medical Ethics

Committee from the University Medical Center Groningen (no.2014/508), and is described in more detail by van Roekel, Vrijen, Heininga, Masselink, Bos, & Oldehinkel, 2016.

In short, participants of the NFNG study were recruited from schools and universities in the northern region of the Netherlands through various channels, including email, electronic learning environments, flyers, social media, and oral presentations during classes and lectures. Invitations were sent to a stratified sample of students from different educational levels, including MBO, HBO, and WO. An online screening questionnaire (N = 2937) was available on www.nofunnoglory.nl for interested individuals to subscribe. Participants received a link to the survey upon subscribing. The baseline survey was administered online and in classes during school hours. A research assistant was present to supervise the classroom sessions and answer any queries. In addition to the screening questionnaire, a total of 138 participants also completed two monthly questionnaires thereafter. As a reward for participating in the study, participants received a 10 euro gift voucher. Additionally, they had the chance to win further prizes, including fashion vouchers, tablets, and a 4-city trip, through a raffle.

The NFNG subsample used in the present study consists of 138 young adults aged 18 to 24 years (78% women, Mage = 21.4), that filled out the screening questionnaire (T0), as well as at the first and second measurement wave approximately one month later (T1) and two months later (T2). .

Variables

Depressive symptoms. Depressive symptoms will be measured using the Patient Health Questionnaire (PHQ; Kroene et al., 2001). The PHQ consists of nine items measuring depressive symptom severity over the last two weeks. Participants respond on a four-point Likert scale, ranging from 0 (not at all) to 3 (nearly every day). An example of an item is 'In the past 2 weeks, how often have you suffered from Little interest or pleasure in activities?'. The mean scores of all nine items calculated, such that a higher score indicates more depressive symptoms. The values for Cronbach's Alph for the survey are α =0.87 at T0 and α = 0.83 at T2.

Wellbeing. Wellbeing will be measured using the Domains of Pleasure Scale (DOPS, van Roekel et al., 2017). Well-being was measured using the Domains of Pleasure Scale (DOPS, van Roekel et al., 2017). Wellbeing was calculated as the mean score of nine items (e.g., 'I enjoy being with family or close friends'), such that a higher score indicated a higher

level of well-being. Participants respond on a continuous scale, ranging from 0 (not at all) to 100 (very much). The Cronbach's Alpha for the DOPS was α =0.90 at t0 and α = 0.83 at t2.

Alcohol use. Alcohol use was measured using two items of The Tracking Adolescents' Individual Lives Survey (TRAILS) substance questionnaire (Ormel et al., 2012). The questionnaire consists of 12 questions regarding an individual's degree of substance use (i.e., drinking alcohol). Alcohol use was calculated as the mean of the two items: 'In the past 7 days, how many glasses of alcohol did you drink from Monday to Thursday?' and 'How many glasses of alcohol did you drink from Friday to Sunday in the past 7 days?, The items were scored on an ordinal scale from 1 to 10, plus the categories: 11= '11-19', 12= '20-39', 13= '40 or more'. A higher score thus indicates more alcohol consumption in the last week. These questions were asked after the question 'Have you ever had alcoholic drinks, even if it was just one glass or a few sips? Yes or no'.

Drug use. Drug use was measured using one item of The Tracking Adolescents' Individual Lives Survey (TRAILS) substance questionnaire (Ormel et al., 2012). If participants answered "yes" to the question "Have you ever used soft or hard drugs, even if it was only once?", participants were asked: "How many times have you used soft drugs (hash, weed, or spacecake in the last 2 weeks?' The term 'how many times' refers to the number of occasions, such as a party, going out or an evening at home". The items were scored on an ordinal scale from 1 to 10, plus the categories: 11= '11-19', 12= '20-39', 13= '40 or more', and a higher score thus indicates more drug use in the last 2 weeks.

Analytical strategy

The data will be analyzed using SPSS (IBM SPSS Statistics Version 28). Descriptive statistics such as mean and standard deviation will be computed for all variables, as well as their mutual correlations. Assumption testing will involve checking for linearity, homoscedasticity, normality of residuals, and multicollinearity. If the assumptions are not met, we will consider appropriate alternative methods or transformations, and provide the rationale for these decisions in the result section. The present study employed listwise deletion to maintain consistency in the sample size across all analyses. This approach ensures that differences in results are attributable to the variables and relationships being analysed, rather than differences in the underlying data subsets.

For hypothesis 1 and 2, that test the effect of alcohol and drug use on depressive symptoms and wellbeing two months later, two separate linear regression analysis will be

performed for depressive symptoms and wellbeing measured at T0 and T2 respectively, serving as the dependent variables. The control variable will be the measurement at T0. The independent variables will be the scores from separate questionnaires assessing drug use and alcohol use, administered at T1, representing the constructs of substance use. The implementation of separate linear regression analyses for each outcome variable at different time points (T1 and T2) acknowledges the temporal dynamics inherent in longitudinal data. By analysing the associations between alcohol and drug use and depressive symptoms, as well as wellbeing, independently at each time point, it is possible to identify potential changes or stability in these relationships over time.

To test hypothesis H3 and H4, which posits that the relationship between alcohol and drug use at T1 and the severity of depression and wellbeing within a two-week period is influenced by age, gender, ethnicity, and education level, a multiple regression analysis with interaction terms will be conducted. The severity of depression and wellbeing will be used as the dependent variable, with alcohol use, drug use, age, gender, ethnicity, education level, and their interaction terms serving as independent variables. The analysis included interactions between alcohol use and each moderator variable (age, gender, ethnicity, and education level), as well as between drug use and each moderator variable. The utilisation of multiple regression analysis with interaction terms in this study permits an examination of the manner in which demographic factors moderate the relationship between alcohol and drug use and the severity of depression.

Results

Testing of assumptions

The assumptions underlying hypotheses 1 and 2 were tested (see appendix B). First the linearity of the data was tested. Graphs and statistical analyses demonstrate that the relationship between the independent and dependent variables is linear. This assumption has not been violated. A normal Q-Q plot and a histogram of the residuals were generated. The residuals follow the diagonal in the Q-Q plot and the histogram resembles a normal distribution. The Shapiro-Wilk test shows no significant deviation. This assumption was not violated. A scatterplot of the residuals against the predicted values indicates that the variance of the residuals is constant over the predicted values, with no clear patterns. This assumption has not been violated. The VIF values are lower than 10 and the

tolerance values are higher than 0.1, indicating that there is no problem with multicollinearity. This assumption has not been violated. The data is suitable for reliable regression analysis.

The assumptions underlying hypotheses 3 and 4 were tested as well (see appendix C). The scatter plots do not exhibit any discernible pattern, thereby indicating that the linearity and homoscedasticity assumptions are not violated. The Q-Q plots demonstrate minor deviations, yet they generally adhere to the diagonal line, indicating that the normality assumption is not significantly violated. Some Variance Inflation Factors (VIFs) are greater than 10, which indicates the presence of multicollinearity. This assumption has been violated in some variables, namely drug use and moderators of drugs and age and gender. In order to address the issue of multicollinearity, it may be necessary to remove one of the variables that are highly correlated with the others.

Descriptive statistics

As depicted in Table 1, the sample consisted of participants that were on average 21.7 years old (*SD*=1.9), mostly women (approximately 78.1%), and approximately 60% university students. The sample was predominantly Caucasian (94.6%).

Also shown in Table 1, on average, participants had a depression score of 0.82 (*SD*=0.61) at baseline, which decreased to 0.67 (*SD*=0.46) after two months. With regard to wellbeing, participants reported a mean score of 71.48 (*SD* = 11.41) at baseline, which decreased to 65.02 (*SD* = 12.05) two months later. The mean alcohol use score at T1 was 3.44 (*SD* = 3.35), and the mean drug use score at T1 was 0.39 (*SD* = 1.51). The large *SD* indicates large variability in alcohol and drug usage patterns within the sample.

As Shown in the table in appendix A, 24.6% of the participants abstain from alcohol consumption over the course of a week. Furthermore, 87.7% of participants consume between zero and seven glasses of alcohol per week. With regard to daily consumption, 60% of men drink none to one glass per day, while among women the percentage is 95.5%.

As shown in Table 2, there was a strong positive correlation between depression at T0 and depression at T2 ($r = 0.775$, $p < 0.01$). This indicates that individuals with higher depressive symptoms at baseline tend to experience higher depressive symptoms two months later. Depression at T0 was significantly negatively correlated with wellbeing at T0 ($r = -0.492$, $p < 0.01$) and wellbeing at T2 ($r = -0.340$, $p < 0.01$), indicating that individuals with higher depressive symptoms initially tend to report lower wellbeing at the same time point

and two months later. Similarly, depression at T2 was significantly negatively correlated with wellbeing at T0 (r = -0.399, p < 0.01) and wellbeing at T2 (r = -0.401, p < 0.01). The results indicate that individuals with higher levels of wellbeing tend to exhibit lower levels of depressive symptoms over time, thereby reinforcing the inverse relationship between depressive symptoms and wellbeing over time.. In terms of wellbeing, there was a strong positive correlation between wellbeing at T0 and T2 (r = 0.672, p < 0.01). This indicates that individuals who report higher levels of wellbeing at baseline tend to maintain higher levels of wellbeing two months later.

With regard to substance use, A significant negative correlation was observed between alcohol use at T1 and gender (r = -0.432, p < 0.01), indicating gender-based differences in alcohol consumption. A small, non-significant positive correlation was observed between alcohol use and age (r = 0.114). The results indicate that alcohol consumption at T1 is weakly and non-significantly negatively correlated with wellbeing at T0 (r = -0.033) and T2 (r = 0.001). Additionally, there is a small, non-significant positive correlation between alcohol consumption at T1 and depression at T0 (r = 0.107) and T2 (r = 0.023). Additionally, a small, non-significant positive correlation was observed between alcohol and drug use at T1 (r = 0.087). The correlation between drug use at T1 and gender (r = -0.328, p < 0.01) indicates gender differences in drug consumption. A small, non-significant negative correlation was observed between drug use and age (r = -0.108). The correlation between drug use at T1 and depression at T0 was found to be small and non-significant (r = 0.140), while the correlation at T2 was near-zero (r = -0.014). The correlation between drug use at T1 and wellbeing at T0 was found to be weak and non-significant (r = -0.029), while a small and non-significant positive correlation was observed between the two variables at T2 (r = 0.122).

Table 1

Descriptive statistics of demographics and main study variables (N=114)

	M [*SD*]/ %	Min.	Max.
Women (%)	78.1	-	-
Age	21.67 (1.9)	18.04	24.97
Current education (%)			
Secondary vocational education (MBO)	2.7	-	-
Higher professional education (HBO)	35.1	-	-

University education (WO)	60.5	-	-
Ethnicity (%)			
Caucasian	94.6	-	-
Indian/Latin-American	1.8	-	-
Other	3.6	-	-
Depressive symptoms T0	0.82 (0.61)	0.00	2.44
Depressive symptoms T2	0.67 (0.46)	0.00	2.00
Wellbeing T0	71.48 (11.41)	20.68	94.10
Wellbeing T2	65.02 (12.05)	34.00	96.88
Alcohol use T1	3.44 (3.35)	0.00	13.00
Drug use T1	0.39 (1.51)	0.00	11.00

Note. The NFNG study had 138 participants but due to listwise deletion, 24 participants were not used in the analyses.

Table 2

Correlations between the relevant study variables (N=114)

	1	2	3	4	5	6	7	8
1.Gender	1							
2.Age	-.128	1						
3.DeprT0	-.115	.042	1					
4.DeprT2	-.073	.087	.775**	1				
5.WellbeingT0	-.025	-.114	-.492**	-.399**	1			
6.WellbeingT2	-.089	-.097	-.340**	-.401**	.672**	1		
7.AlcoholUseT1	-.432**	.114	.107	.023	-.033	.001	1	
8.DrugUseT1	-.328**	-.108	.140	-.014	-.029	.122	.087	1

Note. ** Correlation is significant at the 0.01 level (2-tailed)

DeprT0=depressive symptoms at T0, deprT2=depressive symptoms at T2

Gender is coded as 1 for male, 2 for female.

Listwise $N = 114$

Regression analyses

Hypothesis 1 and 2: Effects *of Alcohol and Drug Use on youths' mental health*

With regard to depressive symptoms, as shown in the upper part of Table 3, the intercept was significant ($B = 0.665$, $p < 0.001$), indicating that when alcohol use at T1 and drug use at T1 are zero, the estimated mean depressive symptoms score at T2 is 0.665 on a

scale from 0 to 3. The main effect of alcohol use at T1 on depressive symptoms at T2 was not statistically significant ($B = 0.003$, $p = 0.800$). Similarly, the effect of drug use at T1 on depressive symptoms at T2 was also not statistically significant ($B = -0.005$, $p = 0.865$).

With regard to wellbeing, as depicted in the lower part of Table 3, the intercept was significant ($B = 64.756$, $p < 0.001$), indicating that when alcohol use at T1 and drug use at T1 are zero, the estimated mean wellbeing score at T2 is 64.756. The effect of alcohol use at T1 on wellbeing at T2 was not statistically significant ($B = -0.035$, $p = 0.919$). Similarly, the effect of drug use at T1 on wellbeing at T2 was also not statistically significant ($B = 0.981$, $p = 0.195$).

Table 3

Regression table: effects of alcohol and drug use on depressive symptoms two months later

Dependent variable	Parameter	Unstandardized *B*	Coefficients Std. Error	Standardized Coefficient Beta	*t*	*Sig.*
Depression T2	Intercept	.665	.063	-	10.511	<.001
	Alcohol use T1	.003	.013	.024	.255	.800
	Drug Use T1	-.005	.029	-.016	-.171	.865
Well-being T2	Intercept	64.756	1.636	-	39.587	<.001
	Alcohol use T1	-.035	.340	-.010	-.102	.919
	Drug use T1	.981	.753	.123	1.304	.195

Hypothesis 3 and 4: *Moderators of Change in Youth's Mental Health over two months*

With regard to depressive symptoms, the regression results presented in Table 4 indicate that the intercept for depressive symptoms two months later was not statistically significant. This suggests that when all predictor variables are set to zero, the estimated mean depressive symptoms score two months later is not significantly different from zero. The main effect of alcohol and drug use and demographic variables (Age, Gender) and education level on depressive symptoms two months later, as well as the moderating effects of age, gender,

education, and ethnicity on this relationship, on depressive symptoms were also non-significant.

With regard to wellbeing, the results presented in Table 5 showed no main effects for alcohol and drug use (T1) on well-being two months later. Similarly, demographic variables age, gender, and education level did not significantly predict well-being. Furthermore, none of the interaction terms between alcohol/drug use and demographic variables when predicting wellbeing two months later were statistically significant. This suggests that the relationship between alcohol and drug use and well-being did not vary significantly based on age, gender, education level, or ethnicity in this sample.

Table 4

Regression Table: Effects of Alcohol and Drug Use and Interactions with Demographic Variables on Depressive Symptoms

	Unstandardised Coefficients		Standardised Coefficient	t	p-value
	B	*Std. Error*	*Beta*		
(Constant)	1.449	1.321	-	1.097	.278
Alcohol Use T1	-.012	1.047	-.084	.-.561	.577
Drug Use T1	-.005	0.69	-.011	-.074	.941
Age	.036	.032	.161	1.115	.271
Gender	.067	.170	.064	.391	.698
Education	-.109	.075	-.233	-1.446	.155
Ethnicity	.051	.059	.145	.869	.389
Alcohol use x age	.018	.048	.036	.372	.710
Alcohol use x gender	.069	.040	.198	1.715	.089
Alcohol use x education	.023	.053	.041	.433	.666

Alcohol use x ethnicity	.134	,101	,181	1.333	.188
Drug use x age	-.088	.088	-.122	-1.003	.318
Drug use x gender	.022	.055	.080	.397	.692
Drug use x education	.014	.018	.110	.783	.436
Drug use x ethnicity	-.376	.218	-.254	-1.726	.090

Note: B= coefficient estimates, *t*= t-value, *Std Error*= standard error

Gender is coded as 1 for male, 2 for female.

Table 5

Regression Table: Effects of Alcohol and Drug Use and Interactions with Demographic Variables on Wellbeing

	Unstandardised Coefficients		Standardised Coefficient	t	p-value
	B	*Std. Error*	*Beta*		
(Constant)	75.763	33.833	-	2.239	.030
Alcohol Use T1	.005	.543	.002	.010	.992
Drug Use T1	-1.123	1.765	-.098	-.636	.528
Age	-.157	.824	-.029	-.191	.849
Gender	-4.409	4.361	-.173	-1.011	.317
Education	-.244	1.933	-.021	-.126	.900
Ethnicity	-2.144	1.499	-.249	-1.430	.159
Alcohol use x age	.806	1.246	.062	.647	.519
Alcohol use x gender	.313	1.058	.035	.296	.768
Alcohol use x education	-.546	1.387	-.038	-.394	.695

Alcohol use x ethnicity	-3.824	2.543	-.206	-1.504	.139
Drug use x age	2.664	2.259	.124	1.179	.241
Drug use x gender	-1.041	1.417	-.148	-.735	.464
Drug use x education	-.123	.481	-.036	-.256	.798
Drug use x ethnicity	7.032	5.535	.190	1.270	.210

Note: *B*= coefficient estimates, *t*= t-value, *Std Error*= standard error
Gender is coded as 1 for male, 2 for female.

Discussion

The central research questions of this study stated 'To what extent is alcohol and drug use a risk factor for the mental health of young people? And 'Are there specific demographic or contextual factors that moderate the relationship between alcohol and drug use, and mental health in youth?'

In this study, the mean age of participants was 21.7 years (*SD* = 1.9). Initial descriptive statistics revealed an average baseline depression score of 0.82 (*SD* = 0.61), which decreased to 0.67 (*SD* = 0.46) after two months, with higher scores indicating more severe depressive symptoms. Similarly, the mean well-being score decreased from 71.48 (*SD* = 11.41) at baseline to 65.02 (*SD* = 12.05) at the two-month follow-up, with higher scores reflecting higher levels of well-being. The mean score of alcohol use was 3.44 (*SD* = 3.35), indicating the average amount of alcohol consumption among participants per week. The mean score of drug use was 0.39 (*SD* = 1.51), representing the average amount of drug consumption among participants per two weeks.

With regard to the frequency of alcohol use, the proportion appears higher compared to national statistics (Castagna, 2024). In the present study we found that 87,7% of the participants either does not drink or drinks only one glass per day, while the statistics from 2023 indicates that 44% of the population either does not drink or drinks only one glass per day. The present study found that 60% of men drink none to one glass per day, while among women, the percentage is 95.5%. The national statistics found that 34.5% of men drink none to one glass per day, while among women, the percentage is 53,3% (Castagna, 2024).

Correlation analyses indicated that higher levels of depressive symptoms at baseline were predictive of higher levels of depressive symptoms two months later, thereby highlighting a potential continuity of depressive experience over time. The negative

correlations between depression and well-being indicate an inverse relationship, with higher levels of depressive symptoms being associated with lower levels of well-being, both concurrently and longitudinally. Conversely, individuals who reported higher levels of well-being at baseline exhibited a tendency to maintain these levels over the two-month period, thereby indicating the stability of well-being.

The correlation analyses revealed that alcohol consumption at T1 was inversely associated with gender, indicating gender differences in alcohol use. This finding is consistent with a previous study presented in the introduction by Tate (2021) and Henderson et al. (2004), which also reported gender variations in alcohol consumption. Age did not significantly relate to alcohol consumption. This contrasts with the findings of Tate (2021) and Henderson et al. (2004) that have identified age as a predictor of alcohol use. While a positive but non-significant correlation existed between alcohol consumption and depressive symptoms at T0 and T2, suggesting a trend towards higher alcohol use and slightly elevated depressive symptoms, this link was not statistically significant. This differs from the potential findings of Tate (2021) and Henderson et al. (2004) which have reported significant relationships between alcohol consumption and mental health indicators. Alcohol consumption had minimal associations with well-being at both time points. In terms of drug consumption, the present study revealed a significant negative correlation between drug use and gender, indicating gender disparities in drug use. This finding is consistent with the potential findings of Tate (2021) and Henderson et al. (2004) However, the present study did not find age to be a significant predictor of drug use, contrasting with potential findings from Tate (2021) and Henderson et al. (2004).

Analyses of hypotheses and recommendations

First, our results show that the level of alcohol and drug use are not associated with the severity of depressive symptoms up to two and eight weeks later, which does not support our first hypothesis. We did not find that higher levels of alcohol and drug are linked to higher levels of depressive symptoms among young individuals. Similarly, our results show that the level of alcohol and drug use are not associated with the severity of depressive symptoms up to two and eight weeks later, which does not support our second hypothesis. We did not find that higher levels of alcohol and drug are linked to lower levels of wellbeing among young individuals.

With regard to the expected moderation of the effect of youths' substance use on mental health by age, gender, education level, and ethnicity (H3 and H4), the study revealed

non-significant findings. This indicates that the relationship between substance use and mental health did not vary significantly based on age, gender, education level, or ethnicity in this sample.

The present study calls into question the validity of the established correlations between substance use and adverse mental health outcomes observed in previous research. A number of studies have established a correlation between alcohol and drug consumption among university students and a range of adverse outcomes, including dependence, academic underperformance and risky behaviours (Benzi et al., 2023; Giftson, 2017; Gasa et al., 2022). Furthermore, adolescent alcohol consumption has been demonstrated to precede the emergence of depressive symptoms, exerting a detrimental influence on brain development (Hammerton et al., 2023). A significant proportion of university students employ alcohol as a coping mechanism for academic stress, particularly those experiencing elevated levels of negative affect (Schick, 2020; Park, 2017; Mobach & Macaskill, 2011; Lennings, 1998). Meanwhile, the use of cannabis among college students gives rise to concerns regarding its deleterious effects on mental and physical health, in addition to its impact on academic performance (Wenzinger & Fayola, 2020). The extant literature indicates that cannabis use during adolescence increases the risk of major depression and suicidal behaviour in young adulthood, as well as an earlier onset of depressive and anxiety symptoms (Gobbi et al., 2019; Bataineh et al., 2023).

The present study is notable for a number of strengths. Firstly, The study employed a longitudinal research design, which permitted the examination of the relationship between substance use, depressive symptoms, and well-being over time. This design permitted the investigation of both immediate and long-term effects, thereby addressing a gap in the literature of mostly cross-sectional studies (Bellos et al., 2013; Chen et al., 2022). In light of the insignificant findings in terms of well-being over a 2-month period, it would be beneficial for future researchers to examine whether the effects of alcohol and drug use on well-being persist over an extended timeframe. A more extended follow-up study could provide insights into the temporal dynamics of these relationships and capture potential delayed effects on well-being outcomes.

Secondly, the utilisation of validated instruments, including the TRAILS Substance Use Questionnaire, the PHQ, and the DOPS, ensured the reliability and validity of the data collected. The utilisation of established scales enhanced the comparability of the study with existing research, facilitating the integration of findings into the broader literature on mental health and substance use.

It is important to acknowledge that, despite the findings, several limitations exist. These limitations and recommendations are intertwined with the hypothesis.

Hypothesis 1: Alcohol and Drug Use and Depressive Symptoms

Previous studies, such as those by Lee et al. (2013) and Marmorstein (2009), have identified significant correlations between substance use and depressive symptoms. The observed differences in the current study may be attributed to a number of methodological factors. The relatively brief timeframe of two months may not fully encompass the longer-term effects of substance use on mental health, in comparison to studies with follow-up periods extending over several years. It is therefore recommended that future research consider extending the follow-up periods beyond two months in order to capture the potential long-term effects of substance use on mental health. It is possible that studies with longer timeframes may reveal delayed impacts on depressive symptoms that are not observable within shorter periods.

Furthermore, the current study's smaller sample size may have reduced the statistical power to detect significant associations. To address this limitation, future research should undertake to increase the sample size and include participants from a range of demographic backgrounds. By recruiting a larger and more diverse sample, studies can enhance the statistical power and generalisability of the findings.

Furthermore, the instruments employed to assess mental health and substance use differed across studies, which may have affected the comparability of findings. It is therefore recommended that standardised and validated instruments be used in all studies, in order to improve the comparability of findings. It is recommended that researchers agree on the use of common tools for the assessment of mental health and substance use, in order to ensure consistency in measurements.

Hypothesis 2: Alcohol and Drug Use and Well-being

The absence of a significant relationship between substance use and well-being in this study also diverges from prior research, which often reported negative impacts of substance use on well-being (Schick, 2020; Park, 2017; Mobach & Macaskill, 2011). This discrepancy may be attributed to the differences in the demographic characteristics of the samples. The current study's sample is predominantly composed of highly educated Caucasian females, whereas other studies included more diverse populations. The limited demographic scope of the study may not fully represent the broader population, thereby influencing the generalisability of the results.

To address this limitation, future studies should aim to recruit Inclusion of participants from a range of cultural, socioeconomic, and educational backgrounds will enhance the generalisability of the findings and provide a more comprehensive understanding of how substance use impacts well-being across diverse groups.

Hypothesis 3 and 4: Moderating Effects of Demographic Factors

The study did not identify any significant moderating effects of age, gender, education level, and ethnicity on the relationship between substance use and mental health. Previous research has frequently reported such moderating effects, indicating that demographic factors influence the strength and direction of these relationships (Tate, 2021; Henderson et al., 2004). The absence of significant findings in the current study may be attributed to the homogeneous nature of the sample, which constrains the variability necessary to detect moderation effects.

Future studies should conduct more detailed analyses of how demographic factors may moderate the relationship between substance use and mental health. This necessitates not only the examination of direct effects but also the exploration of potential interaction effects in larger and more diverse samples.

Moreover, the utilisation of self-report measures, such as the TRAILS Substance Use Questionnaire, introduces the potential for response bias and social desirability effects. It is possible that participants may underreport or overreport their substance use, which could result in inaccurate data. To address this issue, future research should integrate objective indicators of substance use, such as biological markers or peer reports, with self-report questionnaires. The incorporation of supplementary objective measures will serve to enhance the validity of the findings and to mitigate potential biases inherent to self-report data collection.

Conclusion

Met opmerkingen [VH3]: Conclusion does not need to be long. I even prefer a short and to-the-point conclsusion (that is really based on your results, even if that is not much)

In conclusion, this study explored the impact of alcohol and drug use on the mental health of young people and potential moderating factors. The results indicate that higher levels of well-being consistently correlate with lower levels of depressive symptoms across different time points. However, contrary to our hypotheses, neither alcohol nor drug use significantly predicted depressive symptoms or well-being over a two-month period. Additionally, demographic factors such as age, gender, education level, and ethnicity did not moderate these effects. Future research should consider using larger, more diverse samples, longer study durations, and standardized measurement instruments to ensure comparability.

Additionally, incorporating objective measures of substance use could enhance the reliability of findings. It is noteworthy that within a one- to two-month timeframe, substance use does not appear to impact mental health significantly, nor do demographic factors moderate this relationship. This suggests that the effects of substance use on mental health may require longer periods to manifest or might be more detectable in studies with different designs.

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Appendix A

Table A1

Percentages of Alcohol Use per week

Alcohol Use per week	Male	%	Cum.% (Male)	Female	%	Cum. % (Female)	Total	%	Cum. % (Total)
0.00	3	12.0%	12.0%	25	28.1%	28.1%	28	24.6%	24.6%
0.50	1	4.0%	16.0%	4	4.5%	32.6%	5	4.4%	29.0%
1.00	1	4.0%	20.0%	4	4.5%	37.1%	5	4.4%	33.3%
1.50	2	8.0%	28.0%	4	4.5%	41.6%	6	5.3%	38.6%
2.00	0	0.0%	28.0%	7	7.9%	49.4%	7	6.1%	44.7%
2.50	0	0.0%	28.0%	6	6.7%	56.2%	6	5.3%	50.0%
3.00	0	0.0%	28.0%	7	7.9%	64.0%	7	6.1%	56.1%
3.50	1	4.0%	32.0%	9	10.1%	74.2%	10	8.8%	64.9%
4.00	1	4.0%	36.0%	3	3.4%	77.5%	4	3.5%	68.4%
4.50	1	4.0%	40.0%	2	2.2%	79.8%	3	2.6%	71.0%
5.00	2	8.0%	48.0%	4	4.5%	84.3%	6	5.3%	76.3%
5.50	0	0.0%	48.0%	5	5.6%	89.9%	5	4.4%	80.7%
6.00	1	4.0%	52.0%	1	1.1%	91.0%	2	1.8%	82.5%
6.50	1	4.0%	56.0%	1	1.1%	92.1%	2	1.8%	84.2%
7.00	1	4.0%	60.0%	3	3.4%	95.5%	4	3.5%	87.7%
7.50	0	0.0%	60.0%	2	2.2%	97.8%	2	1.8%	89.5%
8.50	1	4.0%	64.0%	0	0.0%	97.8%	1	0.9%	90.4%
9.00	0	0.0%	64.0%	1	1.1%	98.9%	1	0.9%	91.2%
9.50	2	8.0%	72.0%	1	1.1%	100.0%	3	2.6%	93.9%
10.00	1	4.0%	76.0%	1	1.1%	100.0%	2	1.8%	95.6%
10.50	1	4.0%	80.0%	0	0.0%	100.0%	1	0.9%	96.5%
11.00	1	4.0%	84.0%	0	0.0%	100.0%	1	0.9%	97.4%
11.50	1	4.0%	88.0%	0	0.0%	100.0%	1	0.9%	98.2%
12.00	1	4.0%	92.0%	0	0.0%	100.0%	1	0.9%	99.1%
12.50	1	4.0%	96.0%	0	0.0%	100.0%	1	0.9%	100.0%
13.00	1	4.0%	100.0%	0	0.0%	100.0%	1	0.9%	100.0%

Note. Cum. = Cumulative.

Appendix B

Testing of assumptions Hypothesis 1 and 2

Figure B1

Linearity between depressive symptoms at T0 and at T2

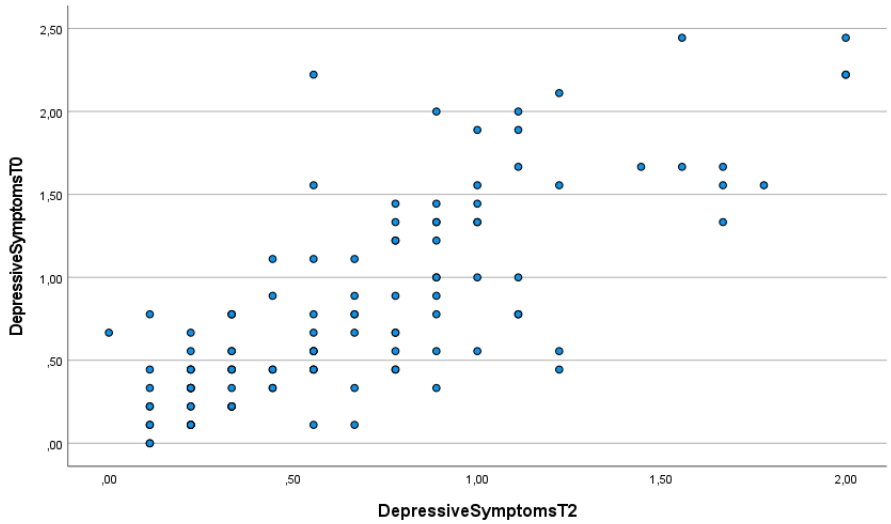

Figure B2

Linearity between wellbeing at T0 and depressive symptoms at T2

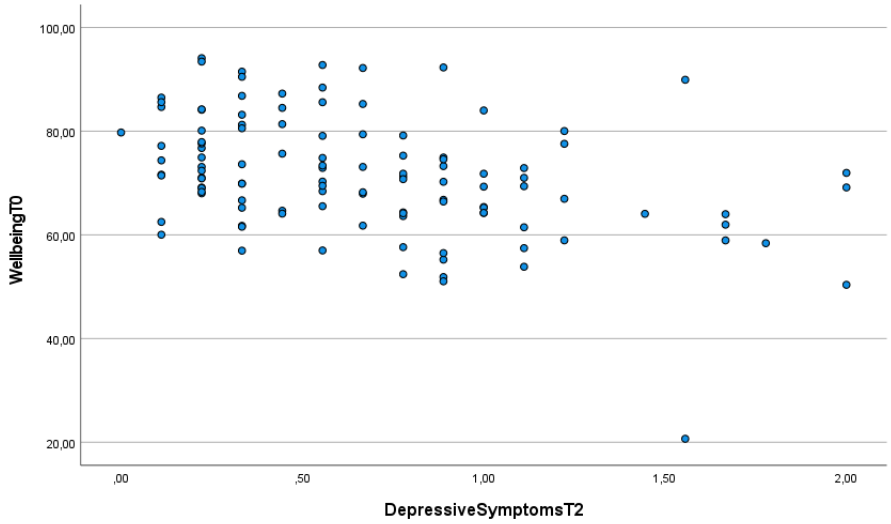

Figure B3

Linearity between wellbeing at T2 and depressive symptoms at T2

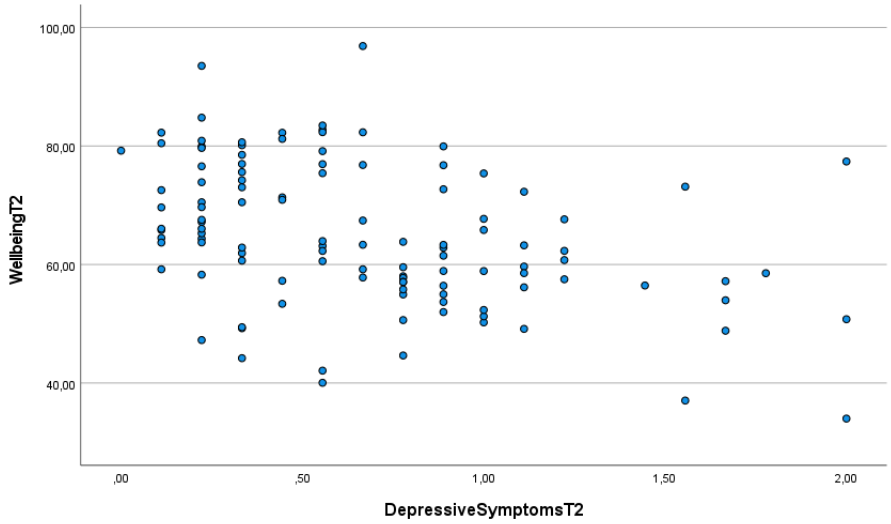

Figure B4

Linearity between alcohol use at T1 and depressive symptoms at T2

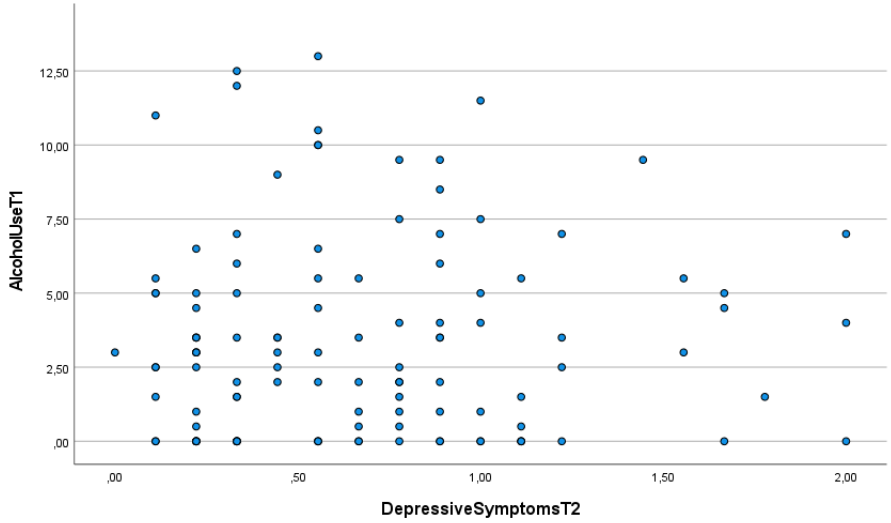

Figure B5

Linearity between drug use at T1 and depressive symptoms at T2

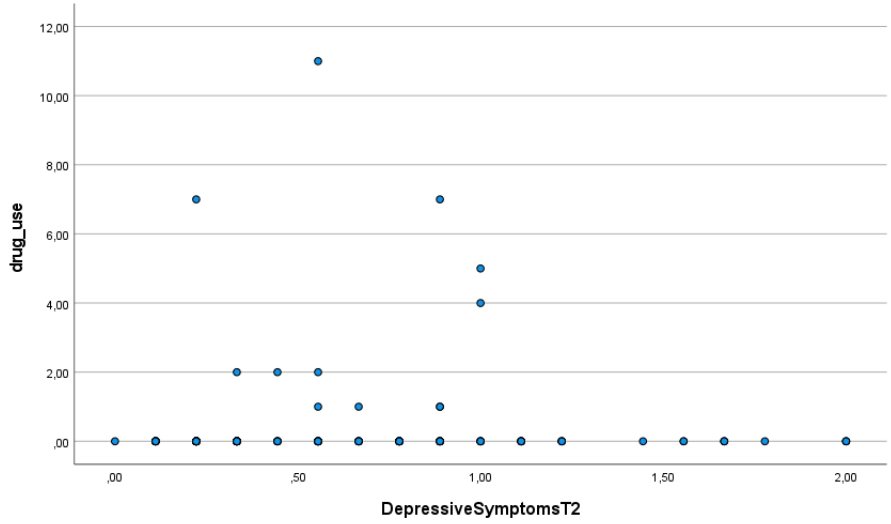

Figure B6

Linearity between depressive symptoms at T0 and wellbeing at T2

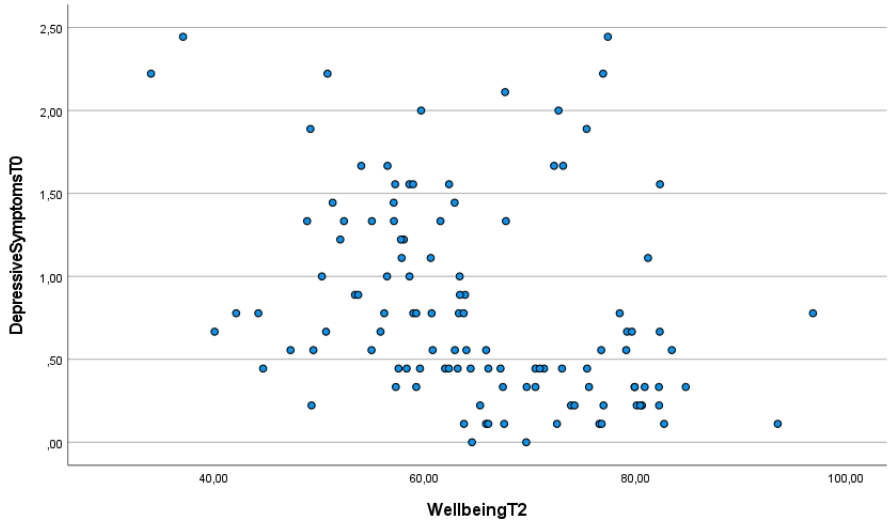

Figure B7

Linearity between wellbeing at T0 and wellbeing at T2

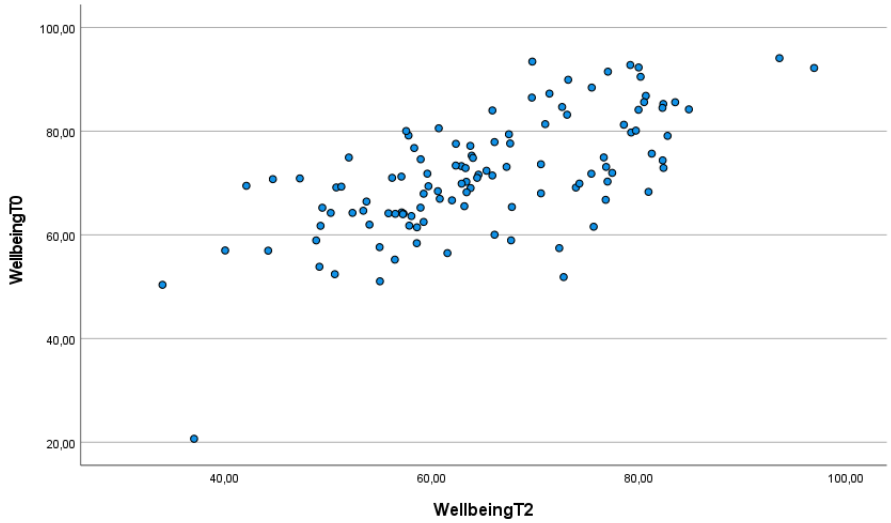

Figure B8

Linearity between alcohol use at T1 and wellbeing at T2

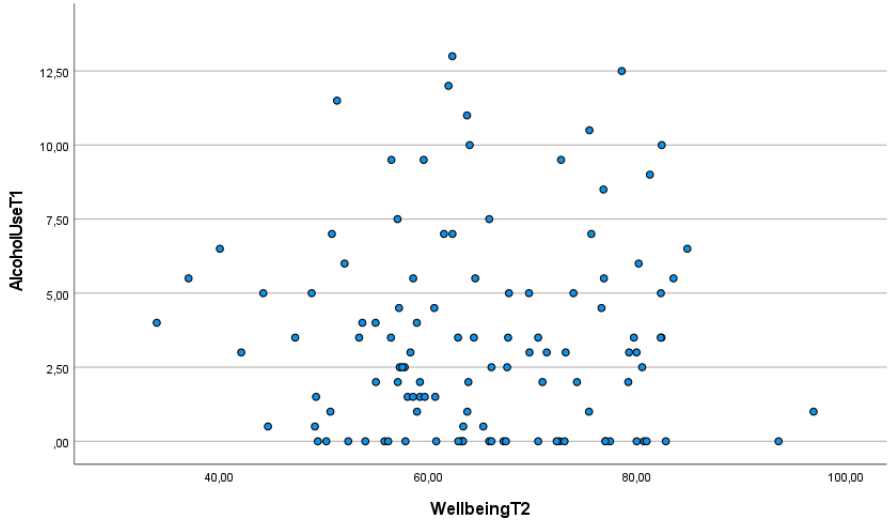

Figure B9

Linearity between drug use at T1 and wellbeing at T2

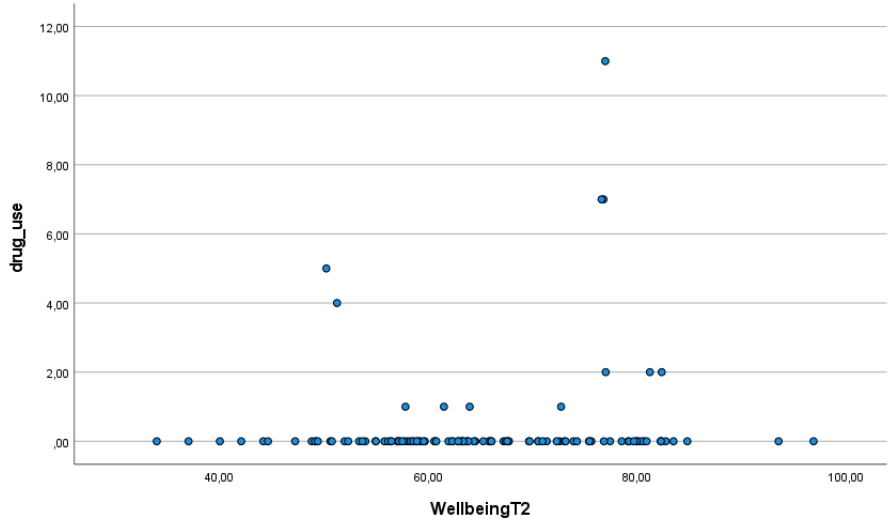

Figure B10

Normality of residuals of dependent variable depressive symptoms at T2

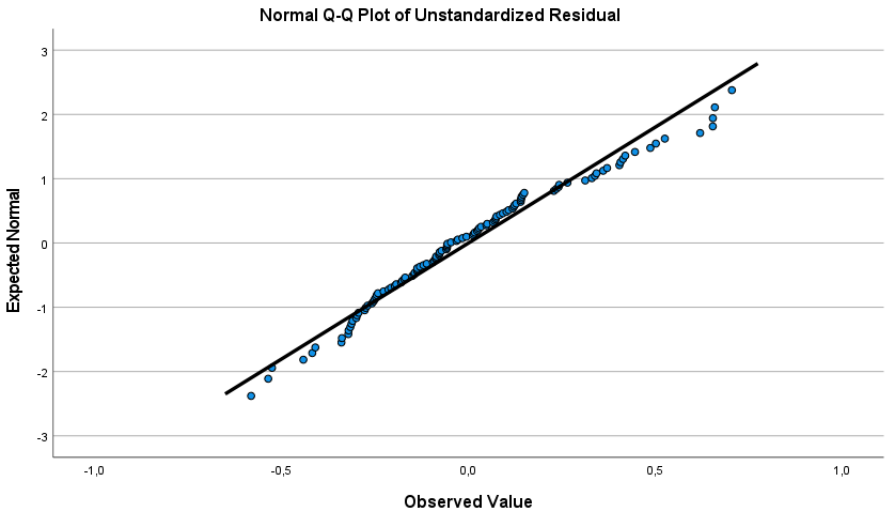

Figure B11

Normality of residuals of dependent variable wellbeing at T2

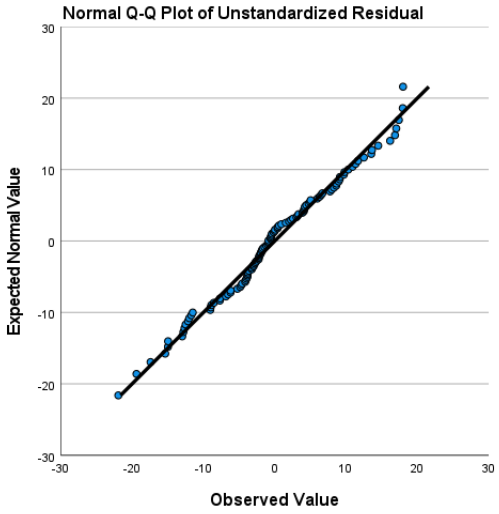

Figure B12

Homoscedasticity of residuals of dependent variable depressive symptoms at T2

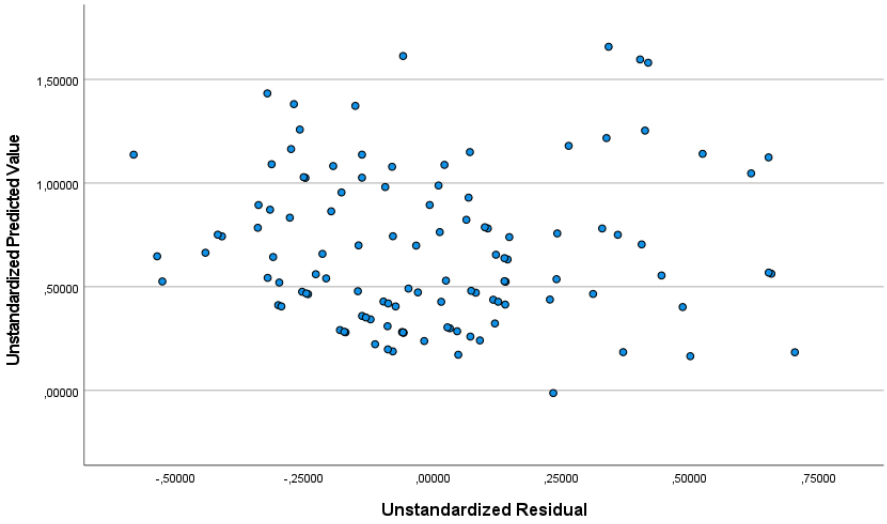

Figure B13

Homoscedasticity of residuals of dependent variable wellbeing at T2

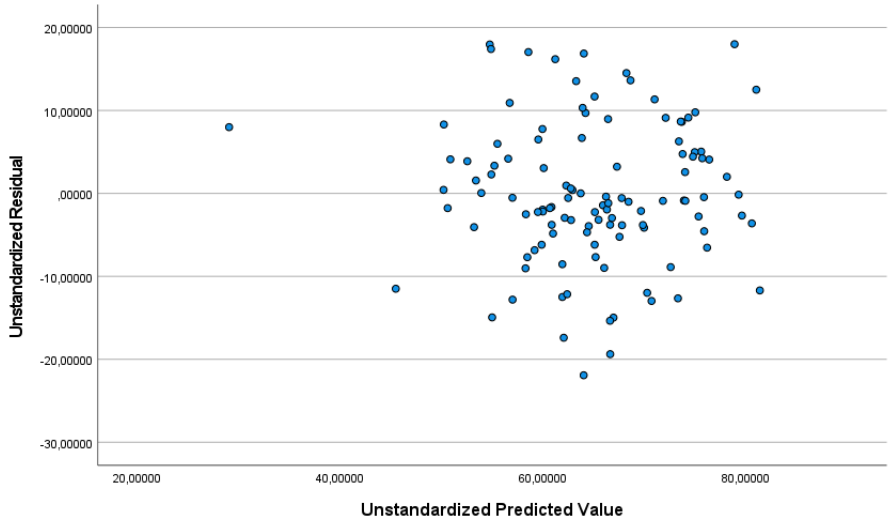

Table B1

Multicollinearity of dependent variables depressive symptoms and wellbeing at T2

	Collinearity statistics	
Model	Tolerance	VIF
Depressive symptoms T0	.734	1.362
Wellbeing T0	.466	2.145
Wellbeing T2	.527	1.899
Alcohol use T1	.982	1.018
Drug use T1	.936	1.068

Note. Dependent variable: Depressive symptoms T2

Table B2

Multicollinearity of dependent variables depressive symptoms and wellbeing at T2

	Collinearity statistics	
Model	Tolerance	VIF
Wellbeing T0	.756	1.323
Depressive symptoms T0	.334	2.996
Depressive symptoms T2	.381	2.624
Alcohol use T1	.976	1.025
Drug use T1	.938	1.066

Note. Dependent variable: Depressive symptoms T2

Appendix C

Testing assumptions hypothesis 3 and 4

Figure C1

Linearity and homoscedasticity of dependent variable depressive symptoms at T2

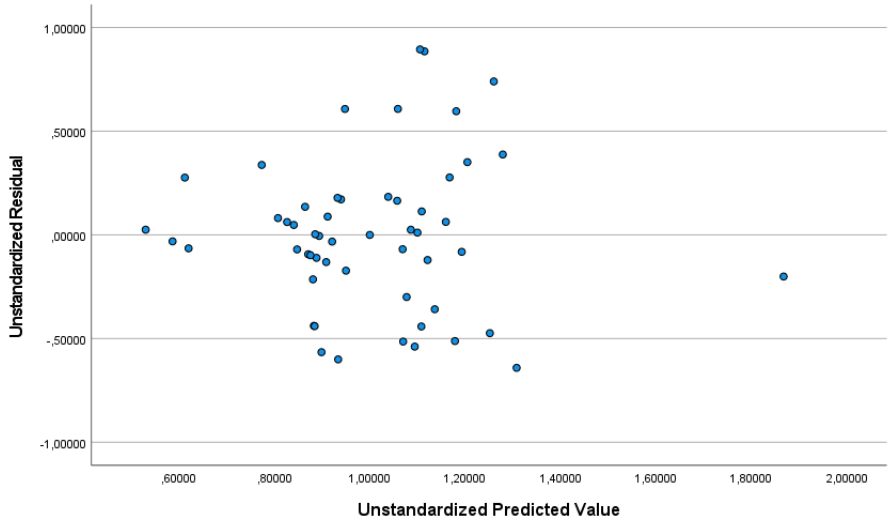

Figure C2

Linearity and homoscedasticity of dependent variable wellbeing at T2

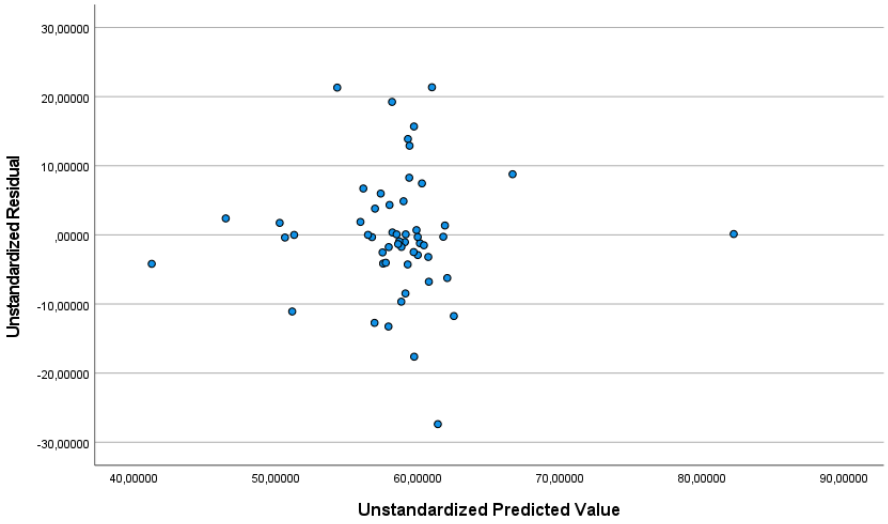

Figure C3

Normality of residuals of dependent variable depressive symptoms at T2

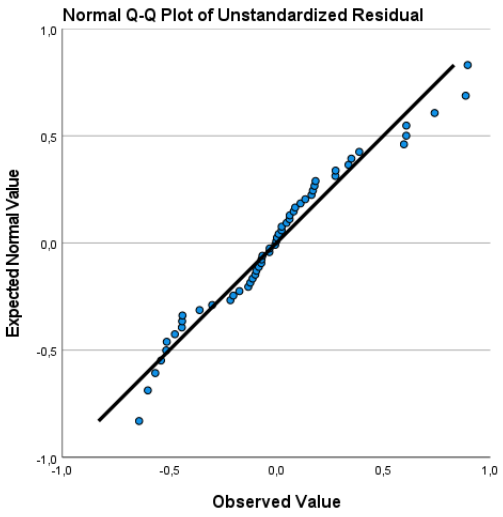

Figure C4

Normality of residuals of dependent variable wellbeing at T2

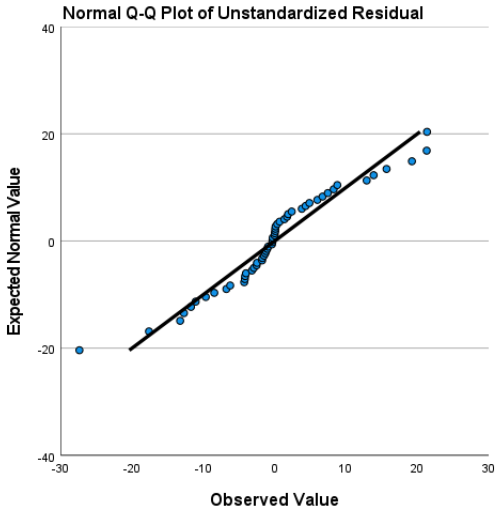

Table C1

Multicollinearity of dependent variables depressive symptoms and wellbeing at T2

	Collinearity statistics	
Model	Tolerance	VIF
Alcohol use T1	.646	1.548
Drug use T1	.016	64.500
Age	.140	7.147
Gender	.178	5.623
Education	.175	5.699
Alcohol x age	.651	1.535
Alcohol x gender	.329	3.035
Alcohol x ethnicity	.470	2.126
Alcohol x education	.439	2.280
Drugs x age	.024	42.438
Drugs x gender	.040	24.829

Drugs x education	.132	7.592
Drugs x ethnicity	.365	2.726