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Smoking and Alcohol Use among Women in Russia: Dual Risk for Prenatal Exposure

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Abstract

Alcohol consumption during pregnancy can produce adverse outcomes; maternal smoking compounds this risk. We examined prevalence of smoking and associations between smoking and alcohol use in Russian women of childbearing age ($N=648$). Smoking was reported by 35% of non-pregnant and 14% of pregnant women. Smoking prevalence was higher (45%) among at-risk drinkers and those at risk for an alcohol-exposed pregnancy (AEP). In a multivariate model, smoking status and city of residence significantly predicted AEP risk. Pregnant women in urban locations were more likely to smoke. Smoking and alcohol misuse often co-occur among Russian women presenting risk for dual prenatal exposure.

Keywords

alcohol; tobacco; smoking; pregnant women; non-pregnant women; Russia

Introduction

Alcohol and nicotine, the addictive stimulant component of tobacco, are teratogens that can produce fetal abnormalities and disorders in prenatally exposed children (Bailey & Sokol, 2011; Marufu, Ahankari, Coleman, & Lewis, 2015; Polanska, Jurewicz, & Hanke, 2015). Alcohol use during pregnancy is associated with adverse pregnancy outcomes and a range of Fetal Alcohol Spectrum Disorders (American Academy of Pediatrics, 2000; Bailey & Sokol, 2011; Interagency Coordinating Committee on Fetal Alcohol Spectrum Disorders, 2011; Sokol, Delaney-Black, & Nordstrom, 2003; Warren, Hewitt, & Thomas, 2011). Smoking increases the risk of primary and secondary infertility, premature birth, spontaneous abortion, low birth weight, infant death (Grjibovski, Bygren, Svartbo, & Magnus, 2004;

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LeClere & Wilson, 1997; Meghea et al., 2014; US Surgeon General, 2004), and behavioral and cognitive problems in children (Cornelius et al., 2011; Polanska et al., 2015). The use of either of these substances during pregnancy is a public health concern (Hackshaw, Rodeck, & Boniface, 2011; Polanska et al., 2015). The risks for adverse outcomes multiply when tobacco and alcohol are used concurrently. A recent review indicated that, in women who drank and smoked during pregnancy, the odds of preterm labor were higher than the sum of the effects of either smoking or drinking alone, indicating that the use of both substances at the same time has a synergistic effect (Odendaal, Steyn, Elliott, & Burd, 2009). The dual risk is a significant concern, and attention should be given to identifying at-risk women and developing prevention to target the concurrent use of these substances (Chen & Maier, 2011; Cornelius & Day, 2009; Ingersoll, Hettema, Cropsey, & Jackson, 2011; Parrish et al., 2012; Testa, Quigley, & Eiden, 2003; Tsai et al., 2010).

Reports indicate that women who smoke before or during pregnancy are more likely to consume alcohol during pregnancy (Lange, Probst, Quere, Rehm, & Popova, 2015; Raatikainen, Huurinainen, & Heinonen, 2007; Smedberg, Lupattelli, Mardby, & Nordeng, 2014), and alcohol is often consumed together with other substances (Chen & Maier, 2011). However, a recent review found an association between drinking and smoking during pregnancy in only half of the reviewed studies ($n=14$), indicating the need for further research (Skagerstrom, Chang, & Nilsen, 2011). The lack of data from low and middle-income countries (LMIC) is another research gap.

While a reduction of women's smoking during pregnancy has been observed in the U.S. (Centers for Disease Control and Prevention, 2009) and most developed countries (Egebjerg Jensen, Jensen, Nohr, & Kruger Kjaer, 2008; Ekblad, Gissler, Korkeila, & Lehtonen, 2014; Manwell, Ignaczak, & Czabala, 2002), many LMIC have experienced an increase in women's smoking, including during pregnancy (Smedberg et al., 2014). To further compound this problem, the rates of tobacco and alcohol use in Russia are among the highest in the world (World Health Organization, 2011). Although historically the prevalence of smoking among Russian women is low (Bobak, Gilmore, McKee, Rose, & Marmot, 2006), the pattern has changed recently. The number of female smokers has increased sharply compared with a smaller increase in smoking among Russian men (Kozlovskaya, Odland, & Grubovski, 2014; Perlman, Bobak, Gilmore, & McKee, 2007; Petrukhin & Lunina, 2012). Studies report that 19.7%–31.7% of women in Russia smoke (Petrukhin & Lunina, 2012; Potemkina et al., 2005; World Health Organization, 2009). The prevalence is higher among women of childbearing age: 37.9% among women aged 19–24 and 31.3% among women aged 25–44 (World Health Organization, 2009). The majority of female smokers smoked daily, and 68.9% of them smoked 10 cigarettes per day (World Health Organization, 2009). A study of medical records in a Russian city revealed an increase in smoking prevalence during pregnancy from 0.1% in 1973–1979 to 3.3% in 2000–2002 (Kozlovskaya et al., 2014). The prevalence in medical records is likely to underestimate the scope of the problem. Another study found that 16% of women reported daily smoking at the first antenatal visit (Grubovski et al., 2004).

Further, 20%–60% of Russian women consume alcohol during pregnancy, including 3%–7.4% who report binge drinking (Balachova et al., 2012; Chambers, Kavteldadze,

Joutchenko, Bakhireva, & Jones, 2006; Grjibovski et al., 2004; Kristjanson, Wilsnack, Zvartau, Tsoy, & Novikov, 2007). An additional challenge is that approximately half of pregnancies are unplanned; many women are not aware they are pregnant until four-to-six weeks into pregnancy (Floyd, Decoufle, & Hungerford, 1999; Floyd, Ebrahim, Boyle, & Gould, 1999), and may consume alcohol and/or smoke at pre-pregnancy levels. Among Russian women of childbearing age, 32%–54% combine at-risk drinking with a pregnancy possibility and are thus at risk for an alcohol-exposed pregnancy (AEP; Balachova et al., 2012). The rate of smoking among these women and the extent of the dual risk of alcohol and tobacco exposure during pregnancy in Russia remain unknown. Thus, it is important to explore the current prevalence of smoking among Russian women, especially those who are pregnant, seeking to become pregnant, or at risk for an unplanned pregnancy and drink at risk. Identification of the scope of the problem is important for prevention and developing intervention strategies for at-risk women. The objective of this study was to examine the prevalence of smoking and associations between smoking and alcohol use in Russian women of childbearing age.

Materials and Methods

Participants

Participants were 657 women of childbearing age (18–44 years) recruited at seven women's clinics ("Zenskaya konsyltatsia"). Because 96% of women in Russia receive services from women's clinics (Sukhanova, 2008), a representative sample of women can be recruited through these clinics. These clinics were selected for the study to represent a diverse sample of women from urban and rural areas; our clinics were located in St. Petersburg (SPB), a major city, and three in the Nizhniy Novgorod Region (NNR), a more rural area. Of women approached, 80%–89% volunteered to participate in the study. The sample was stratified to include pregnant and non-pregnant women; nine were excluded due to age or incomplete information, resulting in an analysis sample of 648 (146 pregnant and 196 non-pregnant in SPB; 155 pregnant and 151 non-pregnant in NNR).

The average age of non-pregnant women was 28.9 years; the average pregnant participant was 27.5 years old and at 20.6 ($SD = 9.0$) weeks of gestation. The present study was a part of a larger study, and details about the sample were included in previous publications (Balachova et al., 2012). Comparable to expectations based on the regional demographic characteristics, the SPB sample included more urban residence, higher education, and higher income (Balachova et al., 2012). The majority of the participants (96.8%) self-reported Russian ethnicity (others included Ukrainians, Belarusians, and other ethnic groups) and had high school or higher education. There was a greater aggregate of married among pregnant participants (73.5%) compared with non-pregnant participants (37.5%). The study was approved by institutional review boards at St. Petersburg State University (SPSU) and the University of Oklahoma Health Sciences Center (OUHSC).

Measures

Participants completed a face-to-face 40-to-50-minute structured interview focusing on alcohol consumption and health risk factors, including smoking. The interview included

items from U.S. and international measures (Kaskutas & Graves, 2000; Kesmodel & Olsen, 2001; Russell, 1994; Russell et al., 1994; Russell et al., 1996; Sokol, Martier, & Ager, 1989) that were reviewed for cultural appropriateness by bilingual project investigators. The study procedures are described in detail elsewhere (REMOVED for review).

Smoking

Participants who reported smoking at the time of the survey, or “current smokers,” were further asked about the number of cigarettes smoked per day on average. The current smokers were stratified into “Very Light”, “Light”, or “Moderate/Heavy” smoker subgroups, based on the number of cigarettes they reported smoking daily. While there is no consensus and various subgroups of smokers have been described, we utilized the following commonly used definitions: “Very Light” smokers were classified as smoking fewer than 5 cigarettes per day (cig/day), “Light” smokers were classified as smoking 6 to 10 (cig/day), and “Moderate/Heavy” smokers were a combined group of moderate-to-heavy smokers that reported smoking 11 cig/day (Husten, 2009; Okuyemi et al., 2002).

Alcohol Consumption

U.S. standard drink definitions were utilized. Risky drinking for non-pregnant women was defined as consuming 8 drinks in a week or 4 drinks in a day, while binge drinking was defined as consuming 4 drinks on one occasion (National Institute of Alcohol Abuse and Alcoholism, 2004; US Department of Health and Human Services, 2005). Similar to approaches that have been used in other countries (Kesmodel, Kesmodel, Larsen, & Secher, 2003; Kristjanson et al., 2007), a beverage-specific weekly quantity/frequency approach was used to determine standardized alcohol content and volume. These values were then transformed to U.S. standard drink units (1 drink unit = 14 grams of pure alcohol; National Institute of Alcohol Abuse and Alcoholism, 2004). Women were asked how often they consumed 4 drinks on an occasion. The response options included 8 categories ranging from “not at all” to “daily”. A detailed description of the alcohol use measures is provided elsewhere (Balachova et al., 2012).

Pregnancy

Participants were asked about sexual intercourse and use of contraception during the 6 months prior to the interview or, for those currently pregnant, 6 months prior to pregnancy. Those reporting vaginal intercourse with a male partner without contraception were coded positive for pregnancy potential. Risk for AEP among non-pregnant women was defined as reporting pregnancy potential and at-risk alcohol consumption (4 drinks on one occasion or 8 drinks per week). Non-pregnant women reported their alcohol consumption and smoking during the three months prior to the interview. Pregnant participants reported their consumption and smoking after recognizing pregnancy.

Statistical analysis

SAS version 9.2 was used to perform the statistical analyses. Summary statistics were calculated to compile the demographic information of the women in this sample and to determine the prevalence of smoking and alcohol consumption in this sample. Chi-square

tests or Fisher's exact tests (if expected values were < 5) and their corresponding p -values were used to detect differences in prevalence proportions of smoking, alcohol consumption, or binge drinking between various subgroups of interest. We also assessed whether associations exist between smoking prevalence and demographic variables of interest, including city of residence, ethnicity, and age group (as stratified by ages 18 to 25 and ages 26).

A Pearson chi-square test was first performed to determine whether there was an association between smoking subgroups and AEP risk. This was followed by a Mantel Haenszel chi-square test to assess the existence of a linear trend between smoking subgroups and AEP risk. Student's t -tests were used to compare mean cigarette consumption between women residing in different cities. Location of residence was also used as a stratification variable to compare the urban SPB location with the more rural NNR region. Logistic regression was used to determine the relationship between AEP risk and cigarette smoking, as well as other variables of interest. Univariate models were generated to determine which variables were independently associated with AEP risk. A multivariate model was then developed to determine which variables best predicted AEP risk.

Global null hypothesis tests were performed and odds ratios, with their respective confidence intervals, were generated to describe the strength of associations. The regression model initially included an interaction term to assess whether the location of residence modified the effect of cigarette smoking on AEP risk. Participants' age group, ethnicity, marital status, education, income level, or having had previous children were evaluated for potential confounders in order to determine whether these factors distorted the relationship between smoking and AEP risk. Alpha was set at 0.05. Confounding covariates were included in the logistic regression model if their inclusion altered the crude odds ratio by 20 percent or more.

Results

Non-pregnant Women's Cigarette and Alcohol Consumption

Across both urban SPB and rural NNR, 35% of non-pregnant women (38% in SPB, 30% in NNR) reported that they currently smoked cigarettes, with no significant differences in smoking prevalence between sites ($p=0.13$; Figure 1). We did not detect any associations between smoking prevalence and non-pregnant women's age group ($p=0.2$) or ethnicity ($p=0.55$). Among the 108 non-pregnant women who reported the number of cigarettes that they typically smoke each day, smokers in both SPB and the NNR smoked an average of approximately 8 cigarettes per day, SPB 95% CI [7.07, 9.28], NNR 95% CI [6.87, 9.95], $p=0.79$.

Of all non-pregnant women who reported current smoking, 76% also reported binge drinking episodes within the last 3 months, while 59% of non-smoking non-pregnant women reported binge drinking ($p<0.01$; Table 1). There was no difference in the prevalence of consuming any amount of alcohol between these two subgroups ($p=0.10$); 98% of non-pregnant smokers and 94% of non-smokers reported alcohol consumption (Table 1). When non-pregnant smokers were stratified into "Very Light", "Light", or "Moderate/Heavy"

smoker subgroups (described in Methods), it was found that 69% of very light smokers participated in binge drinking. Light smokers and moderate/heavy smokers had slightly elevated binge drinking prevalence of 81% and 86%, respectively, although these differences were not significant ($p=0.21$). Taken together, these results reflect a higher prevalence of binge drinking in non-pregnant women who smoke cigarettes than in non-pregnant women who abstain from tobacco use.

Pregnant Women's Cigarette and Alcohol Consumption

Fourteen percent of all participating pregnant women reported that they currently smoked cigarettes. Twenty-one percent of pregnant women in SPB smoked, which was a significantly higher percentage than the 7% of pregnant women in NNR who smoked ($p<0.01$; Figure 1). Across both sites, we did not detect any association between pregnant women's age and smoking prevalence ($p=0.31$). Pregnant smokers in SPB smoked an average of approximately seven cigarettes per day, 95% CI [4.67, 8.51]. Pregnant smokers in NNR smoked an average of six cigarettes per day, 95% CI [3.28, 7.91]. This difference was not significant ($p=0.57$).

Across both locations, 47% of all pregnant women who smoked cigarettes while pregnant also consumed alcohol during their pregnancy, and 7% reported binge-drinking episodes (Table 2). In contrast, 21% of pregnant women who were non-smokers consumed alcohol during pregnancy, with 2% of these non-smoking women reporting that they also participated in binge drinking while pregnant (p -values of <0.01 and 0.08 , respectively; Table 2). Interestingly, 90% of pregnant smokers reported smoking 6 cigarettes per day. Eight percent of these pregnant light or moderate/heavy smokers also reported episodes of binge drinking. Pregnant women who were categorized as very light smokers did not report any episodes of binge drinking while pregnant.

Cigarette Smoking and its Correlation with Risk for AEP

Of the 347 non-pregnant women, 40% were identified to be at risk for an AEP due to the combination of at-risk drinking (8 drinks per week or binge drinking during last 3 months) and unsafe sexual practices. Of these at-risk women, 45% reported that they currently smoked cigarettes, whereas only 28% of non-pregnant women who were not at risk for AEP reported cigarette smoking ($p<0.01$). When stratified by location, 57% of at-risk women in SPB were current smokers and 37% of at-risk women in NNR were current smokers ($p=0.02$; Figure 1). Of the women who were not at risk, 30% of SPB women and 23% of NNR women were current smokers, with no significant differences between the two locations ($p=0.26$). Across both sites, the odds of smoking cigarettes was 2.15 times higher among women at risk for AEP than in women who were not at risk, 95% CI [1.37, 3.38].

Logistic regression was used to determine which variables of interest were significantly associated with being at risk for an AEP. Multivariate logistic-modeling showed that smoking status and city of residence significantly predicted AEP-risk ($p<0.0001$). No interaction was detected between city of residence and smoking status among non-pregnant women ($p=0.5898$). Non-pregnant women who were current smokers had 2.54 times higher odds of being at-risk for AEP than did non-smokers, after adjusting for location, 95% CI

[1.57, 4.11] (Table 3). After we adjusted for smoking status, women who resided in NNR had 3.25 times higher odds of being at-risk for an AEP than did women from SPB, 95% CI [2.04, 5.18] (Table 3). After adjusting for both smoking status and location, no associations were found between risk of AEP and the following demographic variables: age group, ethnicity, marital status, education level, income level, or having previous children. There was no evidence of confounding among these variables, defined as a difference of 20% (or greater) between the crude and adjusted *ORs*. The c-statistic, or area under the ROC-curve, was equal to 0.68, which suggests that the logistical regression model accurately predicts AEP risk. The findings from this multivariate model suggest that smoking status and city of residence may be useful measures to help predict AEP risk among non-pregnant women.

Furthermore, upon stratification of non-pregnant smokers into the very light, light, and moderate/heavy smoking subgroups, we found that 40% of very light smokers were at risk for an AEP, whereas 67% of light smokers and 50% of moderate/heavy smokers were at risk for an AEP ($p=0.04$). This finding demonstrates that smoking subgroup and AEP risk are highly associated. However, given that the light smoking subgroup contained a higher proportion of AEP at-risk women than the moderate/heavy smoking subgroup, a linear trend between smoking subgroup and AEP-risk was not detected ($p=0.08$). Together, these results indicate that, compared with women who are non-smokers or very light smokers, women who are light or moderate/heavy smokers may be more apt to participate in other risky behaviors, such as binge drinking and unsafe sexual practices, which potentially place them at greater risk for an AEP.

Discussion

Principal Findings

We found high smoking prevalence of 35% among non-pregnant women and 14% among pregnant women. This prevalence is higher than was reported in early studies in Russia (Bobak et al., 2006) and is comparable to more recent reports in Russia (World Health Organization, 2009). In addition, the smoking prevalence observed here is higher than smoking prevalence reported in Sweden (15% before pregnancy and 5% during pregnancy; Comasco, Hallberg, Helander, Orelund, & Sundelin-Wahlsten, 2012), France (Melchior et al., 2015), and in the UK (Office for National Statistics, 2013). The prevalence is substantially higher than reported in women of childbearing age in Korea, among whom 7.3% report smoking, 21.4% report heavy alcohol consumption, and 4.3% report both smoking and heavy alcohol consumption (Lee, Ko, & Park, 2013). However, the smoking prevalence among Russian women in this study is similar to reports from 15 other European countries (Lange et al., 2015; Owen, McNeill, & Callum, 1998; Smedberg et al., 2014) and Canada (Lange et al., 2015).

Consistent with data from the World Health Organization (World Health Organization, 2009), we found higher smoking prevalence among pregnant women in urban SPB locations (21%) than in more rural areas of NNR (7%). As expected, the smoking prevalence was higher among women at risk for AEP: 57% in SPB and 37% in NNR. Unexpectedly, we found no relationship between non-pregnant Russian women's smoking status and other demographic variables, including city of residence, age, or ethnicity. Unlike in other

countries (Lee, Ko, & Park, 2013), smoking in Russian women was not associated with traditional at-risk groups, such as younger women. This finding highlights the importance of culture and cross-cultural studies for identifying health behavior risks and prevention targets in women.

In the present study, alcohol use was the best predictor of cigarette use, and smoking was predictive of at-risk drinking. Consistent with other studies, moderate/heavy smokers displayed an increased prevalence of binge drinking compared with non-smokers. Similar to women in other countries (Lange et al., 2015; Lee, Ko, & Park, 2013; Parrish et al., 2012), Russian women who smoke were more likely to drink at-risk while non-pregnant and consume alcohol during pregnancy. These data are similar to reported findings of associations between alcohol consumption and smoking from other countries (Manwell et al., 2002; Passey, Sanson-Fisher, D'Este, & Stirling, 2014). The dual risk of prenatal alcohol and tobacco exposure is particularly concerning because of the synergistic effect of concurrent use of both substances on pregnancy outcomes (Odendaal et al., 2009). Taken together, these results illustrate the high smoking prevalence among women at risk for AEP, and emphasize the importance of developing intervention programs that target this dual risk in women.

Finally, in line with findings from a study in the U.S., we found that women who smoke are more likely to engage in other risky behaviors, such as unsafe sexual practices (Parrish et al., 2012). Russian women who smoke were more likely to be engaged in unprotected sex and be at risk for an AEP. The results indicate that while effects of sociodemographic characteristics on smoking behavior in women may vary in different cultures, the association between smoking and other health risk behaviors in women, e.g., at-risk drinking and unprotected sex, is more consistent across cultures. Prevention and treatment strategies that utilize an integrated approach to address the multiple health behavior risks in women may be particularly promising for improving health outcomes in women and children. Special attention is needed for women of childbearing age who smoke, since they are likely to be engaged in at-risk drinking and unprotected sex placing them and their children at risk of adverse health outcomes.

Strengths and Limitations

The current study had both strengths and limitations. The strengths include a large sample size of women of childbearing age that was recruited at women's health clinics that are attended by the majority of Russian women, sampling women in both rural and urban areas, and assessing drinking behaviors and smoking with items from validated, sensitive instruments.

One limitation was that alcohol consumption and smoking data were collected *via* self-report and no biological measures were utilized. Although self-reports may underestimate alcohol use and smoking (Connor Gorber, Schofield-Hurwitz, Hardt, Levasseur, & Tremblay, 2009), studies indicate that reasonably accurate reports about alcohol use and smoking can be obtained from volunteers in research studies when confidentiality is protected (Babor, Steinberg, Anton, & Del Boca, 2000; Grjibovski et al., 2004; Kesmodel & Frydenberg, 2004; Laatikainen et al., 2002; Laatikainen, Vartiainen, & Puska, 1999; Patrick

et al., 1994), which was the case in current study. In addition, since alcohol consumption and smoking are prevalent in Russia, there may be fewer stigmas associated with admitting alcohol and tobacco use in Russia. Future research may benefit from including biomarkers, e.g., urinary or saliva cotinine for tobacco smoking and urinary EtG and EtS, to validate self-reports of no tobacco and/or alcohol use (Bakhireva & Savage, 2011; Connor Gorber et al., 2009). Finally, this study did not aim to assess associations between smoking and mental health problems, e.g., depression. Future research may address this gap to identify associations between substance misuse and mental health problems in Russian women.

Conclusions and Implications

This is the first report to examine the concurrent use of tobacco and alcohol among women attending women's clinics in Russia. The findings demonstrate that smoking and alcohol misuse are prevalent and often co-occur in Russian women of childbearing age. Prevention efforts aimed at reducing the AEP risk need to address the dual exposure risk. The fact that smoking and risky alcohol use are co-occurring can be utilized in screening for identification of women at risk of nicotine and/or alcohol-exposed pregnancies.

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References

- American Academy of Pediatrics. (2000). Fetal alcohol syndrome and alcohol-related neurodevelopmental disorders. *Pediatrics*, 106(2 Pt 1), 358–361. [PubMed: 10920168]
- Babor TF, Steinberg K, Anton R, & Del Boca F (2000). Talk is cheap: measuring drinking outcomes in clinical trials. *Journal of Studies on Alcohol and Drugs*, 61(1), 55–63.
- Bailey B, & Sokol R (2011). Prenatal alcohol exposure and miscarriage, stillbirth, preterm delivery, and sudden infant death syndrome. *Alcohol Research & Health*, 34, 86–91. [PubMed: 23580045]
- Bakhireva LN, & Savage DD (2011). Focus on: biomarkers of fetal alcohol exposure and fetal alcohol effects. *Alcohol Research & Health*, 34(1), 56–63. [PubMed: 23580042]
- Balachova T, Bonner B, Chaffin M, Bard D, Isurina G, Tsvetkova L, & Volkova E (2012). Women's alcohol consumption and risk for alcohol-exposed pregnancies in Russia. *Addiction*, 107(1), 109–117. doi:10.1111/j.1360-0443.2011.03569.x [PubMed: 21752144]
- Bobak M, Gilmore A, McKee M, Rose R, & Marmot M (2006). Changes in smoking prevalence in Russia, 1996–2004. *Tobacco Control*, 15(2), 131–135. doi:10.1136/tc.2005.014274 [PubMed: 16565462]
- Centers for Disease Control and Prevention. (2009). Trends in smoking before, during, and after pregnancy - Pregnancy Risk Assessment Monitoring System (PRAMS), United States, 31 Site, 2000–2005. *Morbidity and Mortality Weekly Report*, 58(SS-4), 1–36. [PubMed: 19145219]
- Chambers CD, Kavteladze L, Joutchenko L, Bakhireva LN, & Jones KL (2006). Alcohol consumption patterns among pregnant women in the Moscow region of the Russian Federation. *Alcohol*, 38(3), 133–137. doi:10.1016/j.alcohol.2006.06.002 [PubMed: 16905438]
- Chen WA, & Maier SE (2011). Combination drug use and risk for fetal harm. *Alcohol Research & Health*, 34(1), 27–28. [PubMed: 23580037]

- Comasco E, Hallberg G, Helander A, Orelund L, & Sundelin-Wahlsten V (2012). Alcohol Consumption Among Pregnant Women in a Swedish Sample and Its Effects on the Newborn Outcomes. *Alcoholism-Clinical and Experimental Research*, 36(10), 1779–1786. doi:10.1111/j.1530-0277.2012.01783.x
- Connor Gorber S, Schofield-Hurwitz S, Hardt J, Levasseur G, & Tremblay M (2009). The accuracy of self-reported smoking: a systematic review of the relationship between self-reported and cotinine-assessed smoking status. *Nicotine & Tobacco Research*, 11(1), 12–24. doi:10.1093/ntr/ntn010 [PubMed: 19246437]
- Cornelius MD, & Day NL (2009). Developmental consequences of prenatal tobacco exposure. *Current Opinion in Neurology*, 22(2), 121–125. doi:10.1097/WCO.0b013e328326f6dc [PubMed: 19532034]
- Cornelius MD, De Genna NM, Leech SL, Willford JA, Goldschmidt L, & Day NL (2011). Effects of prenatal cigarette smoke exposure on neurobehavioral outcomes in 10-year-old children of adolescent mothers. *Neurotoxicology and Teratology*, 33(1), 137–144. doi:10.1016/j.ntt.2010.08.006 [PubMed: 21256428]
- Dawson DA, Das A, Faden VB, Bhaskar B, Krulwich CJ, & Wesley B (2001). Screening for high- and moderate-risk drinking during pregnancy: a comparison of several TWEAK-based screeners. *Alcoholism: Clinical and Experimental Research*, 25(9), 1342–1349.
- Egebjerg Jensen K, Jensen A, Nohr B, & Kruger Kjaer S (2008). Do pregnant women still smoke? A study of smoking patterns among 261,029 primiparous women in Denmark 1997–2005. *Acta Obstetrica et Gynecologica Scandinavica*, 87(7), 760–767. doi:10.1080/00016340802179814 [PubMed: 18696277]
- Eklblad M, Gissler M, Korkeila J, & Lehtonen L (2014). Trends and risk groups for smoking during pregnancy in Finland and other Nordic countries. *European Journal of Public Health*, 24(4), 544–551. doi:10.1093/eurpub/ckt128 [PubMed: 24025664]
- Floyd RL, Decoufle P, & Hungerford DW (1999). Alcohol use prior to pregnancy recognition. *American Journal of Preventive Medicine*, 17(2), 101–107. [PubMed: 10490051]
- Floyd RL, Ebrahim SH, Boyle CA, & Gould DW (1999). Observations from the CDC. Preventing alcohol-exposed pregnancies among women of childbearing age: the necessity of a preconceptional approach. *Journal of Women's Health and Gender-Based Medicine*, 8(6), 733–736. doi:10.1089/152460999319048
- Grijbovski A, Bygren LO, Svartho B, & Magnus P (2004). Housing conditions, perceived stress, smoking, and alcohol: determinants of fetal growth in Northwest Russia. *Acta Obstetrica et Gynecologica Scandinavica*, 83(12), 1159–1166. doi:10.1111/j.0001-6349.2004.00443.x [PubMed: 15548149]
- Hackshaw A, Rodeck C, & Boniface S (2011). Maternal smoking in pregnancy and birth defects: a systematic review based on 173 687 malformed cases and 11.7 million controls. *Human Reproduction Update*, 17(5), 589–604. doi:10.1093/humupd/dmr022 [PubMed: 21747128]
- Husten CG (2009). How should we define light or intermittent smoking? Does it matter? *Nicotine and Tobacco Research*, 11(2), 111–121. doi:10.1093/ntr/ntp010 [PubMed: 19246425]
- Ingersoll KS, Hettema JE, Cropsey KL, & Jackson JP (2011). Preconception markers of dual risk for alcohol and smoking exposed pregnancy: tools for primary prevention. *Journal of Women's Health*, 20(11), 1627–1633. doi:10.1089/jwh.2010.2633
- Interagency Coordinating Committee on Fetal Alcohol Spectrum Disorders. (2011). Consensus statement recognizing alcohol-related neurodevelopmental disorder (ARND) in primary health care of children.
- Kaskutas LA, & Graves K (2000). An alternative to standard drinks as a measure of alcohol consumption. *Journal of Substance Abuse*, 12(1–2), 67–78. [PubMed: 11288475]
- Kesmodel U, & Frydenberg M (2004). Binge drinking during pregnancy--is it possible to obtain valid information on a weekly basis? *American Journal of Epidemiol*, 159(8), 803–808.
- Kesmodel U, Kesmodel PS, Larsen A, & Secher NJ (2003). Use of alcohol and illicit drugs among pregnant Danish women, 1998. *Scandinavian Journal of Public Health*, 31(1), 5–11. [PubMed: 12623518]

- Kesmodel U, & Olsen SF (2001). Self reported alcohol intake in pregnancy: comparison between four methods. *Journal of Epidemiology & Community Health*, 55(10), 738–745. [PubMed: 11553658]
- Kozlovskaya A, Odland A, & Grjubovski A (2014). Influence of professional employment for mothers and their marital status on birth weight and the risk of premature birth in Monchegorsk Murmansk region over a 30-year period. *Human Ecology*, 8, 3–12.
- Kristjanson AF, Wilsnack SC, Zvartau E, Tsoy M, & Novikov B (2007). Alcohol use in pregnant and nonpregnant Russian women. *Alcohol: Clinical and Experimental Research*, 31(2), 299–307. doi: 10.1111/j.1530-0277.2006.00315.x
- Laatikainen T, Alho H, Vartiainen E, Jousilahti P, Sillanauke P, & Puska P (2002). Self-reported alcohol consumption and association to carbohydrate-deficient transferrin and gamma-glutamyltransferase in a random sample of the general population in the Republic of Karelia, Russia and in North Karelia, Finland. *Alcohol and Alcoholism*, 37(3), 282–288. [PubMed: 12003919]
- Laatikainen T, Vartiainen E, & Puska P (1999). Comparing smoking and smoking cessation process in the Republic of Karelia, Russia and North Karelia, Finland. *Journal of Epidemiology & Community Health*, 53(9), 528–534. [PubMed: 10562876]
- Lange S, Probst C, Quere M, Rehm J, & Popova S (2015). Alcohol use, smoking and their co-occurrence during pregnancy among Canadian women, 2003 to 2011/12. *Addictive Behaviors*, 50, 102–109. doi:10.1016/j.addbeh.2015.06.018 [PubMed: 26117214]
- LeClere FB, & Wilson JB (1997). Smoking behavior of recent mothers, 18–44 years of age, before and after pregnancy: United States, 1990. *Advance Data*, 1997 7 25, (288), 1–11.
- Lee JY, Ko YJ, & Park SM (2013). Factors associated with current smoking and heavy alcohol consumption among women of reproductive age: the Fourth Korean National Health and Nutrition Examination Survey 2007–2009. *Public Health*, 127(5), 473–481. doi: 10.1016/j.puhe.2013.02.009 [PubMed: 23608023]
- Manwell LB, Ignaczak M, & Czabala JC (2002). Prevalence of tobacco and alcohol use disorders in Polish primary care settings. *European Journal of Public Health*, 12(2), 139–144. doi:10.1093/eurpub/12.2.139 [PubMed: 12073753]
- Marufu TC, Ahankari A, Coleman T, & Lewis S (2015). Maternal smoking and the risk of still birth: systematic review and meta-analysis. *BMC Public Health*, 15, 239. doi:10.1186/s12889-015-1552-5 [PubMed: 25885887]
- Meghea CI, Rus IA, Chereches RM, Costin N, Caracostea G, & Brinzaniuc A (2014). Maternal smoking during pregnancy and birth outcomes in a sample of Romanian women. *Central European Journal of Public Health*, 22(3), 153–158. [PubMed: 25438390]
- Melchior M, Cholle A, Glangeaud-Freudenthal N, Saurel-Cubizolles MJ, Dufourg MN, van der Waerden J, & Sutter-Dallay AL (2015). Tobacco and alcohol use in pregnancy in France: the role of migrant status: the nationally representative ELFE study. *Addictive Behaviors*, 51, 65–71. [PubMed: 26233939]
- National Institute of Alcohol Abuse and Alcoholism. (2004). NIAAA council approves definition of binge drinking. *NIAAA newsletter*, 3(3).
- Odendaal HJ, Steyn DW, Elliott A, & Burd L (2009). Combined effects of cigarette smoking and alcohol consumption on perinatal outcome. *Gynecology and Obstetric Investigation*, 67(1), 1–8. doi:10.1159/000150597
- Office for National Statistics. (2013). *Opinions and lifestyle survey, smoking habits amongst adults*, 2012.
- Okuyemi KS, Harris KJ, Scheibmeir M, Choi WS, Powell J, & Ahluwalia JS (2002). Light smokers: issues and recommendations. *Nicotine & Tobacco Research*, 4 Suppl 2, S103–112. doi: 10.1080/1462220021000032726 [PubMed: 12573172]
- Owen L, McNeill A, & Callum C (1998). Trends in smoking during pregnancy in England, 1992–7: quota sampling surveys. *British Medical Journal*, 317(7160), 728. [PubMed: 9732341]
- Parrish DE, von Sternberg K, Velasquez MM, Cochran J, Sampson M, & Mullen PD (2012). Characteristics and factors associated with the risk of a nicotine exposed pregnancy: expanding the CHOICES preconception counseling model to tobacco. *Maternal and Child Health Journal*, 16(6), 1224–1231. doi:10.1007/s10995-011-0848-z [PubMed: 21735139]

- Passey ME, Sanson-Fisher RW, D'Este CA, & Stirling JM (2014). Tobacco, alcohol and cannabis use during pregnancy: Clustering of risks. *Drug and Alcohol Dependence*, 134, 44–50. doi:10.1016/j.drugalcdep.2013.09.008 [PubMed: 24095245]
- Patrick DL, Cheadle A, Thompson DC, Diehr P, Koepsell T, & Kinne S (1994). The validity of self-reported smoking: a review and meta-analysis. *American Journal of Public Health*, 84(7), 1086–1093. [PubMed: 8017530]
- Perlman F, Bobak M, Gilmore A, & McKee M (2007). Trends in the prevalence of smoking in Russia during the transition to a market economy. *Tobacco Control*, 16(5), 299–305. doi:10.1136/tc.2006.019455 [PubMed: 17897987]
- Petrukhin I, & Lunina E (2012). Cardiovascular disease risk factors and mortality in Russia: challenges and barriers. *Public Health Reviews*, 33(2), 436–449.
- Polanska K, Jurewicz J, & Hanke W (2015). Smoking and alcohol drinking during pregnancy as the risk factors for poor child neurodevelopment - A review of epidemiological studies. *International Journal of Occupational Medicine and Environmental Health*, 28(3), 419–443. doi:10.13075/ijomh.1896.00424 [PubMed: 26190723]
- Potemkina R, Glazunov I, Kuznetsova O, Petrukhin I, Frolova E, Kudina E, & Lebedev A (2005). Examination of the spread of behavioral risk factors among the population of Moscow, Saint Petersburg, and Tver by telephone questioning. *Profilac Zabol Ukrep Zdor*, 3, 3–15.
- Raatikainen K, Huurinainen P, & Heinonen S (2007). Smoking in early gestation or through pregnancy: a decision crucial to pregnancy outcome. *Preventive Medicine*, 44(1), 59–63. doi: 10.1016/j.ypmed.2006.07.017 [PubMed: 16959307]
- Russell M (1994). New assessment tools for risk drinking during pregnancy: T-ACE, TWEAK, and others. *Alcohol Health & Research World*, 178(1), 55–61.
- Russell M, Martier SS, Sokol RJ, Mudar P, Bottoms S, Jacobson S, & Jacobson J (1994). Screening for pregnancy risk-drinking. *Alcohol Clin Exp Res*, 18(5), 1156–1161. [PubMed: 7847599]
- Russell M, Martier SS, Sokol RJ, Mudar P, Jacobson S, & Jacobson J (1996). Detecting risk drinking during pregnancy: a comparison of four screening questionnaires. *American Journal of Public Health*, 86(10), 1435–1439. [PubMed: 8876514]
- Skagerstrom J, Chang G, & Nilsen P (2011). Predictors of drinking during pregnancy: a systematic review. *Journal of Women's Health*, 20(6), 901–913. doi:10.1089/jwh.2010.2216
- Smedberg J, Lupattelli A, Mardby AC, & Nordeng H (2014). Characteristics of women who continue smoking during pregnancy: a cross-sectional study of pregnant women and new mothers in 15 European countries. *BMC Pregnancy and Childbirth*, 14, 213. doi:10.1186/1471-2393-14-213 [PubMed: 24964728]
- Sokol RJ, Delaney-Black V, & Nordstrom B (2003). Fetal alcohol spectrum disorder. *Journal of the American Medical Association*, 290(22), 2996–2999. doi:10.1001/jama.290.22.2996 [PubMed: 14665662]
- Sokol RJ, Martier SS, & Ager JW (1989). The T-ACE questions: practical prenatal detection of risk-drinking. *American Journal of Obstetrics & Gynecology*, 160(4), 863–868; discussion 868–870. [PubMed: 2712118]
- Sukhanova L (2008). Statistics of obstetric aid as a factor of providing quality of obstetric and perinatal care in Russia. *Information Analytical Report Social Aspects of Public Health*.
- Testa M, Quigley BM, & Eiden RD (2003). The effects of prenatal alcohol exposure on infant mental development: a meta-analytical review. *Alcohol and Alcoholism*, 38(4), 295–304. [PubMed: 12814894]
- Tsai J, Floyd RL, Green PP, Denny CH, Coles CD, & Sokol RJ (2010). Concurrent Alcohol Use or Heavier Use of Alcohol and Cigarette Smoking Among Women of Childbearing Age with Accessible Health Care. *Prevention Science*, 11(2), 197–206. doi:10.1007/s11121-009-0158-5 [PubMed: 19937383]
- US Department of Health and Human Services. (2005). Helping patients who drink too much: a clinician's guide National Institutes of Health. National Institute on Alcohol Abuse and Alcoholism NIH Publication(07–3769).
- US Surgeon General. (2004) *The Health Consequences of Smoking: A Report of the Surgeon General*. Atlanta (GA).

- Warren KR, Hewitt BG, & Thomas JD (2011). Fetal alcohol spectrum disorders: research challenges and opportunities. *Alcohol Research & Health*, 34(1), 4–14. [PubMed: 23580035]
- World Health Organization. (2009). Global Adult Tobacco Survey, Russian Federation 2009 Country Report. Retrieved from http://www.who.int/tobacco/surveillance/en_tfi_gats_russian_countryreport.pdf
- World Health Organization. (2011). Noncommunicable Diseases Country Profiles 2011.

Figure 1. Smoking prevalence among pregnant and non-pregnant women and subgroups of non-pregnant women in St. Petersburg (SPB) and the Nizhny Novgorod Region (NNR).

Table 1.

Prevalence of alcohol use, binge drinking, and AEP risk among non-pregnant women by their smoking status.

Non-pregnant women (n=347)				
	Smokers n=121 (35%)	Non-smokers n=226 (65%)	Difference	95% Confidence Interval
Drinkers (proportion)	0.98	0.94	0.04	(0.004, 0.08)
Binge drinkers (proportion)	0.76	0.59	0.17	(0.07, 0.27) *
AEP risk (proportion)	0.52	0.33	0.18	(0.08, 0.29) *

Note:

* Denotes statistical significance

Table 2.

Prevalence of alcohol use, binge drinking, and AEP risk among pregnant women by their smoking status.

Pregnant women (<i>n</i> =301)				
	Smokers <i>n</i> =41 (14%)	Non-smokers <i>n</i> =260 (86%)	Difference	95% Confidence Interval
Drinkers (proportion)	0.47	0.21	0.26	(0.10, 0.43) *
Binge drinkers (proportion)	0.07	0.02	0.05	(−0.03, 0.14)

Note:

* Denotes statistical significance

Table 3.

The AEP risk among non-pregnant women: the effect of smoking and location.

Effect	Odds Ratio	95% Wald Confidence Limits		Wald <i>p</i> -value
Smoking status: Current smoker vs. non-smoker	2.54	1.57	4.11	0.0001
City of Residence: NNR vs. SPB	3.25	2.04	5.18	<0.0001
Fit Statistics	C-statistic =0.68			