



Screening for Alcohol Use in Pregnancy: a Review of Current Practices and Perspectives

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Abstract

Global trends of increasing alcohol consumption among women of childbearing age, social acceptability of women's alcohol use, as well as recent changes in alcohol use patterns due to the COVID-19 pandemic may put many pregnancies at higher risk for prenatal alcohol exposure (PAE), which can cause fetal alcohol spectrum disorder (FASD). Therefore, screening of pregnant women for alcohol use has become more important than ever and should be a public health priority. This narrative review presents the state of the science on various existing prenatal alcohol use screening strategies, including the clinical utility of validated alcohol use screening instruments. It also discusses barriers for alcohol use screening in pregnancy, such as practitioner constraints, unplanned pregnancies, delayed access to prenatal care, and stigma associated with substance use in pregnancy, providing recommendations to address these barriers. By implementing consistent alcohol use screening, prenatal care providers have the opportunity to facilitate access to counseling and brief interventions and thus, to prevent new cases of FASD and improve maternal and child health.

Keywords Alcohol · Pregnancy · Screening · Fetal alcohol spectrum disorder · Fetal alcohol syndrome · Prevention

Abbreviations

ASSIST Alcohol, Smoking, and Substance Involvement Screening Test
AUD Alcohol use disorder

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AUDIT	Alcohol Use Disorders Identification Test
CAGE	Cut down, Annoyed, Guilty, Eye-opener
FAS	Fetal alcohol syndrome
FASD	Fetal alcohol spectrum disorder
HSQ	Hospital Screening Questionnaire
NET	Normal Drinker, Eye Opener, Tolerance
PAE	Prenatal alcohol exposure
PCAP	Parent Child Assistance Program
PIP	Pregnancy Information Program
SES	Socioeconomic status
SMAST	Short Michigan Alcohol Screening Test
SUD	Substance use disorder
SURP-P	Substance use risk profile in pregnancy
T-ACE	Tolerance, Annoyance, Cut Down, Eye-opener
TQDH	Ten Question Drinking History
TWEAK	Tolerance, Worried, Eye-opener, Amnesia, K/Cut Down)
WHO	World Health Organization
WIC	Women, Infant and Child program

The levels of alcohol use among women of childbearing age (15–49 years) are currently increasing in most countries globally, due to a number of factors such as economic development, changing gender roles, and social acceptability of alcohol use in women (WHO, 2018). The COVID-19 pandemic has additionally impacted alcohol use patterns among both genders globally (Rehm et al, 2020), and the emerging evidence from some countries suggests that the pandemic can exacerbate patterns of alcohol use, which can, in turn, increase alcohol-attributable problems (Pollard et al., 2020; Rehm et al, 2020). In the USA, for example, there were significant past-year increases in drinking frequency (14%), number of heavy drinking occasions (41%), and alcohol-related problems (39%) among women in 2020 (Pollard et al., 2020).

Globally, about 10% of women in the general population consume alcohol during pregnancy (Popova et al., 2017a), though meta-analyses indicate this is much higher in some countries: over 60% of women in the general population of Ireland consume alcohol during pregnancy, 47% in Belarus, 46% in Denmark, 41% in the UK, and 37% in Russia (Popova et al., 2017a). Certain sub-populations of women across countries may be at higher risk of alcohol use during pregnancy compared to the general population, such as women with substance use disorders (SUDs), women with fetal alcohol spectrum disorder (FASD), women of lower socioeconomic status (SES), and women from marginalized cultural groups (Fraser et al., 2012; McQuire et al., 2020; Montag, 2016; Popova et al., 2017b). For example, the prevalence of alcohol use among pregnant Inuit women in northern Quebec, Canada, was over 6 times higher as compared to that observed in the general population of Canada (60.5% vs 10%, respectively) (Fraser et al., 2012). Among women who consumed alcohol in pregnancy in the UK, binge drinking was reported to be more common among women of lower socioeconomic status (SES) (Scholder et al., 2014).

It is well-documented that alcohol use during pregnancy is associated with numerous adverse pregnancy and neonatal outcomes, including stillbirth, spontaneous abortion, low birthweight, preterm birth, intrauterine growth retardation, small for gestational age (Lebel et al., 2011; Henriksen et al., 2004; Nykjaer et al., 2014; O'Connor et al., 2002; Patra et al.,

2011), and FASD (Jones et al., 1973a; Jones et al., 1973b; Sokol et al., 2003; May et al., 2013). Even relatively low levels of PAE can negatively affect the developing fetus and increase the risk for FASD (Chambers et al., 2019; May et al., 2013). It is estimated that 1 in 13 infants with PAE will develop FASD, and there are 1726 new FASD cases per day, globally (Burd & Popova, 2019). The economic costs of PAE and FASD are substantial in any society, due to the numerous comorbid conditions that are common in individuals with FASD (Oh et al., 2020; Popova et al., 2016a, 2016b) as well as typical adverse social outcomes (e.g., increased involvement in the child welfare system) (Popova et al., 2019; Brownell et al., 2019). In Canada alone, FASD poses an annual cost burden of \$1.3–2.3 billion (Popova et al., 2013), and globally, the annual costs of care per child and adult with FASD are \$22,810 and \$24,308, respectively (Greenmyer et al., 2018).

Prevention at time of pregnancy is only one of several key global health FASD prevention initiatives. It has been estimated that preventing one case of FASD incurs only 3% of the costs it would require to provide support services to individuals with FASD (Greenmyer et al., 2019), and this is related to the high service utilization of individuals with FASD. With the elimination of alcohol use during pregnancy, maternal and neonatal health outcomes can be improved, and new cases of FASD can be prevented. This places screening for PAE at the forefront of FASD prevention, as it demonstrates the potential to reduce the cost and service burden in healthcare and service systems globally.

Recent global trends, including increased alcohol consumption among women of child-bearing age (WHO, 2018), a high proportion of unplanned pregnancies (Bearak et al., 2018), and the COVID-19 pandemic (Sher, 2020), may put many pregnancies at even higher risk for unintentional PAE and FASD. Therefore, the detection and prevention of PAE is of the utmost importance in improving maternal and child health outcomes and preventing new cases of FASD. During the span of each pregnancy, prenatal care providers can implement alcohol screening practices and instruments in their clinical practice to identify PAE and reduce associated harms. Screening for PAE is an example of an effective population-based strategy to reduce the harmful use of alcohol globally (WHO, 2014a). The purpose of this narrative review was to provide an overview of existing prenatal alcohol use screening strategies as well as to describe the clinical utility of validated alcohol use screening instruments and identify barriers for their implementation. Between May 2020 and December 2020, the following databases were searched: PubMed, Web of Science, MEDLINE, EMBASE, and CINAHL Plus. Twenty-three screening strategies were identified, which can be divided into 3 levels: (1) clinician-directed questions in prenatal care encounters, (2) structured, validated alcohol use screening instruments, and (3) laboratory-based tools and biomarkers.

Screening Strategies

Level 1: Clinician-Directed Questions in Prenatal Care Encounters

The first level of screening refers to the routine questions about alcohol use that are asked by the provider during the prenatal care encounters(s), which may occur at one or multiple timepoints during the pregnancy. Prenatal care providers can screen for alcohol use that occurred prior to pregnancy recognition and mitigate maternal stress by providing necessary counseling on the importance of protective factors (e.g., continued alcohol abstinence, proper nutrition), for the remainder of the pregnancy.

Globally, only an estimated 1–3% of women drinking during pregnancy are identified by healthcare providers as doing so (Burd & Popova, 2019). Research suggests there are also some inconsistencies in the capture of this information based on provider types and countries. For example, among a range of health professionals in Australia, only 45% reported routinely asking pregnant women about their alcohol use (Payne et al., 2005). This is consistent with the findings in the USA, which indicate that 38% of medical doctors and residents reported consistently surveying pregnant women about their alcohol use (Arnold et al., 2013). A study of midwives in Norway, however, found that 97% reported asking women about alcohol use at the first prenatal care encounter (Wangberg et al., 2015). Similarly, a national study of midwifery practices in Switzerland found that questions were posed to pregnant women about alcohol use routinely by midwives ranging from 81 to 85% of the time, depending on the specific region (Lemola et al., 2020).

The first level of screening by healthcare professionals using standard questions to assess alcohol use during pregnancy is paramount to understanding which women would require further screening with a validated alcohol use screening tool, as the progression to this step stems from the initial maternal self-report (Sarkar et al., 2010). The identification of women at risk of alcohol-exposed pregnancies and children with FASD, therefore, may be missed if the first level of alcohol use screening is not implemented consistently and thoroughly. Notably, for FASD prevention, it is important for all prenatal care providers to be well-informed about any levels of alcohol consumption of pregnant women in their care, and not simply risky levels of drinking that are commonly assessed in screening instruments (Poole et al., 2019).

Level 2: Validated Alcohol Use Screening Instruments

Table 1 presents 14 instruments, which can be used to screen for alcohol use in pregnant women, 9 of which focus solely on alcohol use screening, while the other 5 screen for substances in addition to alcohol.

Only 5 of these tools have been specifically developed and/or validated for alcohol use screening in pregnant women. These 5 tools are the T-ACE (Tolerance, Annoyance, Cut Down, Eye-opener), TWEAK (Tolerance, Worried, Eye-opener, Amnesia, K/Cut Down), Alcohol Use Disorders Identification Test–consumption subset (AUDIT-C), the 4P's Plus, and the 1-Question Screen (WHO, 2014b; Poole et al., 2019; Chasnoff et al., 2005; Williams et al., 2013; Montag, 2016). Based on individualized assessment needs, prenatal care providers may choose to screen for other substances in pregnancy as well, which can be done using the 4Ps Plus, ASSIST (Alcohol, Smoking and Substance Involvement Screening Test), HSQ (Hospital Screening Questionnaire), PIP (Pregnancy Information Program), and SURP-P (Substance Use Risk Profile in Pregnancy) screening instruments.

The T-ACE is a four-item screening tool and was the first sensitive screen for risk drinking that was developed and validated for use in pregnant women screened in obstetric-gynecologic practice and assesses risk drinking, which was initially defined as the consumption of one or more ounces of alcohol per day while pregnant (Sokol et al., 1989). Both paper-based questionnaires and clinician-directed T-ACE question formats have been found to be acceptable and effective in screening (Chang et al., 2001). Notably, T-ACE assessments during pregnancy have been noted to be more useful than medical records in determining PAE (Montag, 2016) and have demonstrated the ability to predict neurobehavioral effects in children that are associated with PAE when the cut-off mark is changed to 3 points instead of the usual 2-point cut-off (Chiodo et al., 2010). The T-ACE has been

Table 1 Alcohol use screening instruments for pregnant women (all ages)

Screening tool	Number of items	Focus	Format(s)	Sensitivity (%) ^a	Specificity (%) ^a	References
Alcohol only						
T-ACE	4	Risk drinking	Clinician-directed; paper-based questionnaire	69–100	19–89	WHO, 2014b; Sarkar et al., 2010; Chang et al., 2001; Montag, 2016; Russell, 1994; Chiodo et al., 2010; Russell et al., 2016; Sokol, 1989; Chiodo, 2014
TWEAK	7	Risk drinking	Clinician-directed; paper-based questionnaire	59–100	36–83	WHO, 2014b; Sarkar et al., 2010; Montag, 2016; Russell et al., 1994; Russell et al., 1996; Dawson et al., 2005; Dawson et al., 2001
AUDIT-C	3	Alcohol use frequency and levels	Clinician-directed; paper-based questionnaire	18–100	71–100	WHO, 2014b; Lopez et al., 2017; Dawson et al., 2005; Montag, 2016; Sarkar, 2010; Seib et al., 2012; Bush et al., 1998; Bazzo et al., 2015
AUDIT	10	Alcohol use frequency and levels; risk drinking	Clinician-directed; paper-based questionnaire	7–87	86–100	WHO, 2014b; Lopez et al., 2017
CAGE	4	Risk drinking	Paper-based questionnaire	38–59	82–93	WHO, 2014b, Montag, 2016; Russell, 1996; Russell, 1994; Sokol, 1989; Chang et al., 2001; Burns et al., 2010
SMAST	13	Risk drinking	Paper-based questionnaire	7.5–15	96–98	WHO, 2014b; Chang et al., 1998
TQDH	10	Alcohol use	Clinician-directed	N/A	N/A	WHO, 2014b; Weiner et al., 1982
NET	3	Risk drinking	Paper-based questionnaire	24–71	86–99	WHO, 2014b; Burns et al., 2010; Russell et al., 1994
1-Question screen	1	Timing of last drink	Clinician-directed	97	98	Williams et al., 2013

Table 1 (continued)

Screening tool	Number of items	Focus	Format(s)	Sensitivity (%) ^a	Specificity (%) ^a	References
Alcohol and other substances						
4P's Plus	5	Any alcohol or tobacco use (past and pregnancy); risk drinking in partner, parents	Paper-based questionnaire	87–90	30–76	WHO, 2014b; Chasnoff et al., 2007; Chang et al., 2001; Coleman-Cowger et al., 2019
ASSIST	8	Any substance use; problematic use	Clinician-directed interview	67	36	WHO, 2014b; Coleman-Cowger et al., 2019; Hotham et al., 2013
SURP-P	3	Any substance use; problematic use	Paper-based questionnaire	48–65	68–85	WHO, 2014b; Coleman-Cowger et al., 2019; Yonkers et al., 2010; Ondersma et al., 2019
HSQ	18–40	Any substance use	Paper-based questionnaire	N/A	N/A	WHO, 2014b; Streissguth et al., 1992
PIP	~200	Any substance use	Computer-based questionnaire	N/A	N/A	WHO, 2014b; Lapham et al., 1991

^aRefers to detection rates of alcohol use in pregnant women, where available, at the traditional cut-off points

ASSIST Alcohol, Smoking, and Substance Involvement Screening Test, AUDIT Alcohol Use Disorders Identification Test, CAGE Cut down, Annoyed, Guilty, Eye-opener, HSQ Hospital Screening Questionnaire, NET Normal Drinker, Eye Opener, Tolerance, PIP Pregnancy Information Program, SMAST Short Michigan Alcohol Screening Test, SUD Substance use disorder, SURP-P Substance Use Risk Profile in Pregnancy, T-ACE Tolerance, Annoyance, Cut Down, Eye-opener, TQDH Ten Question Drinking History, TWEAK Tolerance, Worried, Eye-opener, Amnesia, K/Cut Down

shown to be more sensitive and specific than the Short Michigan Alcohol Screening Test (SMAST) and Alcohol Use Disorders Identification Test (AUDIT) with respect to identifying lifetime alcohol diagnosis, risk drinking, as well as current drinking (Chang et al., 1998).

The TWEAK is an effective five-item screening tool used to identify women who are at-risk drinkers and has been validated in a number of sub-populations, including individuals with alcohol use disorder (AUD) in treatment, patients in an outpatient setting, and the general population (Chan et al., 1993). There have been mixed results regarding the use of the TWEAK screening tool in different countries. In Denmark, the TWEAK was found to be useful when identifying high-risk drinking during pregnancy (Praestegaard et al., 2018). When screening for alcohol use disorder (AUD) among pregnant women in Argentina, the TWEAK was found to have low reliability and did not perform as well as the AUDIT in this setting (Lopez et al., 2017). Similarly, the reliability of the TWEAK was found to be higher when used in the USA as compared to Argentina or Mexico, though it had lower reliability than the AUDIT in all 3 countries (Cremonte et al., 2010).

The T-ACE and TWEAK are optimized for heavy drinking, and use of these tests alone may produce a screening strategy that is not as sensitive as the test properties when it comes to detecting individuals with lower levels of alcohol consumption during pregnancy (Chang et al., 2001; Montag, 2016). Between the T-ACE and TWEAK, the T-ACE was found to be more sensitive among special sub-populations of pregnant women (Montag, 2016). Notably, in a high SES sub-population, the TWEAK and T-ACE were found to have similarly high sensitivity (99–100% and 93–100%, respectively), but poor specificity (36–43% and 19–34%, respectively), when identifying problem drinking in a pregnant population (Sarkar et al., 2010). It has also been suggested that both the T-ACE and TWEAK may perform better at cut-off points of 3 (Sarkar et al., 2010) or when the threshold for risk drinking is redefined (Chang et al., 2001), and this improves clinical utility of these instruments in identifying PAE (Montag, 2016; Chang et al., 2001). Nonetheless, both the T-ACE and the TWEAK screening instruments are considered to be the most effective screening tools for risk drinking in pregnant women in most countries (Lichtenberger et al., 2016; Seo et al., 2016).

The AUDIT-C includes a total of 3 items that focus on very heavy alcohol exposure (Montag, 2016), which are taken from the 10-item AUDIT. The AUDIT-C captures alcohol use frequency and quantity (Freeman et al., 2019), though the items alone do not distinguish time points of alcohol use with respect to pre-pregnancy, pregnancy recognition, and during pregnancy time periods (Poole et al., 2019). The AUDIT-C has been validated for use in pregnant women (Graves et al., 2020; Chiodo et al., 2010; Lopez et al., 2017; Freeman et al., 2019; Montag, 2016) and is even recommended as a means to confirm PAE in the FASD diagnostic assessment using Australian diagnostic guidelines in the general population (Freeman et al., 2019). Though the AUDIT-C was validated for use in pregnant women, it has been found to be unreliable in assessing alcohol use during pregnancy in an obstetric setting in Italy (Bazzo et al., 2015) and other countries (Montag, 2016). If a score of 5 points or over is obtained with the administration of the AUDIT-C, the clinician is directed to administer the remaining 7 items of the AUDIT, which measure risk drinking behaviors and features of alcohol use disorders. The AUDIT is a commonly used tool to measure alcohol use behaviors in the general population (Poole et al., 2019) and has been evaluated in a number of cultural groups, settings, and countries (Burns et al., 2010; Seo et al., 2016). A recent meta-analysis has suggested, however, that the AUDIT may not generally perform as well in countries with low prevalence rates of AUDs, or in

women (Lange et al., 2019), which needs to be taken into consideration if all 10 items of the AUDIT are to be administered in an obstetric setting.

The CAGE (Cut down, Annoyed, Guilty, Eye-opener) is a four-item questionnaire examining problematic alcohol use, which has mixed results for identifying alcohol misuse in sub-populations globally. It may be superior to the TWEAK and T-ACE in identifying heavy alcohol use during pregnancy among women in Portuguese-speaking populations (Moraes et al., 2005), while other studies suggest it may be less effective in comparison to the TWEAK and T-ACE in other settings (Burns et al., 2010; Montag, 2016; Sarkar et al., 2010). The Short Michigan Alcohol Screening Test (SMAST) is a 13-item paper-based questionnaire, which can be used to examine alcohol use during pregnancy and lifetime alcohol dependence (Selzer, 1975; Chang et al., 1998). When used specifically in pregnancy, the SMAST has 7.5% sensitivity (Chang et al., 1998), which would indicate that the majority of women consuming alcohol during pregnancy would be missed with the use of this instrument. Both the CAGE and SMAST were not originally developed for use in pregnant women (WHO, 2014b; Montag, 2016), and the SMAST has been noted to perform poorly in prenatal alcohol use screening (Burns et al., 2010). Additionally, the CAGE may be less sensitive in women who are non-Caucasian or who belong to minority or disadvantaged populations (Montag, 2016).

The NET (Normal Drinker, Eye Opener, Tolerance) is a 3-item questionnaire which was developed for use in pregnant women (Burns et al., 2010) and captures risk levels of drinking (Bottoms et al., 1989; Burns et al., 2010; Chasnoff et al., 2007). Using a cut-off point of one or greater, the NET has high sensitivity (71%) and specificity (86%) (Russell et al., 1994); however, with one question asking women if they consider themselves to be a normal drinker, this tool may be particularly susceptible to social desirability bias among women who are currently pregnant. Furthermore, it does not specifically ask about alcohol use consumption levels or frequency, which is necessary to assess for risk of FASD, which means this tool is limited in detecting PAE.

A recently developed tool, the “1-Question screen,” can also be used to screen pregnant women for alcohol with only one clinician-directed question that assesses the timing of the last drink consumed. This questionnaire has been compared to the T-ACE and had a 94.7% rate of agreement (Williams et al., 2013). The 1-Question screen has the added benefit of saving clinicians’ time, which makes this less burdensome when considered for implementation on a population level (Williams et al., 2013).

The 4P’s Plus is a five-question screening tool that could be used to identify obstetrical patients at risk for alcohol, tobacco, and/or illicit drug use (WHO, 2014b) and capture exposure which occurred prior to pregnancy recognition, as well as any problematic alcohol and drug use among their parents and partner (Chasnoff et al., 2005). The 4P’s Plus screening tool has been validated in a low SES population in the USA and was found to have a sensitivity of 87% and specificity of 76% and reasonable reliability of 62% for a screening measure (Chasnoff et al., 2007). Furthermore, the 4P’s Plus screening tool is able to identify women who were consuming alcohol but were not considered “heavy drinkers” (Chasnoff et al., 2007), making this particularly useful in identifying FASD risk.

Several additional instruments are available to assess alcohol and other substance use in pregnancy, which include the ASSIST, the HSQ, the PIP, and SURP-P (WHO, 2014b) (see Table 1). With regard to detecting any substance use (not limited to alcohol), the sensitivity is fairly high for the 4P’s Plus (90.2%), ASSIST (79.7%), and SURP-P (92.4%) (Coleman-Cowger et al., 2019). While the ASSIST has high specificity (82.8%), the specificity of the 4P’s Plus and SURP-P is lower in comparison (29.6% and 21.8%, respectively) (Coleman-Cowger et al., 2019). Between these 3 instruments, clinicians tend to prefer the 4P’s Plus

to detect any substance use in pregnant women, as it is brief and easy to administer (Trocin et al., 2020). In comparison, the HSQ and the PIP are far more time-intensive, as these questionnaires have 18–40 items and 200 items, respectively (WHO, 2014b).

In terms of screening specifically for alcohol use during pregnancy, the evidence is mixed overall for the effectiveness of each of the identified instruments used across countries (WHO, 2014b; Sarkar et al., 2010; Lopez et al., 2017; Bazzo et al., 2015; Burns et al., 2010). The utility of the alcohol use screening tool is dependent on the alcohol use behavior that is being measured (i.e., risk drinking or any alcohol consumption). Prenatal care providers may choose to screen for risk drinking based on previous maternal self-report of alcohol consumption during pregnancy. Alternatively, care providers can immediately screen for any levels of alcohol use with the AUDIT-C or the 4Ps Plus instruments. The administration of any of the identified screening instruments (Table 1) would not require clinician training (WHO, 2014b) and would take less than 15 min to administer (Burns et al., 2010).

All countries with published obstetric guidelines on alcohol use in pregnancy indicate that the best option for women is to completely abstain from alcohol during pregnancy, including guidelines in Australia, Canada, Scotland, Sweden, Switzerland, the UK, and the USA (Furtwaengler et al., 2013; Whitehall et al., 2007; Graves et al., 2020; ACOG, 2011). Various practitioner guidelines may also recommend approaches to alcohol use screening with available instruments. In the USA, the American College of Obstetricians and Gynecologists (ACOG) recommend that all women seeking obstetric-gynecologic care should be screened for alcohol use yearly and within the first trimester of pregnancy (ACOG, 2011). The ACOG suggests that routine screening be done using simple and validated tools such as the T-ACE with additional questions that capture both quantity and frequency (ACOG, 2011). The US Preventive Services Task Force (USPSTF) found that the full AUDIT, the abbreviated AUDIT-C, and single-question screening had the best performance with respect to detecting alcohol misuse in adults, young adults, and pregnant women; therefore, the US Preventive Services Task Force (USPSTF) prefer these screening instruments (Moyer et al., 2013).

With respect to adolescents, the American Academy of Pediatrics (AAP) recommends that pediatricians screen all adolescent patients for alcohol used with a screening tool that has been validated in adolescents, such as the CRAFFT (Car, Relax, Alone, Friends/Family, Forget, Trouble), NIAAA Youth Alcohol Screen, or Brief Screener for tobacco, alcohol, and other drugs (BSTAD) (AAP, 2015). Though these tools are not specifically validated for use in pregnant adolescent girls, they are useful in identifying substance use issues in a sub-population at heightened risk of unplanned pregnancies and therefore alcohol-exposed pregnancies (AAP, 2015).

Within Canada, the Society of Obstetricians and Gynecologists of Canada (SOGC) recommends a structured approach to screening (Graves et al., 2020). The first level of screening involves approaches that are practice-based including the single question method, motivational interviewing, and supportive dialogue (Graves et al., 2020), which are the basis for the majority of data on alcohol use behavior available in Canadian birth registries (Poole et al., 2019). The second level of screening includes recommended screening instruments, such as the AUDIT-C or T-ACE for adults or the CRAFFT for adolescent populations (Graves et al., 2020). The use of other evidence-based tools, such as the TWEAK or CAGE, is also suggested, with the recommendation to pair all administered screening tools with access to brief interventions for alcohol use during pregnancy (Graves et al., 2020).

The World Health Organization (WHO) recommends that healthcare providers discuss both past and present alcohol and substance use with all pregnant women as early in the pregnancy as possible and at every prenatal visit (WHO, 2014b).

Level 3. Laboratory Screening Tools for PAE

Maternal self-report will generally always underestimate alcohol consumption during pregnancy (Lange et al., 2014). The third level of alcohol use screening is the use of laboratory-based screening tools used to measure PAE via ethanol biomarkers (e.g., fatty acid ethyl esters) found in blood, maternal and neonatal hair, placenta, cord blood, and meconium. The decision to screen at this level, however, may be indicative of previously identified alcohol use risk behavior using other measures, including maternal self-report. One of the major drawbacks of this method is its being significantly more resource intensive as compared to routine screening based on self-report.

There are several ethanol blood biomarkers, which can be extracted from neonatal cord blood or maternal blood samples. Based on a narrative synthesis of PAE screening measures, it was found that using blood biomarkers alone had lower sensitivity and specificity and were less useful in assessing low to moderate levels of alcohol use during pregnancy, as compared to maternal self-report (Howlett et al., 2017). Generally, the testing of blood and urine samples is ineffective in detecting PAE overall, as it only captures recent alcohol use relative to the time of the sample (Joya et al., 2012). Similarly, the use of a breathalyzer administered during prenatal care visits was identified as an effective means to detect and quantify alcohol use during pregnancy in all 3 trimesters, among women in the Republic of Congo (Greenmyer et al., 2020a), but this would only capture alcohol use levels at the time of the prenatal care encounter.

The testing of meconium, or an infant's first few bowel movements, is considered the gold standard for assessing PAE. Meconium testing produces estimates that are 4 times higher as compared to self-report (Lange et al., 2014); however, meconium testing only captures PAE which occurred in late stages of pregnancy and likely identifies continuous drinking through pregnancy and therefore may miss many cases of PAE, especially pregnancies with early, light exposure. In addition to meconium testing, the analysis of maternal or neonatal hair is commonly used to establish PAE (Chan et al., 2004; Joya et al., 2012). There are several emerging technologies for additional biomarkers of PAE, including ethyl glucuronide, which has high sensitivity (82%) and specificity (75%) (Himes et al., 2015), as well as neonatal dried blood spots (Bakhireva et al., 2012) and placental tissue (Matlow et al., 2012; Shukla et al., 2011), for which the clinical utility is yet to be established.

Improving Detection and Prevention of PAE

Practitioner adherence to obstetric guidelines for alcohol use screening may vary across countries due to several factors. For example, numerous studies have identified time constraints or competing priorities of prenatal care providers as being a barrier to screening for alcohol use among pregnant women during visits (Wangberg et al., 2015; Chiodo et al., 2010; France et al., 2010; Doi et al., 2014; Doi et al., 2015). Qualitative research has also identified the lack of training among primary care providers as a barrier to engaging in

conversations with pregnant women about their alcohol use (Wangberg et al., 2015; Chiodo et al., 2019; Taylor et al., 2007; Wouldes et al., 2009). Furthermore, healthcare providers may be deterred from screening for alcohol use based on the perceived lack of an available, validated screening tool and feelings of general discomfort in screening women (Oni et al., 2020). Improved training would be an important step to improve the PAE and FASD knowledge base and skills in screening among prenatal care providers including physicians, obstetricians, gynecologists, and midwives. Such training is also crucial for prenatal care providers involved in programs serving pregnant and postpartum women, such as the “Women, Infant and Child” (WIC) program, a widely utilized US federal program that provides supplemental foods, healthcare referrals, and nutrition education for low-income pregnant, breastfeeding, and non-breastfeeding postpartum women (Richards et al., 2010).

Recognition and medical confirmation of pregnancy may occur later for some women, at which point there may have already been significant levels of PAE. This may be influenced by unplanned pregnancies, which constitute a major roadblock in preventing alcohol use during pregnancy. An estimated 44% of pregnancies worldwide are unplanned, with rates even higher (up to 65%) in developing countries (Bearak et al., 2018). Pregnancy planning may also affect the timing of first access to prenatal care, where prenatal care providers can screen and identify alcohol use patterns during the first and subsequent encounters. Notably, in Canada, an alcohol-exposed pregnancy was found to be associated with lesser odds of an optimally timed prenatal ultrasound compared to pregnancies that were not alcohol-exposed (OR: 0.69; 95% CI: 0.53–0.90) (Abdullah et al., 2019). Furthermore, women experiencing violence (Cha et al., 2014; Jamieson et al., 2020) or those with mental health (Kim et al., 2005; Krans et al., 2013) or addiction issues (Roberts et al., 2010a) may have a delayed onset of utilization of prenatal care or may have limited access to prenatal care, especially if living in rural or remote communities (Simkhada et al., 2008). As these characteristics are also associated with an increased risk of alcohol use during pregnancy (Skagerstrom et al., 2011), this means that prenatal care providers may miss the opportunity to identify and address alcohol use during pregnancy among women who may be more prone to having alcohol-exposed pregnancies or which patients have a heightened need for access to brief interventions. It is also important for clinicians to recognize that PAE and FASD are typically recurrent in families and the provision of effective interventions for women at risk can prevent PAE in subsequent pregnancies and thus prevent future cases of FASD.

Research demonstrates that pre-pregnancy alcohol use patterns can significantly predict alcohol use during pregnancy; therefore, it is very important in screening for PAE (Skagerstrom et al., 2011; Montag, 2016; McQuire et al., 2020). Furthermore, alcohol use behaviors during pregnancy may be influenced by pre-existing beliefs and knowledge regarding the teratogenic effects of alcohol and FASD awareness (Nilsen et al., 2008; Watt et al., 2016; Williams et al., 2011). Globally, it may be viewed as more socially acceptable to drink alcohol during pregnancy in some countries, especially if healthcare providers themselves are not trained in the field of FASD. In countries with large-scale efforts to address FASD, however, there may be greater awareness of the harms of alcohol use during pregnancy, which may create stigma and underreporting of such behavior if it does occur (Watt et al., 2016). Stigma impacts maternal self-report in this case, even if prenatal care providers do sensitive and thorough screening for alcohol use during pregnancy. There is a significant level of stigma around substance use during pregnancy in general, which may deter pregnant women from reporting their consumption (Roberts et al., 2010a).

In addition to stigma, alcohol use screening may have important legal implications in some countries, depending on laws related to substance use during pregnancy and prenatal injuries/maltreatment, which may also impact maternal self-report (Denison et al., 2014; Stone et al., 2015). Alcohol use screening measures, such as meconium testing, may be linked to the involvement of child protective services and temporary or permanent custody loss in some cases (Motherisk Commission, 2018) and therefore should be exercised with extreme precision and caution. The issue of child apprehension is related to health equity, which is demonstrated by the over-representation of certain sub-populations of women with children in the child welfare systems in North America (Denison et al., 2014; OHRC, 2018; Allan et al., 2015). These systems have been criticized for being discriminatory against Indigenous and Black communities (OHRC, 2018; Allan et al., 2015). This is especially important to note in the practice of alcohol use screening as this may be related to the over-screening of certain sub-populations in the prenatal care setting, while the general population in these communities may be simultaneously under-screened (Greenmyer et al., 2020b). Furthermore, fears of child apprehension may lead to limited utilization of healthcare (Denison et al., 2014) and underreporting of alcohol use during pregnancy. This, in turn, may result in underutilization of substance use disorder treatment, and the lack of screening may exclude women from access to brief interventions on alcohol use during pregnancy.

To minimize maternal underreporting of alcohol use in pregnancy, prenatal care providers can build rapport with their clients as they assess for alcohol use at multiple timepoints throughout the pregnancy, as this will increase the validity of maternal self-report (WHO, 2014b; Doi et al., 2014). While underreporting may still occur, there is great value in screening by simply asking pregnant women about alcohol use, as this has been proven to result in greater awareness or altering of alcohol use behavior in pregnancy (Floyd et al., 2007; Tzilos et al., 2011). Furthermore, studies on pregnant women's perspectives show that screening for the use of alcohol is found to be acceptable during pregnancy (Roberts et al., 2010b; Toquinto et al., 2020). It is important for prenatal care providers to maximize the trust relationship, ensure a judgment-free environment, and conduct at least the first level of screening for pregnant women using alcohol and other substances.

The benefit of screening pregnant women for alcohol use is the capacity to facilitate access to brief interventions for women with identified alcohol-exposed pregnancies, to anticipate deliveries with increased complexity, and to identify newborns with increased risk for placement in the NICU, increased mortality risk, and those in need of developmental support or supervision. Evidence suggests brief interventions, such as educational, motivational interviewing or cognitive-behavioral interventions, are effective in reducing alcohol intake or rates of abstinence from alcohol during pregnancy when led by healthcare providers and community leaders, in individual and group settings, including computer-delivered formats (O'Connor et al., 2018). Such interventions must be designed and implemented in light of the context of PAE among women that may participate in them, including pregnancy history, intergenerational trauma and discrimination, or child apprehension (Denison et al., 2014; Stone et al., 2015; OHRC, 2018; Allan & Smykie, 2015).

Pregnant women deemed at risk can be referred to tailored interventions such as the parent-child assistance programs (PCAP), for example, which counsel pregnant women at risk of alcohol and drug-exposed pregnancies (Rasmussen et al., 2012; Thanh et al., 2015). This PCAP model has been proven to be cost-effective and effective in preventing cases of FASD in children among mothers at high-risk of alcohol exposed pregnancies,

including mothers with FASD (Thanh et al., 2015). The PCAP model has been adopted in numerous locations in North America (Thanh et al., 2015) and is one example of an intervention that addresses the context of alcohol use during pregnancy for the targeted sub-population in a supportive manner (Pei et al., 2019). Another example is a very low cost, in-office pictorial intervention program for alcohol use in pregnancy that was developed and tested in the same communities in the Congo, which continues to be studied as a model for sub-Saharan countries (Williams et al., 2014). Furthermore, participation in programs such as the WIC in the USA can increase utilization of prenatal care among women at risk of alcohol-exposed pregnancies (Richards et al., 2010), which indirectly facilitates the detection and prevention of PAE.

Limitations

The current narrative review provides important implications for clinical practice, which must be understood within several existing limitations. First, the current review did not use specific inclusion or exclusion criteria for studies on current screening practices and tools. Second, the findings in this review are limited to the studies with data on current provider practices in high-income countries, which may not be an accurate depiction of screening practices globally. Additionally, there may be other effective screening strategies or tools currently being pilot-tested for which there is insufficient data or data that are yet to be published.

Conclusions and Recommendations

PAE screening stands to greatly benefit all women who consume alcohol prior to pregnancy, and it is one of the most important public health initiatives to prevent FASD. As such, alcohol screening should be mandatory and implemented consistently among all prenatal care providers. All prenatal care providers, including physicians, obstetricians, midwives, and nurses, must be trained in FASD prevention and must have the capacity to inform and advise pregnant women about the risks of alcohol use in pregnancy.

Prenatal care providers must carefully choose the alcohol use screening level based on individualized needs, such as the cultural context, pre-pregnancy alcohol use patterns, health status history, and the resources required to implement the screening measure. The evidence is mixed regarding the implementation of the first level of screening, with great variations across countries and provider types. If simply asking about alcohol use in pregnancy has the potential to change alcohol use behavior (Floyd et al., 2007; Tzilos et al., 2011), it is imperative that prenatal care providers take this opportunity. As patterns of alcohol use in the post-partum period tend to return to pre-pregnancy levels (Leggat et al., 2021), care providers can also use screening as a time to inform and advise women about the risks of alcohol use during breastfeeding, including impaired cognitive development of the infant (Gibson et al., 2018). Furthermore, consistent PAE screening will result in better data in population-based birth registries, which will allow researchers to measure the true prevalence of PAE and to design, implement, and evaluate PAE interventions over time.

There are also several evidence-based alcohol use screening instruments that have been validated as a means to screen for PAE: the AUDIT-C, 1-Question screen, and 4Ps Plus

that measure any alcohol use and instruments such as the TWEAK, T-ACE, and CAGE which measure problematic use and risk drinking. Further research must be conducted to validate other existing screening instruments in pregnant women, in various cultural groups and settings. Prenatal care providers can choose from the recommended instruments based on their respective practitioner guidelines, while keeping in mind that any level or type of alcohol use in pregnancy can be harmful and therefore should be detected. All alcohol use screening of pregnant women must be done with care and precision and in a non-judgmental way, as these results may have important implications for child health.

Women who are at risk for, or have reported, alcohol-exposed pregnancies should be referred for a diagnostic assessment and further specialist treatment if needed or offered a brief intervention aimed at achieving alcohol abstinence or, at the very least, reducing alcohol intake as much as possible. It is important to facilitate the design and implementation of appropriate interventions for women at risk of alcohol-exposed pregnancies. Prenatal care providers must be knowledgeable about the existing interventions in their communities that can offer supportive services to promote healthy behaviors into the postpartum period.

It is crucial for prenatal and other healthcare providers to provide a clear, evidence-based message for women about the risks of alcohol use in pregnancy, including FASD. As pre-pregnancy levels and beliefs about alcohol use can influence alcohol consumption in pregnancy, care providers must actively refute any common misconceptions, such as the idea that one drink per day is not known to be harmful. Providers should encourage all women to avoid consuming any alcohol throughout their pregnancy and while trying to become pregnant, emphasizing the benefits of doing so to the health and well-being of the mother and child.

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Declarations

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