Polysubstance Use among Iowa Adults

A special report from the 2021 Iowa Health, Wellbeing, Use of Substances, and Gambling Survey

December 2022

Prepared for
Iowa Department of
Health and Human Services

Prepared by
Justine Radunzel
Ki H. Park
Kyle Endres
Mary E. Losch

IOWA HHS | UNI University of Northern Iowa. Center for Social & Behavioral Research

Acknowledgements

Suggested citation: Radunzel, J., Park, K.H., Endres, K., & Losch, M.E. (2022). *Polysubstance Use among Iowa Adults A special report from the 2021 Iowa Health, Wellbeing, Use of Substances, and Gambling Survey*. Cedar Falls, IA: Center for Social and Behavioral Research, University of Northern Iowa.

Gov. Kim Reynolds
Lt. Gov. Adam Gregg
Iowa Department of Health and Human Services (HHS) Director Kelly Garcia

Report Contact Information:
Pat McGovern
Data Manager
HHS, Bureau of Substance Abuse
pat.mcgovern@idph.iowa.gov

Ki Park, PhD, Assistant Director
Center for Social and Behavioral Research
University of Northern Iowa, Cedar Falls, IA 50614-0402
(319) 273-2105; Ki.Park@uni.edu

or

Mary E. Losch, PhD, Professor and Director
Center for Social and Behavioral Research
University of Northern Iowa, Cedar Falls, IA 50614-0402
(319) 273-2105 Mary.Losch@uni.edu

TABLE OF CONTENTS

List of Figures

List of Tables

List of Acronyms

CSBR..... Center for Social and Behavioral Research

HHS..... Iowa Department of Health and Human Services

IDPH..... Iowa Department of Public Health

IGTP..... Iowa Gambling Treatment Program

IRB..... Institutional Review Board

OTC..... Over-the-counter medication

QoL..... Quality of Life

UNI..... University of Northern Iowa

SECTION A. POLYSUBSTANCE DEFINITION

BACKGROUND

This report focuses on examining demographic characteristics and other factors associated with using multiple substances, or polysubstance use. Findings are based on analyses of the 2021 Iowa Health, Wellbeing, Use of Substances, and Gambling Survey (Survey) data. For more details about the study design, the questionnaire, the methods, and the point estimates of Iowa adults' attitudes and behaviors about their health and wellbeing, substance use, gambling behaviors, and mental health, see the initial report by Park, Radunzel, Endres, and Losch (2022).

Briefly, the Survey asked adult Iowans about substance use behaviors in the past 30 days for the following substances: alcohol[1] (and binge drinking[2]), marijuana, methamphetamine, opioids, any other illegal substance, prescription drugs (in ways other than directed) and over-the-counter (OTC) medication (in ways other than directed). In this report, the likelihood of reporting polysubstance use as compared to single- or no-substance use is examined in relation to various demographic characteristics and other factors such as quality of life (QoL).

IBM SPSS Statistics 28 and SUDAAN v 11.0.3 were used to determine population estimates of responses. SUDAAN was used to assess the statistical significance of proportion and mean differences in this report. Further explanation of some of the procedures (e.g. CROSSTAB or REGRESS in SUDAAN) can be found at www.rti.org/sudaan.[3] The significance level was set at 0.05 (or 5%) for all statistical tests. Percentages in this report may not sum to 100% due to rounding. All reported findings are based on data weighted to Iowa population metrics.

[1] Alcohol use was defined as having "a 12-ounce beer, a 5-ounce glass of wine, or a drink with one shot of liquor" at least for one day in the past 30 days.

[2] Binge drinking was defined as "5 or more drinks of alcohol for men and 4 or more drinks for women on any occasion within a two-hour period" at least once in the past 30 days.

[3] For most comparisons, the chi-squared test was used based on the CROSSTAB procedure. The one exception was for QoL scores where regression was used based on the REGRESS procedure.

Given that polysubstance use has been defined in a number of different ways in the literature depending on which combinations of substances are being evaluated such as alcohol, nicotine, and/or other drugs (e.g., marijuana),[4] alternative ways of defining polysubstance use were examined prior to settling upon a definition for polysubstance use for this report. In the next subsection, the substances used by Iowa adults and the association between alcohol use and other drug use are summarized to illustrate our process for determining the substances to be included in the polysubstance use definition for this report. Following this, the way polysubstance use was defined in this report is provided along with an estimate of how many Iowa adults would be classified in this group according to this definition. After this, bivariate relationships between polysubstance use and demographic characteristics such as age and sex are provided in section B, and bivariate relationships between polysubstance use and other factors such as QoL, mental health, and gambling behaviors are presented in section C. The report concludes with a summary of the findings and how these findings compare with those reported in other polysubstance studies.

SUBSTANCE USE

The most common substance used by Iowa adults was alcohol (63%). In addition, nearly one in five of all respondents indicated that they had at least one day of binge drinking (21%) in the past 30 days. As illustrated in Figure A.1, the next most common substance used by Iowa adults was marijuana (11%) followed by prescription misuse (6%). The percentage of respondents indicating that they had used methamphetamine, opioids, or misused OTC medications was 3% for each substance. Additionally, 1% reported using another illegal drug beyond the drugs explicitly asked about on the questionnaire.

[4] Some studies on polysubstance use have included alcohol in their polysubstance definition (e.g., Cicero, Ellis, & Kasper, 2020; Connor, Feeney, Kelly, & Saunders, 2017; Ou, Hu, Lin, & Wong, 2019), while others have not (e.g., Lorvick, Browne, Lambdin, & Comfort, 2018; McMurray, 2020). Some studies have also included tobacco or nicotine use in their polysubstance definition (e.g., Cicero et al., 2020; Ou et al., 2019), while others have focused only on drug classes other than tobacco and alcohol (e.g., Lorvick et al., 2018; McMurray, 2020). The 2021 Iowa Health, Wellbeing, Use of Substances, and Gambling Survey did not ask about tobacco or nicotine use.

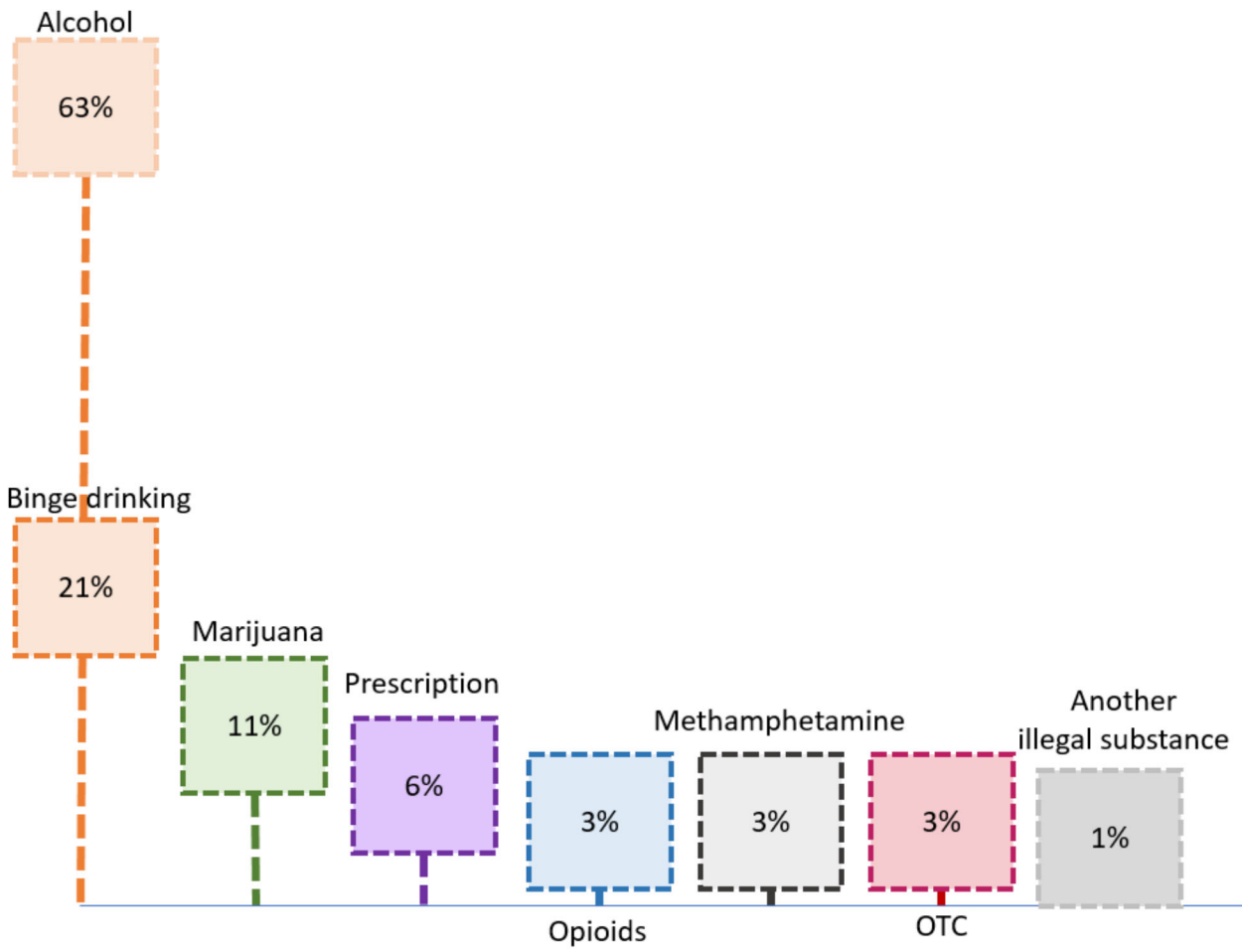

Figure A.1. *Substance use*

The association between the use of alcohol, binge drinking and other substances is shown in Figure A.2. Results indicated that Iowa adults who had binge drank in the past 30 days were significantly more likely to have used one of the other drugs (19%) or more than one of the other drugs (labeled polydrug; 14%) than those who either had not used alcohol (11% for one drug and 4% for polydrug) or had used alcohol but had not binge drank (11% for one drug and 3% for polydrug).

In other words, alcohol drinking without binge drinking was not significantly associated with polydrug use compared to those who did not use alcohol. That is, there was not a significant difference in the percentage of respondents using one of the other drugs or the percentage of respondents using more than one of the other drugs between those who had not used alcohol and those who had used alcohol but had not binge drank.

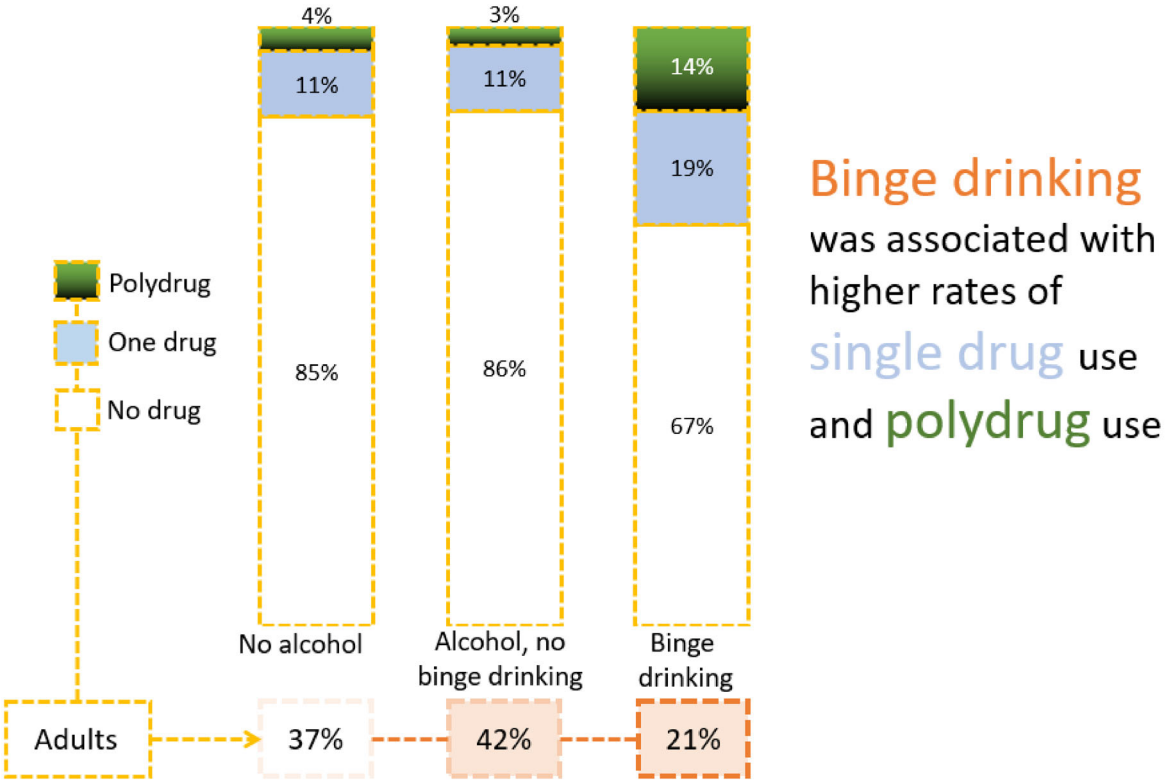

Figure A.2. *Alcohol use, binge drinking and other substances*

POLYSUBSTANCE DEFINITION: TWO OR MORE SUBSTANCES

Polysubstance use can be defined in a variety of ways depending on whether or not alcohol use and/or tobacco products are incorporated in the definition.[5] Based on the association between the use of binge drinking and other substances found among Iowa adults (Figure A.2), polysubstance use was defined in this report as using two or more substances in the past 30 days including the following behaviors: binge drinking, marijuana use, methamphetamine use, opioids use, another illegal substance use, prescription drug misuse or OTC medication misuse (see Figure A.3).

[5] See prior footnote for references.

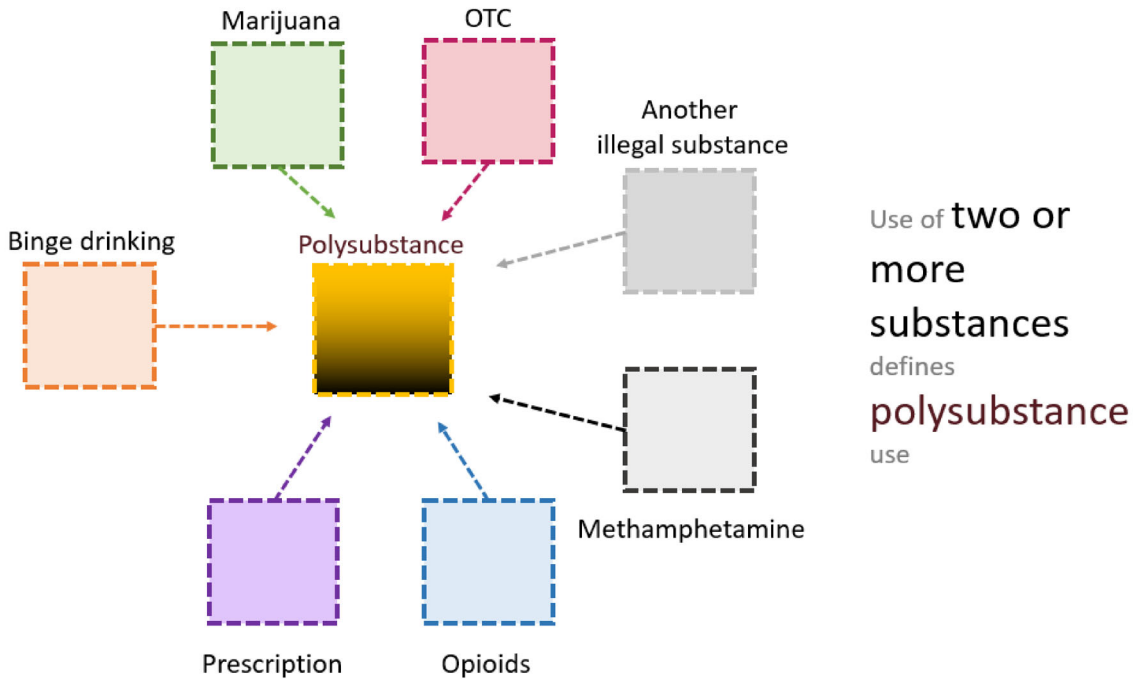

Figure A.3. *Substances defining polysubstance use*

Based on these substances, participants were classified into one of the following three groups according to the number of substances used in the past 30 days: no substance, one substance, and multiple substances.[6] It is important to note that multiple substance use does NOT measure use at the same time, but only that more than one substance was used during the course of 30 days. Based on Survey results, it is estimated that 10% of Iowa adults have used two or more substances during the past 30 days meaning that one in ten adults reported polysubstance use behavior (Figure A.4).

Figure A.4. *Polysubstance use in the past 30 days*

[6] Nearly 4,000 (or 98.1%) of the 4,055 respondents could be classified into one of the three groups. The remaining 76 respondents could not be classified due to missing responses to one or more alcohol and substance use items.

In comparison, 23% had either engaged in binge drinking or used exactly one of the other drugs but not both during the past 30 days[7] and 68% had not used any of these substances. Based on the 2021 state population, these percentages represent about 234,345 adult Iowans who reported polysubstance use, 540,154 adult Iowans who reported one substance use, and 1,617,317 adult Iowans who reported no substance use in the past 30 days (see table A.1).

Table A.1. *Iowa adults and polysubstance use in the past 30 days*

Group		No substance	One substance	Polysubstance
Adults	Percent	68%	23%	10%
	Estimated number	1,617,317	540,154	234,345

For those in the polysubstance group, the most prevalent combination of substances (as illustrated in Figure A.5) was binge drinking and marijuana (29%), followed by prescription and OTC misuse (12%), binge drinking, marijuana, methamphetamine, and opioids (10%), and binge drinking and prescription misuse (6%). The prevalence of each of the remaining combinations of substances was 4% or lower (see Appendix A for a complete list of combinations).[8]

[7] Among those who had used one substance in the past 30 days, the most prevalent substance was binge drinking (62%), followed by marijuana use (21%), prescription drug misuse (10%), OTC misuse (3%), opioids (2%), and methamphetamine (2%). None of the respondents in the single-substance use group indicated using another illegal drug.

[8] In terms of individual substances, the most prevalent substance for adult reporting polysubstance use was binge drinking (71%), followed by marijuana use (68%), prescription drug misuse (43%), OTC misuse (29%), methamphetamine (24%), opioids (22%), and other illegal drugs (7%).

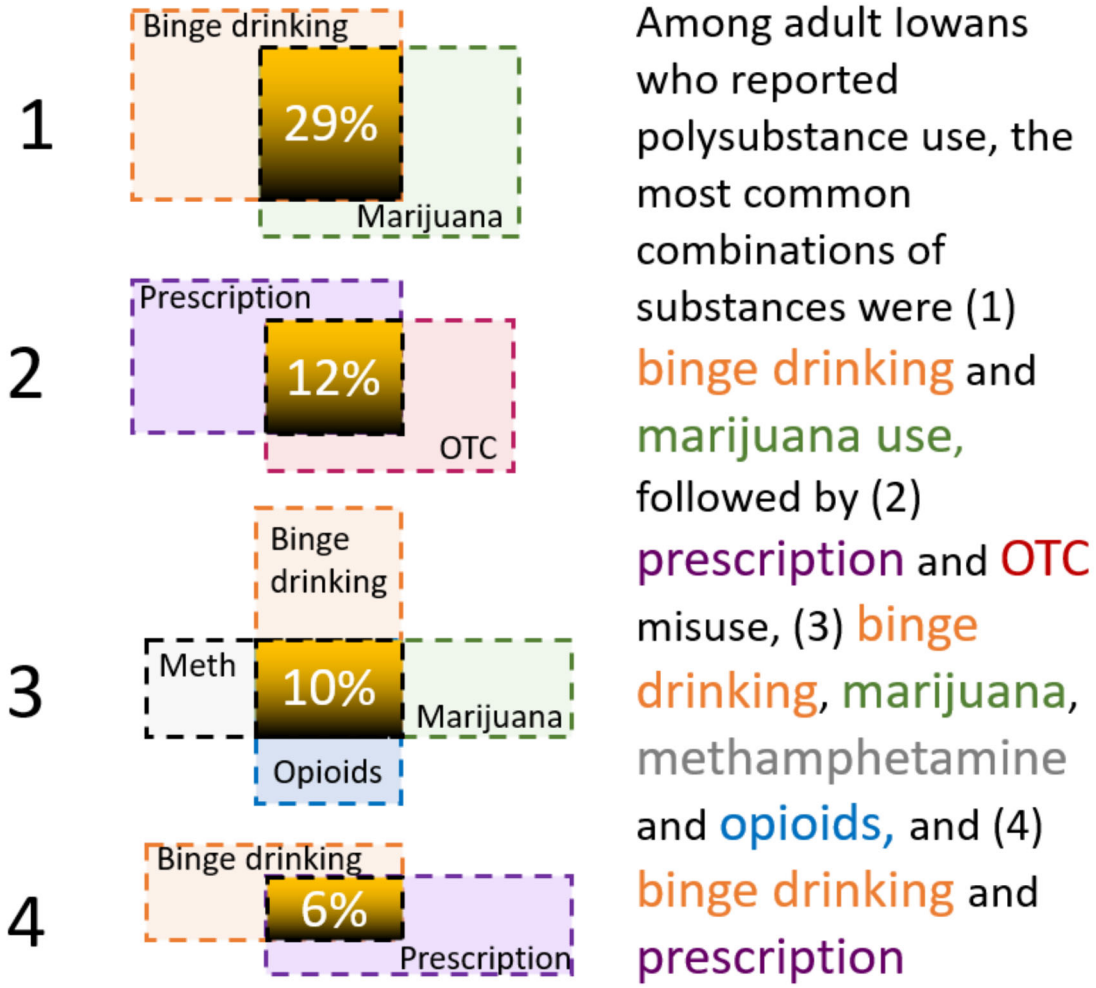

Figure A.5. *Most common polysubstance combinations in the past 30 days*

SECTION B. POLYSUBSTANCE AND DEMOGRAPHICS

In this section, the relationships between polysubstance use and demographic characteristics are examined. The demographic characteristics evaluated included: sex (male or female),[9] age (categorized as 18 to 34; 35 to 54; or 55 and older), race (White, Black, Asian, or other race), ethnicity (Hispanic/Latino or non-Hispanic/Latino), marital status (categorized as married; divorced, widowed, or separated; or never married), sexual orientation (heterosexual; lesbian or gay; bisexual or pansexual), health insurance status (insurance or no insurance), household annual income (categorized as less than $50K; $50K to less than $100K; or $100K or more), location of residence (categorized as rural, town, or urban), and education level attained (categorized as grade 12, GED, or lower than grade 12; some college or an associate degree; or bachelor degree or higher).

Results are presented only for the demographic characteristics that were found to be significantly related to polysubstance use at the .05 significance level. These included sex, age, ethnicity, marital status, sexual orientation, health insurance, and education level attained. There was not a significant difference in polysubstance use by race,[10] household annual income,[11] or location of residence (results not shown).

---

[9] We asked both sex (male/female) and gender identity. Polysubstance use was not examined in relation to gender identity given that only a small number of respondents (n=30 representing only 0.8% of the sample) identified as one of the following other than man or woman: non-binary/non-conforming, gender queer, transgender man (female-to-male), transgender woman (male-to-female), another gender identity, or two or more gender identities.

[10] For race, only 3% of the sample was Black, 2% Asian, and 2% other race.

[11] When an alternative annual household income grouping was examined: <$35K, $35K to less than $100K, vs. $100K or more, there was an overall significant association between annual household income and polysubstance group with Iowa adults earning < $35K (14%) being significantly more likely to be report polysubstance use than those earning $35K to less than $100K (8%). However, the percentage of polysubstance use for both the lower- and middle-income groups were not significantly different from those with $100K or more (the higher-income group; 10%), and there were no differences in the percentage of single substance use among the three income groups (percentages of single-substance use ranged from 21% to 23% across these three income groups).

POLYSUBSTANCE AND SEX

Males were not only more likely to have used a single substance than were females (27% vs. 19%, respectively), but they were also more likely than females to have used multiple substances in the past 30 days (13% vs. 7%; Figure B.1). The sample was comprised of 47% males and 53% females.

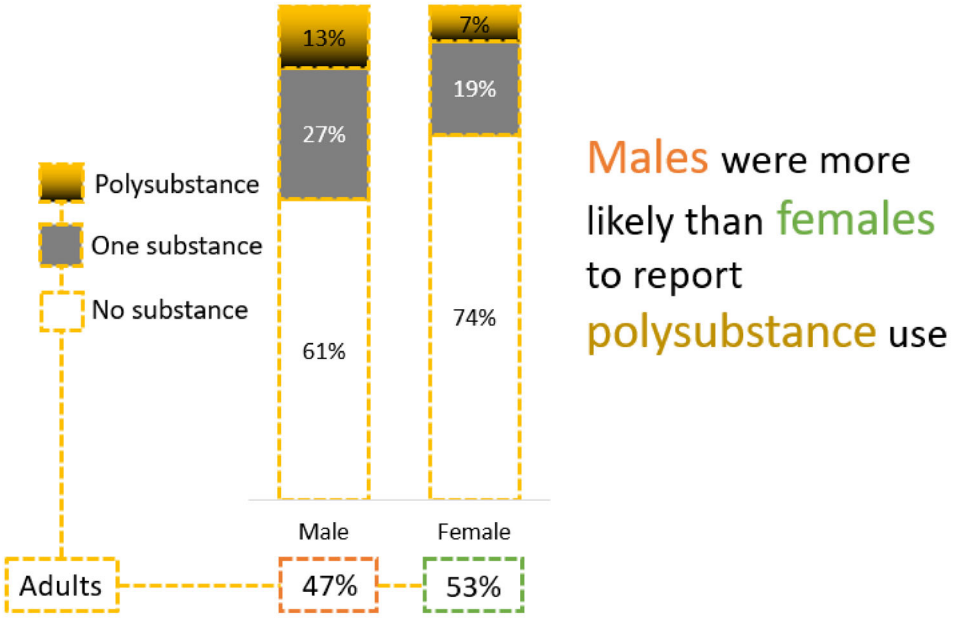

Figure B.1. *Polysubstance use by sex*

POLYSUBSTANCE AND AGE

When comparing polysubstance use by age group, Iowa adults aged 18 to 34 years old (17%) were more than 4 times as likely to have used multiple substances than Iowa adults aged 55 years and older (4%), and those aged 35 to 54 years old (11%) were nearly 3 times as likely to have used multiple substances as older adults aged 55 and older (Figure B.2). Additionally, younger adults aged 18 to 34 years (32%) were significantly more likely than the older age group to have used a single substance (55+ years: 14%); there was not a significant difference in the use of a single substance between respondents aged 18 to 34 years old and those aged 35 to 54 years old (26%). The sample was comprised of 27% adult Iowans aged 18 to 34 years old, 32% aged 35 to 54 years old, and 41% aged 55 years and older.

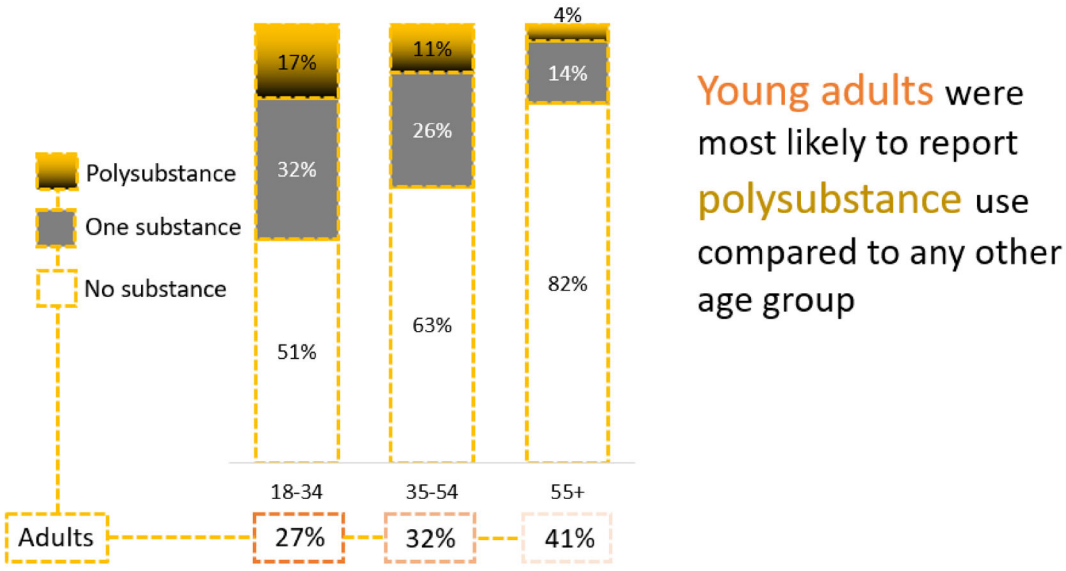

Figure B.2. *Polysubstance use by age group*

POLYSUBSTANCE AND ETHNICITY

Hispanic/Latino adults (25%) were nearly 3 times as likely as non-Hispanic/Latino adults to report polysubstance use (Figure B.3). In contrast, there was no difference in the percentage reporting use of one substance between the two ethnicity groups. Only 5% of respondents reported their ethnicity as Hispanic/Latino.

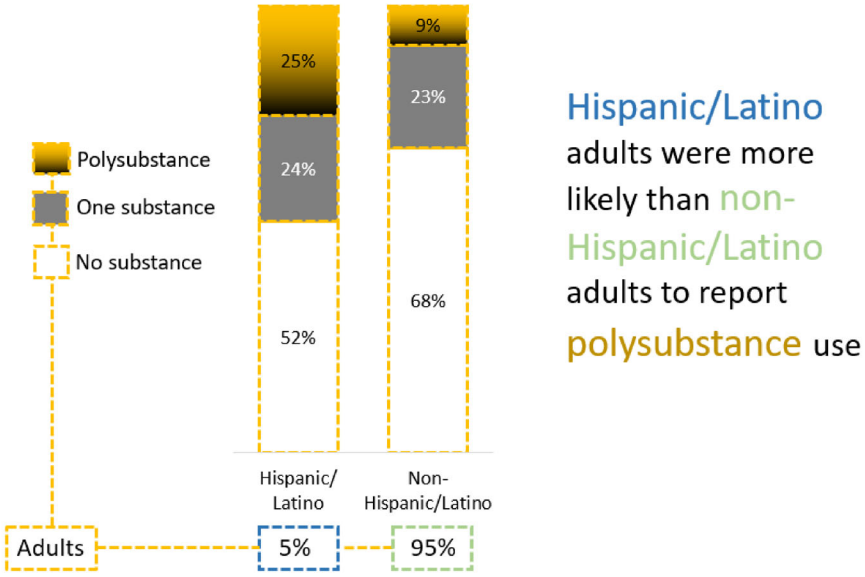

Figure B.3. *Polysubstance use by ethnicity*

POLYSUBSTANCE AND MARITAL STATUS

As illustrated in Figure B.4, a greater percentage of respondents who reported never having been married used a single substance (30%) or multiple substances (16%) in the past 30 days compared to those who were married or those who were divorced, widowed, or separated (one substance: 20% to 21%, polysubstance: 7% to 8%). More than half (55%) of the respondents were married, 19% were divorced, widowed, or separated, and 26% were never married.

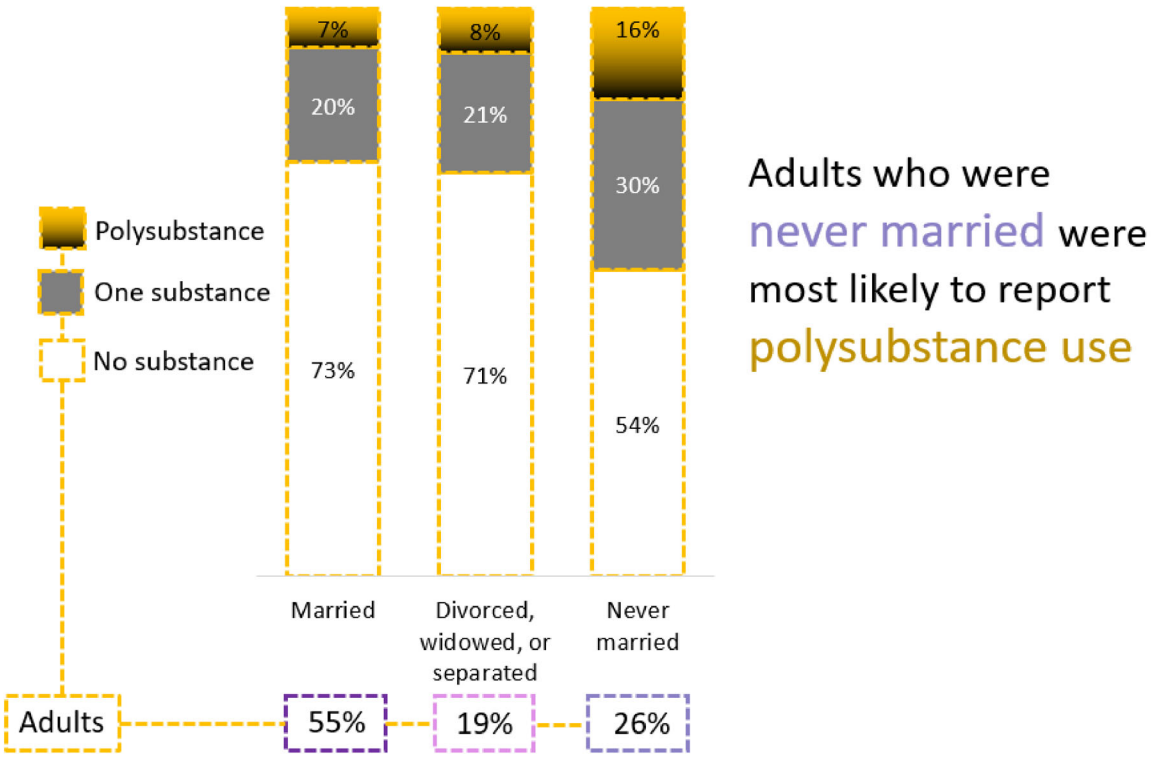

Figure B.4. *Polysubstance use by marital status*

POLYSUBSTANCE AND SEXUAL ORIENTATION

Iowa adults who identified as bisexual or pansexual (33%) were not only more likely to have used a single substance than respondents who identified as heterosexual (22%), but they were also more likely to have used multiple substances in the past 30 days (19% vs. 9%, respectively; Figure B.5). Polysubstance use for lesbian or gay adult Iowans was not significantly different from either of the other two groups (heterosexual or bisexual or pansexual). This latter finding could be due to the small sample size given that only 5% of respondents identified as bisexual or pansexual, and 2% identified as lesbian or gay.

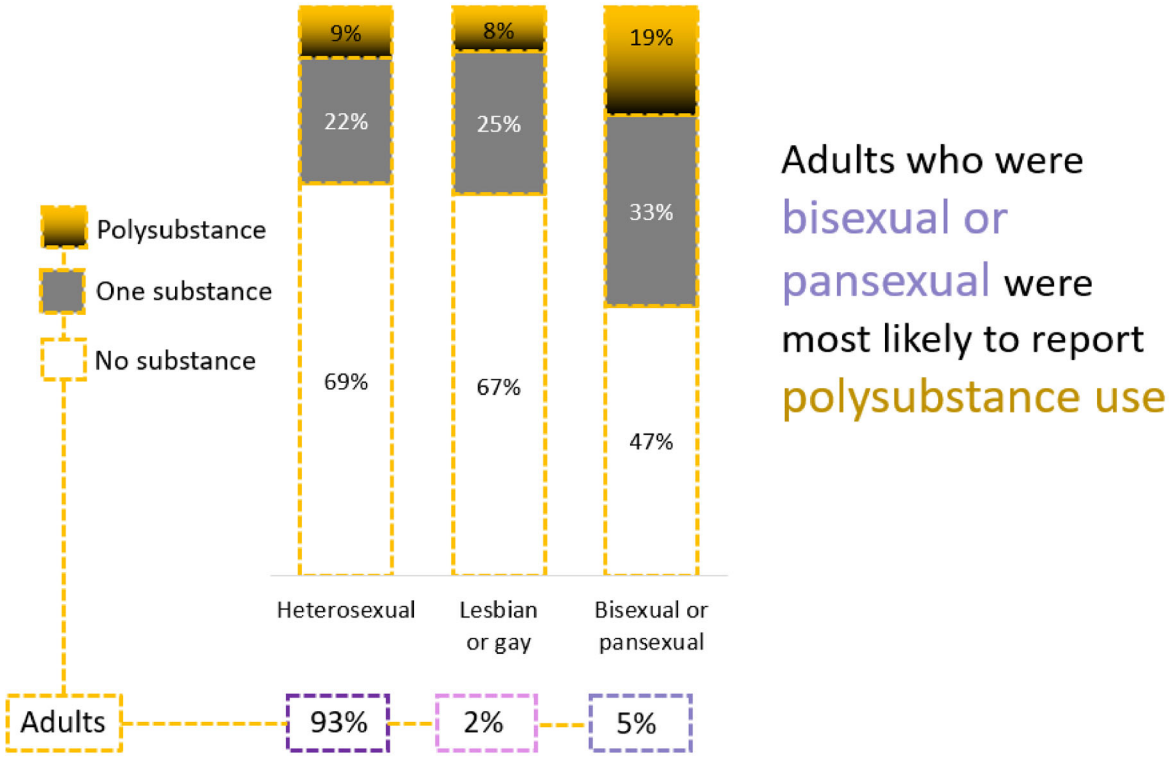

Figure B.5. *Polysubstance use by sexual orientation*

POLYSUBSTANCE AND HEALTH INSURANCE STATUS

Iowa adults who indicated that they were not covered by any kind of health insurance were more than 4 times as likely to have used multiple substances (34%) than those who indicated that they were covered by some kind of health insurance (8%; Figure B.6). The percentage who reported using a single substance was similar between the two health insurance status groups (22% to 23%). Only 5% of Iowa adults indicated that they did not have health insurance.

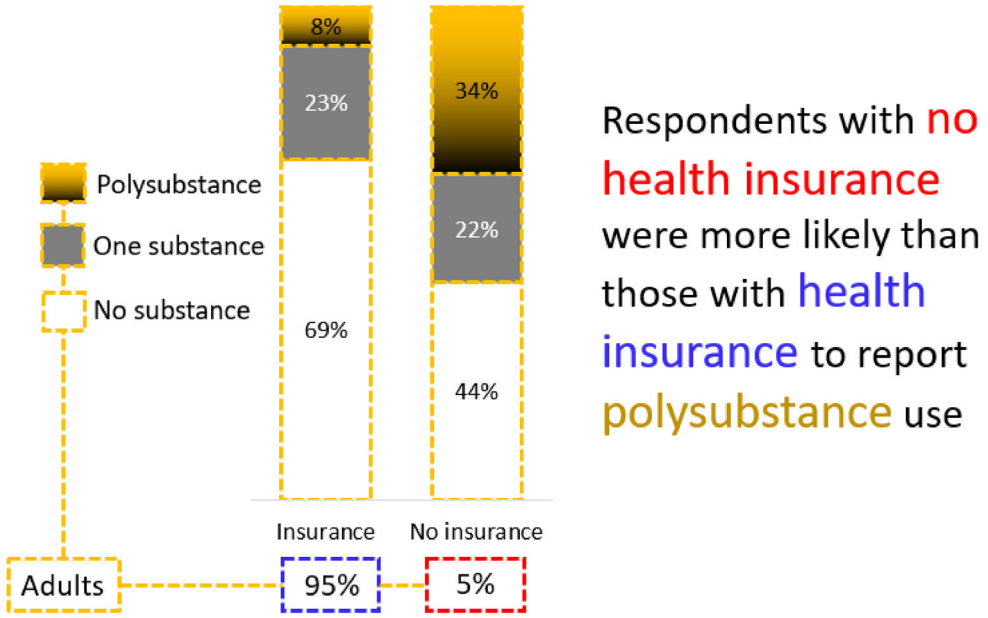

Figure B.6. *Polysubstance use by health insurance status*

POLYSUBSTANCE AND EDUCATION LEVEL

When comparing polysubstance use by education level, Iowa adults who completed high school or a GED or less were more likely than those with higher education levels to indicate that they had used multiple substances. More specifically, 15% of participants who completed high school or a GED or less had used multiple substances in the past 30 days (Figure B.7). In comparison, 9% of those with some college experience or who earned an associate's degree and 6% of participants who graduated with a 4-year college degree used multiple substances. Each education level category consisted of roughly a third of the sample.

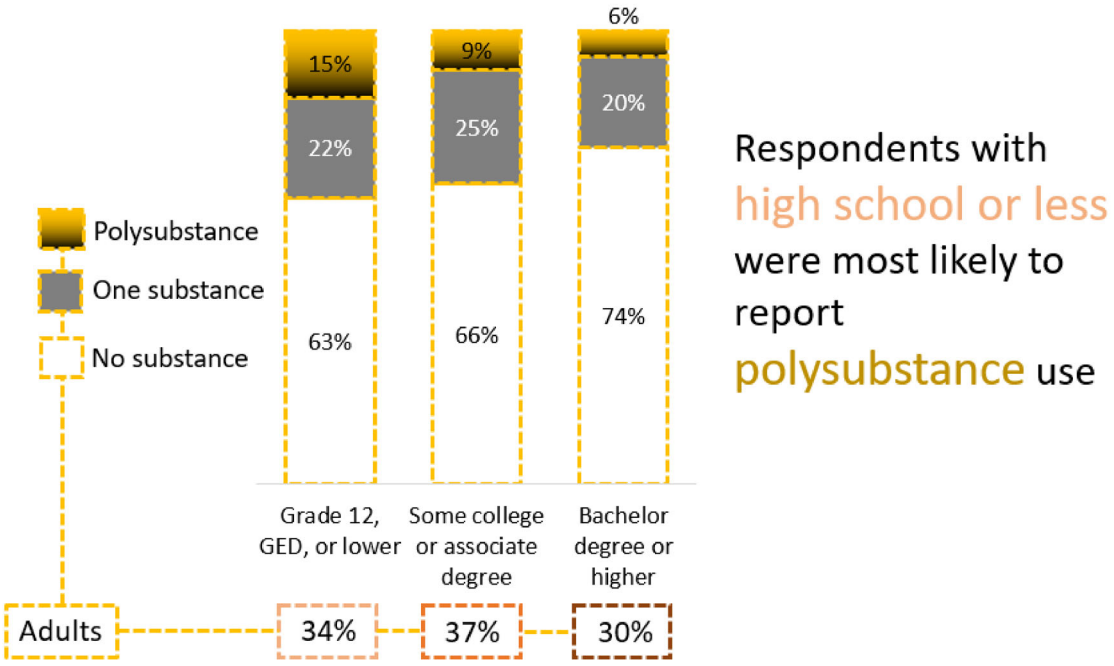

Figure B.7. *Polysubstance use by education level*

SECTION C. POLYSUBSTANCE AND OTHER FACTORS

In this section, the relationships between polysubstance use and other participant attributes related to their health and wellbeing and gambling behaviors are examined. The additional participant characteristics evaluated included: quality of life scores, mental health, gambling behaviors, awareness of Your Life Iowa (YLI) state helpline, and opinions about public health investments made in substance use prevention, treatment, and harm reduction strategies.

Results are presented only for the attributes that were found to be significantly related to polysubstance use at the .05 significance level. These included: quality of life, mental health, and gambling behaviors. There was not a significant relationship between polysubstance use and awareness of YLI or respondents' attitudes toward public health substance use investments (results not shown).

POLYSUBSTANCE AND QUALITY OF LIFE

Quality of Life (QoL) was measured as the mean value across eight 5-point Likert scale items. For six items, participants were asked how satisfied or dissatisfied they were with regards to the following: the quality of their life, their health, their ability to perform daily activities, their self, their personal relationships, and the conditions of their living place.[12] For the two remaining items, participants were asked about their level of agreement with the statements that they have enough energy for everyday life and that they have enough money to meet their needs.[13] Higher mean scores indicate respondents were more satisfied with their QoL.[14]

The average QoL score for Iowa adults using no substances was at 4.1 on a 5-point scale.[15] In comparison, the average QoL score was significantly lower for those using one substance at 3.8 as well as for those who reported polysubstance use at 3.6.[16]

[12] Response options for these six items ranged from 1=Very dissatisfied to 5=Very satisfied.

[13] Response options for these two items ranged from 1=Strongly disagree to 5=Strongly agree.

[14] The reliability estimate (Cronbach's alpha) for the QoL measure was .90.

[15] The QoL index for the state population was 4.42 (SD=0.62) in a similar survey in the state in 2018. In 2018, a pilot study of the Iowa Gambling Treatment Program (IGTP) patients QoL score was 3.20 (SD=1.15).

[16] There was also a significant difference in the mean QoL scores between Iowa adults using a single substance and those using multiple substances.

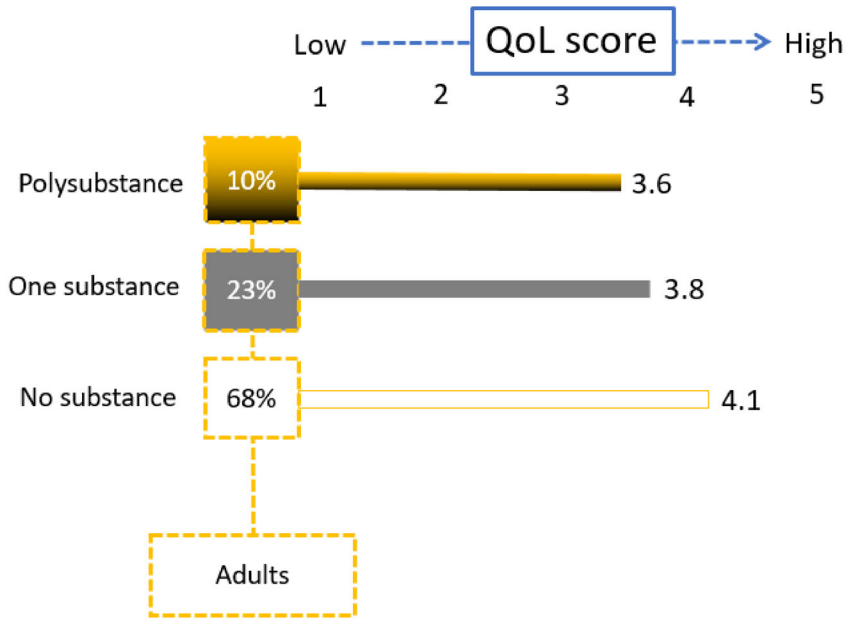

Figure C.1. *Polysubstance use and quality of life score*

POLYSUBSTANCE AND MENTAL HEALTH

Participants were asked about whether they had stopped doing some of their usual activities during the past 30 days because they felt so sad or hopeless; 23% indicated that they had. Participants were also asked whether they had thoughts about killing themselves during the past 30 days; 7% indicated that they had suicidal thoughts.

As shown in Figure C.2, respondents who had experienced feelings of sadness or hopelessness were not only more likely to have used a single substance (31%) but they were also more likely to have used multiple substances in the past 30 days (18%) than those who did not indicate experiencing such feelings (one substance: 20%, polysubstance: 7%).

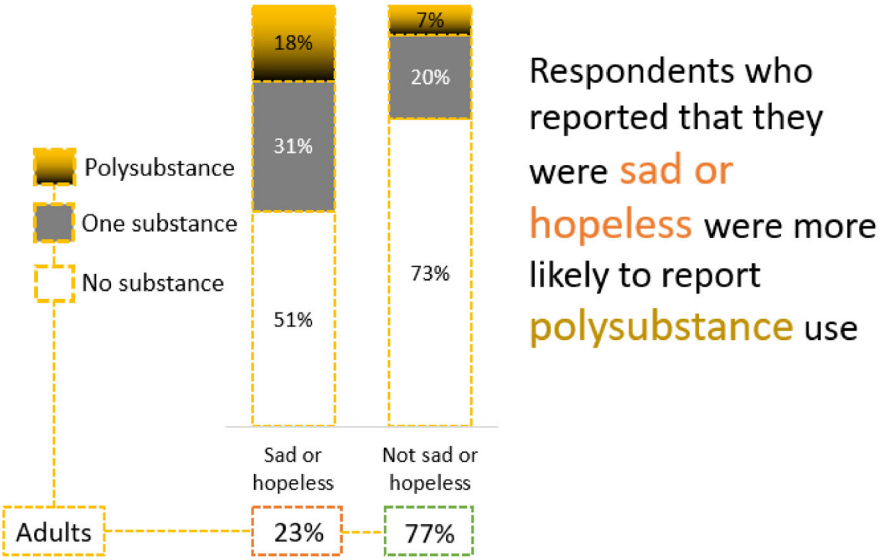

Figure C.2. *Polysubstance use and feelings of sadness or hopelessness*

Additionally, participants experiencing suicidal thoughts were significantly more likely than those who didn't indicate such thoughts to report polysubstance use (28% vs. 8%, respectively). There was not a significant difference between these two groups in the percentage reporting use of a single substance (28% vs. 22%, respectively).

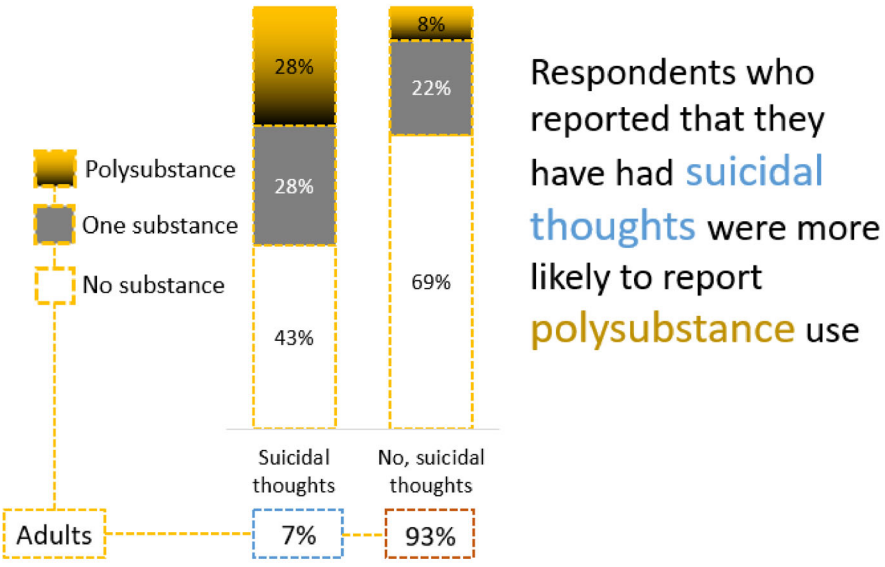

Figure C.3. *Polysubstance use and having thoughts of suicide*

POLYSUBSTANCE AND GAMBLING

Participants were asked about their gambling behaviors in the past 30 days in the following four areas: games in a casino, lottery games, sports wagering, and fantasy sport contests. About one in three Iowa adults (32%) participated in at least one of these gambling behaviors in the past 30 days, while 68% did not participate in any of these gambling behaviors. The most common gambling behavior was participating in lotteries (25%). About one in 20 (6%) of respondents indicated that they had engaged in sports wagering, and 5% in fantasy sports. Respondents were allowed to choose multiple gambling behaviors.

As shown in Figure C.4, non-gamblers were the least likely to have used one substance (20%) or multiple substances (6%) in the past 30 days. In comparison, Iowa adults who engaged in at least one of these gambling behaviors were more likely to report polysubstance use. More specifically, Iowa adults who engaged in sports wagering or fantasy sports were considerably more likely to have used multiple substances (34% vs. 46% respectively) than those who had not participated in any gambling behaviors and have used multiple substances (6%) in the past 30 days.

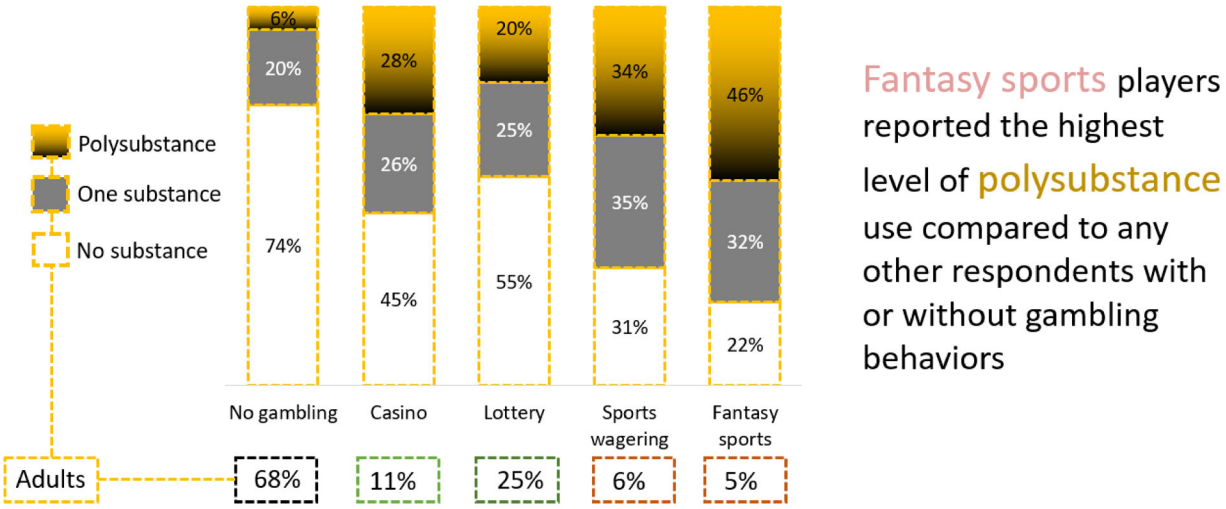

Figure C.4. *Polysubstance use by gambling behaviors*

SECTION D. SUMMARY OF FINDINGS

Using data collected from the 2021 Iowa Health, Wellbeing, Use of Substance, and Gambling Survey, this study investigated the prevalence of polysubstance use among Iowa adults as well as the demographic characteristics and other attitudes and behaviors associated with polysubstance use. It is important to note that polysubstance use does NOT measure use at the same time, but only that more than one substance was used during the course of 30 days.

First, this study found that one in ten Iowa adults (10%) reported polysubstance use behavior in the past 30 days based on inclusion of the following substances: binge drinking (alcohol), marijuana, methamphetamine, opioids, another illegal substance, prescription drugs (in ways other than directed) and OTC medication (in ways other than directed). This represents about 230,000 adult Iowans using multiple substances in the past 30 days. An additional two out of ten (23%), or more than 540,000 adult Iowans, engaged in binge drinking or using one of the other drugs in the past 30 days. Among people who reported polysubstance use, the most common combination of substances was binge drinking and marijuana (29%; Appendix A). Among people who used a single substance, the most common substance was binge drinking (62%) followed by marijuana (21%).

The following demographic characteristics were found to be significantly related to polysubstance use: sex, age group, ethnicity, marital status, sexual orientation, health insurance status, and education. More specifically, males, younger adults, those who have never been married, and those with lower education levels were more apt to engage in polysubstance use. These findings are consistent with those reported in other polysubstance studies (e.g., Compton, Valentino, & DuPont, 2021; McMurray, 2020; Ou et al., 2019) and binge drinking studies (e.g., Kanny, Naimi, Liu, Lu, & Brewer, 2018).

In this study, while there was not a significant association between race and polysubstance use, there was a significant association between ethnicity and polysubstance use. More specifically, Hispanic/Latino adults were found to be more likely to report polysubstance use than non-Hispanic/Latino adults. In the literature, the findings for race and ethnicity in relation to polysubstance use have been mixed. For example, Evans, Grella, Washington, and Upchurch (2017) reported greater polysubstance use among Hispanics than non-Hispanic whites with African Americans being significantly more likely than either of these two groups to engage in polysubstance use. Other studies (e.g., McMurray, 2020) have found no association between race/ethnicity and polysubstance use.

Results from the current study also suggest that Iowa adults who identified as bisexual or pansexual were twice as likely to report polysubstance use as those who identified as heterosexual. In a review of the evidence available on lesbian, gay, and bisexual (LGB) substance

use in comparison to those who identified as heterosexual, Green and Feinstein (2012) indicated that the association between bisexual identity and increased substance use has been reported in multiple studies. In their same review, the authors suggested that increased substance use among those who identify as lesbian or gay has been mixed with some studies showing increased use and others showing no difference. In the current study, polysubstance use for lesbian or gay adult Iowans was not significantly different from those who identified as heterosexual or those who identified as bisexual or pansexual. This finding could be due to a lack of statistical power since only 5% of respondents identified as bisexual or pansexual and 2% identified as lesbian or gay.

In this study, there was not a significant difference in polysubstance use among socioeconomic status groups defined by annual household income, though when results were examined by health insurance status, those without health insurance were estimated to be 4 times as likely to report polysubstance use as those with health insurance. Among the more recent polysubstance studies reviewed (see References section), none examined the relationship between annual household income and polysubstance use. However, other studies on risky alcohol use (e.g., Collins, 2016; Kanny et al., 2018; Roche, Lee, Battams, Fischer, Cameron, & McEntee, 2015) have found lower annual household incomes to be associated with binge drinking.

This study also found polysubstance use to be significantly related to other participant attitudes and behaviors related to their health and wellbeing. More specifically, adult Iowans who reported polysubstance use tended to have significantly lower QoL scores on average than people who used a single substance, and both of these groups had lower QoL scores than the no substance use group. Additionally, respondents who reported that they stopped doing some of their usual activities during the past 30 days because they felt so sad or hopeless were twice as likely to engage in polysubstance use as those who did not have such feelings of sadness or hopelessness. Moreover, this study found that adults who had thoughts about killing themselves were more likely than those without such thoughts to report polysubstance use. These latter findings are consistent with results from other polysubstance studies. For example, two recent polysubstance studies (e.g., McMurray, 2020; Ou et al., 2019) found having mental health concerns to be a significant predictor of polysubstance use.

Iowa adults who engaged in gambling behaviors were also found to be more likely to engage in polysubstance use, especially for those engaged in sports wagering or fantasy sports. Although studies focused on fantasy sports and sports betting are limited in the literature, due to these

being relatively new legal gambling activities in many states[17], the finding of an association between gambling and polysubstance use aligns with those reported in other general gambling behavior studies. For example, in their systematical review of studies that focused on characteristics associated with gambling behaviors, Merkouris, Thomas, Shandley, Rodda, Oldenhof, and Dowling (2016) found problem gambling to be associated with higher rates of substance and alcohol use disorders, especially among males.

Although the study provides insights into polysubstance use among adult Iowans, it is important to note that survey research, like all research, has limitations. The possible limitations for the 2021 Iowa Health, Wellbeing, Use of Substance, and Gambling Survey were outlined in the initial report (Park et al., 2022; page 44). In addition, this survey was collected during the second year of the COVID-19 pandemic, and some of the attitudes and behaviors reported in this survey may be linked to experiences during these difficult years. Nevertheless, the findings of the study are consistent with those reported in the literature on polysubstance use and can provide valuable insights into the demographic characteristics and other attitudes and behaviors associated with polysubstance use among Iowa adults. Further studies may be warranted to examine in a multivariate fashion which of these factors are the most relevant in determining polysubstance use.

[17] Murphy, Governor of New Jersey, et al. v. National Collegiate Athletic Assn. et al., Volume No. 16-476, Retrieved from https://www.supremecourt.gov/opinions/17pdf/16-476_dbfi.pdf. See also Volberg, Evans, Zorn, and Williams (2022). Iowa legalized online sports betting in May 2019.

REFERENCES

Cicero, T. J., Ellis, M. S., & Kasper, Z. A. (2020). Polysubstance use: a broader understanding of substance use during the opioid crisis. *American Journal of Public Health*, *110*(2), 244-250.

Collins, S. E. (2016). Associations between socioeconomic factors and alcohol outcomes. *Alcohol Research: Current Reviews*, 38(1), 83-94.

Compton, W. M., Valentino, R. J., & DuPont, R. L. (2021). Polysubstance use in the US opioid crisis. *Molecular Psychiatry, 26*(1), 41-50.

Connor, J. P., Feeney, G. F., Kelly, A. B., & Saunders, J. B. (2017). Polysubstance use. In K. Wolff, J. White, & S. Karch (Eds.), *The SAGE Handbook of Drug and Alcohol Studies: Biological Approaches*. (pp. 283-305). California: Sage Publications.

Evans, E. A., Grella, C. E., Washington, D. L., & Upchurch, D. M. (2017). Gender and race/ethnic differences in the persistence of alcohol, drug, and poly-substance use disorders. *Drug and Alcohol Dependence*, *174*, 128-136.

Green, K. E., & Feinstein, B. A. (2012). Substance use in lesbian, gay, and bisexual populations: an update on empirical research and implications for treatment. *Psychology of Addictive Behaviors, 26*(2), 265-278.

Kanny, D., Naimi, T. S., Liu, Y., Lu, H., & Brewer, R. D. (2018). Annual total binge drinks consumed by US adults, 2015. *American Journal of Preventive Medicine, 54*(4), 486-496.

Lorvick, J., Browne, E. N., Lambdin, B. H., & Comfort, M. (2018). Polydrug use patterns, risk behavior and unmet healthcare need in a community-based sample of women who use cocaine, heroin or methamphetamine. *Addictive Behaviors*, *85*, 94-99.

McMurray, D. E. (2020). Risk factors for polysubstance abuse: A national secondary data analysis study (Doctoral dissertation, Walden University).

Merkouris, S. S., Thomas, A. C., Shandley, K. A., Rodda, S. N., Oldenhof, E., & Dowling, N. A. (2016). An update on gender differences in the characteristics associated with problem gambling: A systematic review. *Current Addiction Reports, 3*(3), 254-267.

Ou, T. S., Hu, Y. H., Lin, H. C., & Wong, S. W. (2019). Patterns and determinants of polysubstance use among retired population in a US nationally representative sample. *Innovation in Aging, 3*(Suppl 1), S693.

Park, K., Radunzel, J., Endres, K., & Losch, M.E. (2022). *2021 Iowa Health, Wellbeing, Use of Substances and Gambling Survey*. Cedar Falls, IA: Center for Social and Behavioral Research, University of Northern Iowa.

Roche, A. M., Lee, N. K., Battams, S., Fischer, J. A., Cameron, J., & McEntee, A. (2015). Alcohol use among workers in male-dominated industries: A systematic review of risk factors. *Safety Science, 78*, 124-141.

Volberg, R.A., Evans, V., Zorn, M., Williams, R.J. (2022*). Legalized Sports Betting in the United States and Potential Impacts in Massachusetts*. Amherst, MA: School of Public Health and Health Sciences, University of Massachusetts Amherst.

APPENDIX A. POLYSUBSTANCE COMBINATIONS IN PAST 30 DAYS

Rank	Polysubstance combination[1]	N[2]	%[3]
1	BNGE/MARJ/	98	29.1%
2	PRES/OTCM/	42	12.3%
3	BNGE/MARJ/METH/OPID/	16	9.8%
4	BNGE/PRES/	19	6.0%
	BNGE/MARJ/METH/	6	2.3%
	BNGE/MARJ/METH/OILG/OTCM/	1	0.5%
	BNGE/MARJ/METH/OPID/OILG/	1	0.7%
	BNGE/MARJ/METH/OPID/OILG/PRES/OTCM/	1	0.2%
	BNGE/MARJ/METH/OPID/OTCM/	1	0.2%
	BNGE/MARJ/METH/OPID/PRES/OTCM/	2	0.3%
	BNGE/MARJ/METH/OTCM/	1	0.1%
	BNGE/MARJ/METH/PRES/OTCM/	2	0.3%
	BNGE/MARJ/OILG/	6	2.2%
	BNGE/MARJ/OILG/OTCM/	1	0.1%
	BNGE/MARJ/OPID/	2	0.7%
	BNGE/MARJ/OPID/OILG/PRES/	1	0.5%
	BNGE/MARJ/OPID/PRES/	3	2.0%
	BNGE/MARJ/OPID/PRES/OTCM/	1	0.9%
	BNGE/MARJ/PRES/	6	2.9%
	BNGE/MARJ/PRES/OTCM/	2	0.5%
	BNGE/METH/	2	0.6%
	BNGE/METH/OPID/OTCM/	1	0.9%
	BNGE/METH/OPID/PRES/	1	0.9%
	BNGE/METH/OTCM/	1	0.0%
	BNGE/OILG/	2	1.0%
	BNGE/OPID/	2	0.3%
	BNGE/OTCM/	12	3.7%
	BNGE/PRES/OTCM/	12	4.1%
	MARJ/METH/	14	3.2%
	MARJ/METH/OILG/	2	0.4%
	MARJ/METH/OPID/	1	0.1%
	MARJ/METH/OPID/OILG/	1	0.3%
	MARJ/METH/OPID/OILG/PRES/	1	0.1%
	MARJ/METH/OPID/OTCM/	1	0.1%
	MARJ/METH/OPID/PRES/	2	1.1%
	MARJ/METH/PRES/	4	1.0%

Rank	Polysubstance combination[1]	N[2]	%[3]
	MARJ/METH/PRES/OTCM/	2	0.8%
	MARJ/OILG/	1	0.1%
	MARJ/OPID/	6	0.5%
	MARJ/OPID/PRES/	2	0.5%
	MARJ/OTCM/	2	0.4%
	MARJ/PRES/	15	3.5%
	MARJ/PRES/OTCM/	7	2.1%
	METH/OILG/PRES/OTCM/	1	0.0%
	METH/PRES/OTCM/	3	0.3%
	OPID/PRES/	4	1.2%
	OPID/PRES/OTCM/	1	0.9%
	Total	315	100.0%

[1]BNGE for binge drank; MARJ for marijuana use; METH for methamphetamine use, OPID for opioid use, OILG for other illegal drug use, PRES for prescription misuse, and OTCM for OTC medication misuse.
[2] Unweighted counts.
[3] Weighted percentages.