# Prevalence and Predictors of Maternal Alcohol Consumption in Two Regions of Ukraine

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## Abstract

**Background**—Fetal Alcohol Spectrum Disorders (FASD) are thought to be a leading cause of developmental disabilities worldwide. However, data are lacking on alcohol use among pregnant women in many countries.. The purpose of this study was to evaluate the prevalence and predictors of alcohol consumption by pregnant women in Ukraine.

**Methods**—Cross sectional screening of pregnant women was conducted in two regions of Ukraine during the recruitment phase of an ongoing clinical study that is part of the Collaborative Initiative on Fetal Alcohol Spectrum Disorders (CIFASD). Women attending a routine prenatal visit at one of two participating regional centers were asked about alcohol consumption. Quantity and frequency of alcoholic beverages consumed in the month around conception and in the most recent month of pregnancy were measured using a standard interview instrument.

**Results**—Between 2007 and 2012, 11,909 pregnant women were screened on average in the second trimester of pregnancy. Of these, 92.7% reported being ever-drinkers. Among ever-drinkers, 54.8% reported drinking alcohol in the month around conception, and 12.9% consumed at least three drinks on at least one day in that time period. In the most recent month of pregnancy, 46.3% continued to report alcohol use and 9.2% consumed at least three drinks per day. Significant predictors of average number of drinks or heavier drinking per day in either time period in pregnancy included lower gravidity, being single, unmarried/living with a partner, or separated, lower maternal education, smoking, younger age at initiation of drinking and higher score on the TWEAK screening test for harmful drinking.

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**Conclusions**—These findings support the need for education/intervention in women of childbearing age in Ukraine, and can help inform targeted interventions for women at risk of an alcohol exposed pregnancy. The initiation of a standard screening protocol in pregnancy is a step in the right direction.

## Keywords

alcohol; pregnancy; Ukraine; prevalence; epidemiology

## Introduction

For well over 30 years, the Fetal Alcohol Syndrome (FAS) and now Fetal Alcohol Spectrum Disorders (FASD) have been recognized as one of the leading causes of developmental disabilities (Jones et al., 1973). FASD is completely preventable if a pregnant woman avoids alcohol throughout pregnancy. However, the prevalence, patterns and predictors of maternal alcohol consumption in many parts of the world are largely unknown, leading to missed opportunities for public health intervention and prevention (May and Gossage, 2001).

The riskiest pattern of alcohol consumption in pregnancy is thought to be heavy episodic or binge drinking, i.e., four or more drinks per occasion rather than more frequent daily alcohol consumption at lower quantities (Sokol et al., 1986; May et al., 2004).

In addition, a number of maternal predictors of alcohol consumption in pregnancy and of alcohol-related birth outcomes have been identified in various study populations, some of which are common across groups and some of which differ by setting. These include low socioeconomic status, race/ethnicity, tobacco use, fewer years of education, older maternal age, rural residence, higher gravidity and parity, and being unmarried (Abel and Hannigan, 1995; Day et al., 1993; May et al., 2005, 2008, 2011; Viljoen et al., 2002).

In settings where the drinking culture is widespread, is comprised of heavy episodic consumption, and suspected maternal risk factors are common, the concern for FASD might be great. Based on overall per capita consumption of alcohol, Ukraine is one such country (Popova et al, 2007). The prevalence of heavy episodic consumption among women in Eastern European countries has been estimated in some studies to be relatively rare (Pomerleau et al, 2008; Hinote et al, 2009). However, few data have been published on the prevalence, pattern, or predictors of alcohol use among women of reproductive age or pregnant women in any Eastern European countries. Recently, Balachova et al. (2012) reported that among 648 non-pregnant Russian women, 89% consumed alcohol in the last three months and 65% reported drinking in a heavy episodic or binge pattern.

The purpose of this study was to evaluate the prevalence and pattern of alcohol consumption in pregnancy as reported by women in Ukraine, and to describe maternal predictors of potentially harmful alcohol consumption to help inform future intervention and prevention strategies in this setting.

## Materials and Methods

### Study design and sampling

The present study represents a cross-sectional analysis of the screening phase of an ongoing prospective cohort study that was conducted among a sample of pregnant women in Ukraine as part of the Collaborative Initiative on Fetal Alcohol Spectrum Disorders (CIFASD). The CIFASD is supported by the National Institute on Alcohol Abuse and Alcoholism and is a multidisciplinary initiative conducted in several countries throughout the world (www.CIFASD.org). The primary goals of the CIFASD are to better characterize the spectrum of physical and neurodevelopmental outcomes resulting from prenatal alcohol exposure and to develop better diagnostic, prevention and treatment approaches for FASD. The methods and scope of CIFASD studies have been described elsewhere (Arenson et al. 2010; Mattson et al., 2010).

In order to identify women eligible for recruitment into the longitudinal cohort study in Ukraine, two centralized prenatal care facilities in two regions (oblasts) in the western area of Ukraine were selected for screening women about their alcohol consumption. All women who came in for a routine prenatal visit to one of the two centers were eligible to be screened with a standard, brief set of questions on alcohol consumption, other exposures, demographics and pregnancy history. The screening process was incorporated into routine practice at both sites and was conducted in person by a specially trained study nurse during her regularly scheduled work shift. Data from the screener were identified by an identification number only and no personal identifiers were retained. Women who agreed to be screened were offered information on the risks of alcohol consumption in pregnancy.

The present analysis was conducted using cross-sectional data obtained from those screened at the two participating sites between 2007 and 2012. The overall study was approved by the institutional review boards at the University of California San Diego and Lviv Medical University in Ukraine.

### Measures

The screening instrument was administered by the study nurse, using a paper-based set of 17 questions on maternal demographics, pregnancy history, tobacco and illicit drug use and current use of any medications. For women who reported being ever drinkers in their lifetime, the interview also included eight questions on the quantity and frequency of alcohol use, four of which were focused on the month around conception and four referring to the most recent month of pregnancy. Women were asked to recall the number of days they had 1 or 2 drinks, 3 or 4 drinks, or 5 or more drinks during the relevant time period, and if they drank smaller amounts on a daily basis. The alcohol questions were based on a previously validated questionnaire developed by Barr and Streissguth (2001) to identify risky drinkers in pregnancy. Quantity and frequency of alcohol consumption in responses to these questions was summarized in two ways. The first summary measure was the average number of drinks per day over the month for which the mother was reporting as a reflection of the overall quantity of alcohol consumed. The second summary measure was the average number of drinks for only the days in which the mother reported any alcohol consumed

(average drinks per drinking day), as a reflection of heavier episodic or binge drinking during the time period covered by the maternal report.

In addition to the quantity and frequency questions, women were also asked to respond to seven standard screening questions for risky drinking that comprise the CAGE, the TWEAK and the T-ACE (Russell et al, 1996). Using the scoring systems established for these measures, one point each was assigned for desire to cut down on drinking (Cut Down Question; CAGE, TWEAK, T-ACE); the need for an "eye opener" (Eye-Opener Question; CAGE, TWEAK, T-ACE); feeling annoyed by other's criticism of the respondent's drinking (Annoy Question; CAGE, T-ACE); inability to remember activities after a drinking episode (Amnesia Question; TWEAK); guilt regarding drinking (Guilty Question; CAGE). Two points were assigned on the TWEAK for a positive answer to the question that others are concerned about the respondent's drinking (Worry Question). Finally, women were asked about tolerance for alcohol, using the "hold" version of this question defined as number of drinks the mother could usually drink on an occasion before passing out, falling asleep or becoming too sick to continue. The question was asked in this version after consultation with the research collaborators in Ukraine who determined this version was more likely to be understood by women in their setting. A response of six or more drinks to this question resulted in two points on the TWEAK and the T-ACE.

### Statistical Analysis

Demographic, pregnancy history, and alcohol consumption variables were described using frequencies and percentages for categorical variables and means with standard deviations for continuous measures. To evaluate predictors of alcohol consumption in pregnancy, four separate models were constructed using the subset of the sample who reported being "ever-drinkers": two models for the amount of alcohol consumed in the month around conception (drinks per day and drinks per drinking day) and two models for the amount of alcohol consumed in the most recent month of pregnancy (drinks per day and drinks per drinking day). The summary measure of alcohol consumed in each model was constructed by summing the total number of drinks consumed per occasion multiplied by the total number of occasions, and dividing by the time period of interest, i.e., for drinks per day, the sum was divided by 30 days and for drinks per drinking day, the sum was divided by the number of occasions the mother reported drinking during that 30 day period.

The quantity of alcohol per occasion categories on the questionnaire were: 1 or 2 drinks, 3 or 4 drinks, and 5 or more drinks. Therefore, women who reported drinking 1 or 2 drinks on an occasion were counted as consuming a quantity at the midpoint of the range (i.e.,1.5). Similarly, women who reported drinking 3 or 4 drinks per occasion were counted as having consumed a quantity at the midpoint of the range (i.e., 3.5). In addition, the category of 5 or more drinks created right censoring in the data, as the upper end of the range in that category was unknown. Therefore, instead of fitting an ordinary linear regression model, an accelerated failure time (AFT) model was employed which is also a linear model of the regression effects but can accommodate right censoring (Allison, 1995). To fit the AFT models, the summary alcohol outcome measures were log transformed. Therefore, the estimates of association cannot be directly interpreted relative to a specific number of drinks

consumed, but the relative magnitude and direction of the effects as well as statistical significance are interpreted in a straightforward manner.

Selection of covariates for the multivariate models was performed using a stepwise procedure. Twenty-two covariates were considered for the models: site, maternal age, paternal age, the difference between maternal age and paternal age, gestational age at screening, gravidity, parity, previous spontaneous abortion, previous still birth, previous elective termination, marital status, maternal education, age when first began consuming alcohol, current smoking status, taking any medication regularly, taking specifically named supplements: folic acid, any other single vitamin, a multivitamin, or iodine supplements, TWEAK, T-ACE, and CAGE overall scores.

We first fitted univariate AFT models for each of the 22 covariates, and selected those covariates that predicted the outcome with a p-value cutoff of 0.20 or less. Because there is substantial overlap in the questions that comprise the three screening tools for harmful drinking, the TWEAK, CAGE and T-ACE, we built separate prediction models using only one measure in each model, and compared them using the $R^2$ measure of explained variation. The $R^2$ was calculated using the following formula:

$$R^2 = 1 - \frac{\sigma^2}{Var(b'X) + \sigma^2}$$

where $\sigma^2$ is the squared scale parameter in the AFT model, b is the vector of estimated regression parameters, and X is the vector of covariates. The variance in the formula was the sample variance of $b'X$ from the data. The above formula is applicable to right censored data as it replaces the variance of the censored (transformed) outcome with the denominator in the above (Xu, 2003).

Separate multivariate prediction models each containing only one summary score from a screening tool for harmful drinking, the TWEAK, CAGE or T-ACE, were fitted using other covariates identified from the univariate selection process, and a backward selection procedure was employed with a p-value cut-off of 0.10. We further examined the contribution of the addition of the selected covariates to these models by computing the $R^2$ using the same formula above. All analyses were conducted using SAS Enterprise Guide Version 4.2.

## Results

Between 2007 and 2012, 11,909 women were screened, 7,327 at the site in Rivne Oblast, and 4,582 at the site in the Khmelnytsky Oblast. Over the study period, due to staffing constraints associated with one study nurse assigned to perform the screening at each site, this sample represents approximately 25% of the total number of women referred to these Centers for prenatal care. As shown in Table 1, more than three-quarters of women in the sample were 21 to 34 years of age, were screened in the second trimester of pregnancy, were married living with their spouse, and had at least a high school education. A small

proportion (4.1%) reported current tobacco use, and almost no women (<1%) reported any illicit drug use.

Almost all women (92.7%) reported consuming alcohol at some point in their lives (Table 1), and among ever-drinkers, most (93.2%) started to drink alcohol at or before 18 years of age (Table 2). Over one half of ever-drinkers (52.2%) reported they could "hold" 3 or more drinks on an occasion. Only a small proportion – approximately 10% - scored "positive" with two points or more on the TWEAK or the T-ACE instruments, and less than 1% scored positive on the CAGE – the only instrument of the three that does not include a question on tolerance (Table 2).

Almost no women reported daily drinking. Instead, the most frequent pattern was episodic drinking. In the month around conception, 54.8% of women reported some alcohol, 12.9% of women reported drinking at least 3 drinks on at least one occasion, and 3.7% of women reported drinking 5 or more drinks at least one time in that month. When asked about the most recent month of pregnancy, slightly fewer women reported the same patterns: 9.2% consumed at least 3 drinks on at least one occasion, and 3.3% consumed at least 5 drinks on at least one occasion. However, it was notable that approximately 46.3% of women were continuing to drink at least some alcohol at that stage of pregnancy (Table 2).

The ability of predictive models (as described in statistical methods) to explain the variation in alcohol consumption differed by the specific summary measure of quantity and frequency of alcohol and the window of time relative to pregnancy. As shown in Table 3, overall, the models examined were able to explain a higher proportion of the variance in drinks per day than in drinks per drinking day both in the month around conception period and the most recent month within pregnancy. Single component questions from the TWEAK, T-ACE or CAGE were generally poor in explaining variance in alcohol consumption, whereas the "hold" question alone performed nearly as well or better than any other models (Table 3). The model containing the TWEAK score plus other covariates explained the highest proportion of the variance among all of the models that were compared: 33.6% – 37.6% of the variance in drinks per day, and 12.2% – 21.7% of the variance in drinks per drinking day (Table 3).

The predictive models containing the TWEAK score plus other covariates are shown in Tables 4 and 5. Number of drinks per day consumed around the time of conception was associated with lower gravidity, lower number of previous spontaneous abortions, having had two or more previous stillbirths, marital status (single, not married but living with partner or separated), lower education, smoking, no maternal use of any medications on a regular basis, earlier age started drinking, and higher TWEAK score (Table 4). Similar risk factors were identified for drinks per drinking day in the period around conception, including lower gravidity, marital status, smoking, no maternal use of any medications on a regular basis, younger age started drinking, higher TWEAK score. There were differences between sites on these measures (Table 4).

For the most recent month in pregnancy (Table 5), lower gravidity, higher parity, previous elective termination, later gestational age at screening, marital status (single, not married but

living with partner, or separated), lower education, smoking, younger age started drinking, and higher TWEAK score were associated with more drinks per day. Similar factors were associated with drinks per drinking day in this time period in pregnancy. Folic acid supplementation was inversely associated with drinks per drinking day, and there were differences between sites (Table 5). There was little variation in alcohol consumption patterns over the five-year period of this analysis (data not shown).

## Discussion

Using a standard screening questionnaire integrated into routine prenatal care at two large referral facilities in two separate regions of Western Ukraine, the prevalence of alcohol consumption prior to and within pregnancy was estimated for a large sample of women. There is a paucity of data available on this important question in Ukraine, and certainly for many countries throughout the world. Our findings suggest that as in other obstetric settings, screening for alcohol use can identify pregnant women who might benefit from an intervention (Balachova et al., 2013).

In 2001, Cocherham et al (2006) surveyed 5,962 women 18 years of age and older from four former Soviet republics in economic and social transition, 1,469 of whom were from Ukraine, and reported that only 1.2% were frequent drinkers, while 76.3% were habitual vodka drinkers. In another epidemiologic study of alcohol use in Ukraine, Webb et al (2005) used a national probability sample to survey substance use disorders and health. Heavy alcohol use for women was defined as at least monthly consumption of >=60g of ethanol on a drinking day (equivalent to between four and five standard U.S. drinks) or more frequent use at lower amounts. The prevalence of heavy alcohol use in women in this sample in Ukraine was increased with younger age, more urban residence, higher education, never having been married and being the parent of a child. While only 4.7% of women were lifetime abstainers, the 12-month prevalence of heavy alcohol use was 8.5% for women, suggesting that a substantial proportion of the female population might be at risk of an alcohol-exposed pregnancy.

Recently, Balachova et al (2012) described the prevalence of alcohol consumption reported in a face-to-face interview as part of a cross-sectional study of 648 women of childbearing age in two regions of Russia. In their sample, 89% of non-pregnant women reported consuming some alcohol, and consistent with our findings, the majority of women (65%) reported drinking in a heavy episodic or binge pattern in the last three months. Also consistent with our study, in the Russian sample, 20% of pregnant women reported consuming alcohol, while 6% in one site and none in the other reported drinking in a binge pattern while pregnant.

Two other studies have been published on the prevalence of within-pregnancy drinking in Russian women. Kristjanson et al (2007) surveyed 200 pregnant women in St. Petersburg, and found that nearly 60% reported drinking when they knew they were pregnant and 34.9% reported drinking in the last 30 days. Of those who were currently drinking, 7.4% reported having at least one binge episode of 5 or more drinks. Similarly, in the Moscow Region of Russia, Chambers et al (2006) reported that among 413 pregnant respondents, 4.8% reported

at least one episode of 5 or more drinks in the last month, and 10.5% reported at least one episode of 3 or 4 drinks.

The prevalence of reported consumption at any level in the Ukraine sample can also be compared to U.S. data derived from the Behavioral Risk Factor Surveillance System, a periodic national survey of health behaviors that includes questions about alcohol use in the previous month for a representative sample of adults across the U.S., a subset of whom are pregnant at the time of the survey. The most recent data from the survey cover the period 2005–2010, and summarize responses from 13,880 pregnant women and 331,196 women of childbearing age (MMWR, 2012). The overall prevalence of any alcohol consumption in non-pregnant women was 51.5% and 7.6% for women who reported they were pregnant. This is in sharp contrast to the prevalence of within-pregnancy drinking in the sample from Ukraine, where more than 40% reported consuming alcohol in the most recent month of pregnancy. The prevalence of binge drinking, currently defined in the BRFSS as 4 or more drinks per occasion, was reported in 15.0% of non-pregnant women and 1.4% of pregnant women (MMWR, 2012). While these figures are not directly comparable to our data, we found that among ever-drinking pregnant women around the time of conception, the prevalence of drinking 5 or more drinks on an occasion was 3.7%, and the prevalence of drinking 3 to 4 drinks on at least one occasion was 10.5% (Table 2).

The U.S. data also demonstrates some consistencies and some contrasts with the Ukraine data in terms of predictors of risky alcohol use. In the U.S. survey, drinking any amount in pregnancy or binge drinking in pregnancy is associated with older maternal age, higher education, being employed, and not married. In non-pregnant women, the predictors are similar, except that younger age is associated with riskier drinking in women of childbearing age (MMWR, 2012). In contrast, in the Ukraine sample, lower education was associated with drinking around and in pregnancy, while marital status, specifically being unmarried, was consistently associated with risk in both the U.S. and in Ukraine.

Our findings regarding the value of the standard screening instruments for risky alcohol consumption are consistent with those reported in other populations in that the TWEAK and T-ACE were better predictors of quantity and frequency of alcohol consumed than the CAGE. A single question about the amount of alcohol a woman can hold appears to have some value in this population. We did not ask the "high" version of the tolerance question so are unable to determine how this approach would or would not have affected the predictive value of this measure.

The fact that we found differences between sites might be explained by differing patterns of referral for prenatal care, and/or the other unmeasured factors such as rural vs. urban residence. These factors should be explored further with respect to designing targeted interventions.

This study has a number of strengths as well as limitations. To our knowledge, this study represents the largest sample of alcohol consumption data among pregnant women in Ukraine that has been published to date, and thus can be informative in terms of designing prevention and intervention strategies in this setting. As with nearly all studies of maternal

alcohol consumption, the validity of self-report might be questioned. We addressed this by training the study nurses to ask the questions in a non-threatening manner, and by incorporating the screener into routine obstetric practice. However, it is possible that women under-reported when asked while still pregnant about current alcohol consumption. It has been shown previously that retrospective reports of alcohol consumption tend to reflect higher levels of consumption than antenatal reports regarding the same pregnancy (Hannigan et al, 2010) It is also possible that women who were screened in mid-pregnancy were less able to accurately recall their typical alcohol consumption in the month around conception than in the most recent month. On the other hand, they may have been more likely to disclose alcohol use that occurred earlier in pregnancy prior to recognition of pregnancy.

The sample may have been biased towards women who are lighter drinkers in that not all women were offered or agreed to be screened, and heavier drinkers might be less likely to attend prenatal care visits. However, it is important to note that in Ukraine, prenatal care is provided through the Ministry of Health and is universally available to all women.

In summary, our findings support the need for universal education and intervention in women of childbearing age in Ukraine, and for continued intervention in women who already know they are pregnant, particularly those mothers with characteristics associated with higher levels of consumption, to avoid alcohol consumption entirely. These objectives, along with intervention for children who are affected by prenatal exposure to alcohol are key components incorporated into the ongoing CIFASD study in Ukraine. The initiation of a standard screening protocol in pregnancy that has been shown to be feasible as part of this study is an important step in the right direction.

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**Table 1**

Maternal characteristics of 11,909 pregnant women screened at two sites in Ukraine 2007–2012

| Characteristic | N (%)[*] |
|---|---|
| Maternal Age (yrs) | |
| <21 | 1,547 (13.0%) |
| 21–34 | 9,424 (79.1%) |
| >=35 | 938 (7.9%) |
| Paternal Age (yrs) | |
| <21 | 387 (3.3%) |
| 21–34 | 9,372 (79.3%) |
| >=35 | 2,066 (17.5%) |
| Gestational Age at Time of Screening (wks) | |
| <=11 | 585 (4.9%) |
| 11.1–24 | 9,158 (77.2%) |
| >24 | 2,124 (17.9%) |
| Gravidity | |
| 1 | 4,992 (41.9%) |
| 2 | 3,562 (29.9%) |
| 3 or more | 3,354 (28.2%) |
| Parity | |
| 0 | 6,101 (51.2%) |
| 1 | 4,016 (33.7%) |
| 2 or more | 1,791 (15.0%) |
| Number of Previous Spontaneous Abortions | |
| 0 | 10,146 (85.2%) |
| 1 | 1,403 (11.8%) |
| 2 or more | 359 (3.0%) |
| Number of Previous Stillbirths | |
| 0 | 11,755 (98.7%) |
| 1 | 142 (1.2%) |
| 2 or more | 9 (0.1%) |
| Number of Previous Pregnancy Terminations | |
| 0 | 10.456 (87.8%) |
| 1 | 975 (8.2%) |
| 2 or more | 475 (4.0%) |
| Marital Status | |
| Single | 341 (2.9%) |
| Married living with spouse | 10,463 (87.9%) |

| Characteristic | N (%)[*] |
|---|---|
| Not married, living with spouse | 1,059 (8.9%) |
| Separated from spouse | 16 (0.1%) |
| Divorced | 25 (0.2%) |
| Widowed | 5 (0.04%) |
| Mother's Years of Education | |
| <9 | 26 (0.2%) |
| 9–11 | 2,819 (23.7%) |
| 12–15 | 4,828 (40.5%) |
| >15 | 4,235 (35.6%) |
| Mother's Tobacco Use in Last 3 Months (yes) | 488 (4.1%) |
| Mother's Illicit Drug Use (any) | 4 (0.03%) |
| Mother Taking Folic Acid Supplement (yes) | 3,863 (32.4%) |
| Mother Taking Iodine Supplement (yes) | 1,206 (10.1%) |
| Ever Consumed Alcohol (yes) | 10,976 (92.7%) |

[*] Missing values: paternal age: 84 missing; gestational age at screening: 42 missing; gravidity, parity, previous spontaneous abortion: 1 missing; previous termination, previous stillbirth: 3 missing; maternal education: 1 missing; illicit drug use: 2 missing; smoking status: 1 missing; folic acid or iodine supplement use: 2 missing

**Table 2**

Alcohol consumption characteristics of 10,976 ever-drinking pregnant women screened at two sites in Ukraine 2007–2012

| Alcohol Consumption Variable | N (%)[*] or Range |
|---|---|
| Age When First Started to Drink (yrs) | |
| <11 | 109 (1.0%) |
| 11–15 | 3,670 (33.7%) |
| 16–18 | 6,390 (58.6%) |
| 19–21 | 694 (6.4%) |
| >21 | 41 (0.4%) |
| CAGE Score | |
| 1 or more | 72 (0.7%) |
| 2 or more | 25 (0.2%) |
| TWEAK Score | |
| 1 or more | 1,146 (11.0%) |
| 2 or more | 1,136 (10.9%) |
| T-ACE Score | |
| 1 or more | 1,140 (11.0%) |
| 2 or more | 1,129 (10.9%) |
| Total Number of Drinks Can Hold (Tolerance) | |
| 1 to 2 | 4,961 (47.8%) |
| 3 to 4 | 3,707 (35.7%) |
| 5 or more | 1,715 (16.5%) |
| **Month Around Conception** | |
| Consumed Alcohol Almost Every Day | 27 (0.2%) |
| Number of Times Consumed 1 or 2 Drinks | |
| 1 to 3 occasions | 4,486 (40.9%) |
| 4 or more occasions | 786 (7.2%) |
| Range | 0–30 |
| Number of Times Consumed 3 or 4 Drinks | |
| 1 to 3 occasions | 1,027 (9.4%) |
| 4 or more occasions | 126 (1.1%) |
| Range | 0–16 |
| Number of Times Consumed 5 or More Drinks | |
| 1 to 3 occasions | 347 (3.2%) |
| 4 or more occasions | 57 (0.5%) |
| Range | 0–25 |

| Alcohol Consumption Variable | N (%)[*] or Range |
|---|---|
| Consumed Any Alcohol (yes) | 6,003 (54.8%) |
| Consumed at Least 3 Drinks on at Least 1 Occasion (yes) | 1416 (12.9%) |
| **Most Recent Month of Pregnancy** | |
| Consumed Alcohol Almost Every Day | 20 (0.2%) |
| Number of Times Consumed 1 or 2 Drinks | |
|   1 to 3 occasions | 4,044 (36.9%) |
|   4 or more occasions | 578 (5.3%) |
|   Range | 0–30 |
| Number of Times Consumed 3 or 4 Drinks | |
|   1 to 3 occasions | 722 (6.6%) |
|   4 or more occasions | 69 (0.6%) |
|   Range | 0–12 |
| Number of Times Consumed 5 or More Drinks | |
|   1 to 3 occasions | 325 (3.0%) |
|   4 or more occasions | 37 (0.3%) |
|   Range | 0–25 |
| Consumed Any Alcohol (yes) | 5,083 (46.3%) |
| Consumed at Least 3 Drinks on at Least 1 Occasion (yes) | 1012 (9.2%) |

[*]
Missing values: age first drink: 72 missing; CAGE score: 1 missing, TWEAK, T-ACE score, number of drinks can hold: 587 missing; month around conception: 1–2 drinks occasion: 13 missing, 3–4 drinks occasion: 17 missing, 5 or more drinks occasion: 8 missing, consumed any alcohol: 22 missing, consumed at least 3 drinks on at least 1 occasion: 8 missing; most recent month in pregnancy: drank almost every day, 1–2 drinks occasion, 3–4 drinks occasion, consumed at least 3 drinks on at least 1 occasion: 1 missing; 5 or more drinks occasion, consumed any alcohol: 3 missing.

**Table 3**

Comparison of models in proportion of explained variation in alcohol consumed by 10,976 ever-drinking pregnant women at two sites in Ukraine 2007–2012

|  | $R^2$ Drinks per Day at Conception | $R^2$ Drinks per Drinking Day at Conception | $R^2$ Drinks per Day in Pregnancy | $R^2$ Drinks per Drinking Day in Pregnancy |
|---|---|---|---|---|
| TWEAK only | 27.1% | 7.6% | 32.6% | 11.2% |
| TWEAK plus other covariates | 33.6% | 12.2% | 37.6% | 21.7% |
| T-ACE only | 24.6% | 7.4% | 28.7% | 10.8% |
| T-ACE plus other covariates | 31.5% | 12.1% | 34.2% | 21.4% |
| CAGE only | 12.9% | 1.1% | 23.5% | 3.9% |
| CAGE plus other covariates | 23.2% | 8.2% | 33.1% | 19.4% |
| Amnesia Question | 9.8% | 0.9% | 10.9% | 0.9% |
| Annoy Question | 9.5% | 0.3% | 6.4% | 0.5% |
| Cut Down Question | 5.0% | 0.5% | 5.5% | 0.6% |
| Eye-Opener Question | 8.3% | 0.7% | 12.4% | 1.1% |
| Guilty Question | 6.5% | 0.7% | 8.7% | 1.3% |
| Worry Question | 8.3% | 0.6% | 9.5% | 1.1% |
| Tolerance Question (6 or more drinks) | 15.2% | 6.8% | 19.2% | 10.1% |
| Hold Question (number of drinks) | 26.7% | 13.0% | 30.1% | 15.3% |

**Table 4**

Predictors of alcohol consumption in month around conception among 10,976 ever-drinking pregnant women screened at two sites in Ukraine 2007–2012

| | Drinks per Day At Conception Estimate (SE)[*] | p-value | Drinks per Drinking Day At Conception Estimate (SE)[*] | p-value |
|---|---|---|---|---|
| Intercept | 0.148 (0.034) | <0.001 | 0.660 (0.160) | <0.001 |
| Gravidity | | | | |
| 1 | Reference | | Reference | |
| 2 | −0.009 (0.003) | 0.002 | −0.053 (0.013) | <0.001 |
| 3 or more | −0.002 (0.003) | | −0.063 (0.018) | |
| Previous Spontaneous Abortion | | | | |
| 0 | Reference | | Reference | |
| 1 | −0.013 (0.004) | 0.001 | −0.044 (0.018) | 0.053 |
| 2 or more | −0.010 (0.007) | | −0.012 (0.034) | |
| Previous Stillbirth | | | | |
| 0 | Reference | | | |
| 1 | −0.012 (0.011) | <0.001 | | |
| 2 or more | 0.227 (0.056) | | | |
| Previous Termination | | | | |
| 0 | | | Reference | |
| 1 | | | 0.061 (0.021) | 0.001 |
| 2 or more | | | 0.090 (0.030) | |
| Marital Status | | | | |
| Married living with spouse | Reference | | Reference | |
| Single | 0.037 (0.007) | | 0.036 (0.035) | |
| Not married, living partner | 0.023 (0.004) | <0.001 | 0.062 (0.018) | 0.009 |
| Separated | 0.161 (0.035) | | 0.193 (0.164) | |
| Divorced | −0.013 (0.025) | | −0.002 (0.119) | |
| Widowed | −0.231 (0.050) | | −0.340 (0.238) | |
| Maternal Education (yrs) | | | | |
| <9 | Reference | | Reference | |
| 9–11 | −0.095 (0.028) | | −0.175 (0.131) | |
| 12–15 | −0.096 (0.028) | <0.001 | −0.152 (0.131) | 0.068 |
| >15 | −0.103 (0.028) | | −0.178 (0.131) | |
| Smoking (any in last 3 months) | 0.110 (0.006) | <0.001 | 0.239 (0.027) | <0.001 |
| Maternal Use of Any Medications on a Regular Basis (yes) | −0.007 (0.002) | 0.002 | −0.103 (0.013) | <0.001 |

| | Drinks per Day At Conception Estimate (SE)[*] | p-value | Drinks per Drinking Day At Conception Estimate (SE)[*] | p-value |
|---|---|---|---|---|
| Use of Single Vitamin Supplement (yes) | | | 0.027 (0.015) | 0.067 |
| Age Started Drinking (yrs) | | | | |
| >21 | Reference | | Reference | |
| <11 | 0.106 (0.022) | | 0.246 (0.106) | |
| 11–15 | 0.039 (0.019) | <0.001 | 0.168 (0.091) | <0.001 |
| 16–18 | 0.014 (0.019) | | 0.071 (0.091) | |
| 19–21 | −0.014 (0.020) | | −0.154 (0.093) | |
| TWEAK Score | | | | |
| 0 | Reference | | Reference | |
| 1 | 0.201 (0.035) | | 0.267 (0.168) | |
| 2 | 0.136 (0.004) | <0.001 | 0.381 (0.018) | <0.001 |
| 3 | 0.699 (0.043) | | 0.992 (0.207) | |
| >=4 | 0.974 (0.031) | | 1.039 (0.146) | |
| Site | | | | |
| Rivne | Reference | | Reference | |
| Khmelnytsky | −0.015 (0.003) | <0.001 | 0.048 (0.012) | <0.001 |

[*] Overall $R^2$ 33.6% for drinks per day, 12.2% for drinks per drinking day

**Table 5**

Predictors of alcohol consumption in the most recent month of pregnancy among 10,976 ever-drinking pregnant women screened at two sites in Ukraine 2007–2012

| | Drinks per Day Last Month Estimate (SE)* | p-value | Drinks per Drinking Day Last Month Estimate (SE)* | p-value |
|---|---|---|---|---|
| Intercept | 0.108 (0.028) | <0.001 | 0.495 (0.147) | <0.001 |
| Gravidity | | | | |
| 1 | Reference | | Reference | |
| 2 | −0.012 (0.003) | <0.001 | −0.081 (0.018) | <0.001 |
| 3 or more | −0.017 (0.005) | | −0.109 (0.025) | |
| Parity | | | | |
| 0 | Reference | | Reference | |
| 1 | 0.010 (0.003) | 0.014 | 0.050 (0.018) | 0.016 |
| 2 or more | 0.011 (0.005) | | 0.031 (0.027) | |
| Previous Termination | | | | |
| 0 | Reference | | Reference | |
| 1 | 0.010 (0.004) | 0.017 | 0.075 (0.020) | <0.001 |
| 2 or more | 0.009 (0.005) | | 0.082 (0.028) | |
| Gestational Age at Screening (wks) | | | | |
| <=11 | Reference | | | |
| 11.1–24 | −0.001 (0.004) | 0.071 | | |
| >24 | 0.005 (0.005) | | | |
| Marital Status | | | | |
| Married living with spouse | Reference | | Reference | |
| Single | 0.018 (0.006) | | 0.065 (0.032) | |
| Not married, living partner | 0.016 (0.003) | <0.001 | 0.072 (0.017) | <0.001 |
| Separated | 0.057 (0.028) | | 0.260 (0.147) | |
| Divorced | −0.027 (0.021) | | −0.023 (0.109) | |
| Widowed | −0.127 (0.042) | | −0.113 (0.219) | |
| Maternal Education (yrs) | | | | |
| <9 | Reference | | Reference | |
| 9–11 | −0.089 (0.023) | <0.001 | −0.274 (0.121) | 0.015 |
| 12–15 | −0.089 (0.023) | | −0.247 (0.121) | |
| >15 | −0.093 (0.023) | | −0.268 (0.121) | |
| Smoking (any last 3 months) | 0.076 (0.005) | <0.001 | 0.210 (0.024) | <0.001 |
| Maternal Use of Supplements | | | | |
| Folate (yes) | | | −0.029 (0.014) | 0.032 |

| | Drinks per Day Last Month Estimate (SE)[*] | p-value | Drinks per Drinking Day Last Month Estimate (SE)[*] | p-value |
|---|---|---|---|---|
| Iodine (yes) | | | 0.047 (0.016) | 0.003 |
| Multivitamins (yes) | 0.004 (0.002) | 0.079 | 0.029 (0.016) | 0.067 |
| Age Started Drinking (yrs) | | | | |
| >21 | Reference | | Reference | |
| <11 | 0.096 (0.018) | | 0.431 (0.097) | |
| 11–15 | 0.027 (0.016) | <0.001 | 0.163 (0.084) | <0.001 |
| 16–18 | 0.009 (0.016) | | 0.075 (0.084) | |
| 19–21 | −0.0003 (0.016) | | −0.034 (0.086) | |
| TWEAK Score | | | | |
| 0 | Reference | | Reference | |
| 1 | 0.201 (0.030) | | 0.312 (0.158) | |
| 2 | 0.124 (0.003) | <0.001 | 0.379 (0.017) | <0.001 |
| 3 | 0.682 (0.032) | | 0.995 (0.184) | |
| >=4 | 0.883 (0.029) | | 1.241 (0.149) | |
| Site | | | | |
| Rivne | Reference | | Reference | |
| Khmelnytsky | 0.023 (0.002) | <0.001 | 0.271 (0.011) | <0.001 |

[*] Overall $R^2$ 37.6% for drinks per day, 21.7% for drinks per drinking day