Prenatal Substance Use and Perceptions of Parent and Partner Use Using the 4P's Plus Screener

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Abstract

Background—Prenatal substance use screening is recommended. The 4 P's Plus screener includes questions on perceived problematic substance use in parents and partner that are not considered in risk stratification.

Objectives—This research examined the: (1) prevalence of self-reported problematic parental and partner substance use and associations with biochemically-verified prenatal substance use; (2) utility of self-reported perceptions of parent/partner substance use as proxies for prenatal substance use; and (3) degree to which the sensitivity of the 4P's Plus can be augmented with consideration of parent/partner questions in risk stratification.

Methods—A convenience sample of 500 pregnant women was recruited between January 2017 and January 2018. Participants completed the 4P's Plus and provided urine for drug testing. Diagnostic utility of problematic parent/partner substance use questions was assessed, then compared to the 4P's Plus used as designed, and to the 4P's Plus used with these 2 questions included in risk stratification.

Results—Half (51%) of respondents reported either partner or parental problematic substance use. When partner or parent problematic substance use were considered as proxies for prenatal substance use, sensitivity was 65% and specificity was 55%. When used as intended, sensitivity was 94% and specificity was 29%. Including partner/parent questions increased sensitivity to 96% but lowered specificity (19%). Partner substance use and combined partner/parent use were associated with prenatal substance use [adjusted odds ratio (aOR): 2.0 (1.2, 2.4; p = 0.006); aOR= 1.6 (1.1, 2.5, p = 0.04)].

Conclusions for Practice—Sensitivity of the 4P's Plus may improve with inclusion of self-reported problematic partner/parent substance use items in risk stratification.

Keywords

Introduction

Substance use during pregnancy is associated with a variety of negative health effects. (Havens et al. 2009; NIDA 2017a, b). Despite these health risks, substance use during pregnancy is not uncommon in the United States (Coleman-Cowger et al. 2018a, b; Oga et al. 2018; SAMHSA 2013), and 2017 data from the National Survey on Drug Use and Health indicates a concerning upward trend over the past 2 years with respect to use of illicit drugs (SAMHSA 2018). At present, approximately, 20% of pregnant women aged 15–44 years old reported use of illicit drugs, tobacco products, or alcohol. (Ahrnsbrak et al. 2017) Early detection of substance use in pregnancy is important to protect the developing fetus from potentially harmful exposures in utero (Forray 2016).

While available screening data on prenatal drug use indicate a public health problem, such numbers are likely underestimated given the stigma and risk of legal consequences associated with reporting substance use during pregnancy (Kelly et al. 2001). To better identify women who may benefit from additional education and intervention, The American College of Obstetricians and Gynecologists (ACOG) recommends universal drug screening in pregnancy. Though no standard recommended screening tool exists, the 4P's Plus (parent, partner, past, pregnancy) is a well-recognized screener that has been validated with pregnant women. The 4P's Plus asks about perceptions of problematic substance use in parents and partner, and substance use by the respondent, both pre- and within-pregnancy (Chasnoff et al. 2007).

Substance use during pregnancy has been associated with several factors, including the woman's pre-pregnancy substance abuse, as well as the substance use of her parents and partner (Chambliss 2008; Chang et al. 2006; Chasnoff et al. 2001; Flynn and Chermack 2008; Gilman et al. 2008; Harrison and Sidebottom 2009; Hutchins and Dipietro 1997; Olsen 1993; Skagerstróm et al. 2011). However, no published studies have looked at the association between a pregnant woman's *perceptions* of problematic parent or partner substance use and her substance use during pregnancy. Perception of problematic substance use differs from actual substance use, and risk perception in general has been shown to be significantly associated with substance (Grevenstein et al. 2015). A re-examination of factors associated with prenatal drug use is needed, given the current climate of increasing marijuana, stimulant, and opioid use during pregnancy (Anderson et al. 2018; Brown et al. 2017; Rudd et al. 2016).

To address the problem of underreporting prenatal drug use, the 4P's Plus questionnaire begins with two innocuous questions—one asking about perception of problematic parent use, and the second about problematic partner use—with the aim of easing women into a conversation before introducing the primary subject of substance use during the current

pregnancy (NTI Upstream 2011). In the conventional use of the 4P's Plus, the responses to these primer questions, by design, are not considered in the risk stratification into high vs. low risk of prenatal drug use (NTI Upstream 2011).

Chasnoff et al. found during the validation of the 4P's Plus using routinely collected clinical data for 2002 pregnant women who were Medicaid-eligible that the first two questions on perceptions of problematic parent and partner use did not predict prenatal drug use (NTI Upstream 2011). Beyond this one study conducted in the states of Washington and South Carolina, though, no other studies have examined the potential utility of the first two questions on perceptions of problematic parent and partner substance use. Given that the study in question utilized data from pregnant women of low socioeconomic status, and a population with prenatal substance use prevalence of 9%, substantially lower than the 20% currently estimated nationally, further examination of the utility of these the parents and partner questions of the 4P's Plus, beyond serving as primers for a conversation on prenatal drug use, is warranted (Ahrnsbrak et al. 2017; NTI Upstream 2011). Since the initial validation of the 4P's Plus, several publications have examined the screener but none have conducted comprehensive sensitivity and specificity analyses with biochemical verification, including testing the utility of the primer questions as proxies for drug use, such as those performed herein (Calvo et al. 2010; Chasnoff et al. 2007, 2005, 2001; Jones 2005).

Given the challenges associated with screening for prenatal drug use, including but not limited to, under-reporting due to stigma or fear of legal consequences, these indirect probing questions could potentially serve as a proxy for prenatal drug use if shown to correlate strongly with substance use. Beyond serving as proxy questions for detecting substance use, incorporating the responses to these questions as indicators could detect substance use that may be missed by more direct questions regarding substance use and thus improve the overall sensitivity of screener.

Our study aims to utilize the 4P's Plus screener for three purposes: (1) to examine the prevalence of self-reported problematic parental and partner substance use and the associations with substance use during pregnancy; (2) to evaluate the utility of self-reported perceptions of parental and partner substance use as proxies for prenatal drug use; and (3) to quantify the degree to which the sensitivity of the screener can be improved if self-reported problematic parental and partner substance use are included in the evaluation of screening results. The addition of questions about perception of problematic parent and partner substance use to grading of the 4P's Plus could add vital information to the screener and aid in better detection of prenatal substance use, and in evaluating correlates of substance use in the current pregnancy.

Methods

Our study was part of a larger study conducted at 2 urban prenatal clinics. A detailed methodological report has been published elsewhere (Coleman-Cowger et al. 2018a, b). In brief, data for study were collected between January 2017 and January 2018 and a total of 500 pregnant women presenting for prenatal care appointments were enrolled. Inclusion

criteria were: (1) age 18 years or older; (2) speak and understand English well enough to provide informed consent; and (3) currently pregnant.

Procedure

Potentially eligible women were identified from the appointment rosters by research staff. Study research assistants approached these women in the waiting area before their appointment. All pregnant women, irrespective of trimester, who met the inclusion criteria, were approached. If a participant was interested, the study staff coordinated with the clinic staff to determine the appropriate time to engage the participant in the study; often this was done before the participant met with her obstetrician. Once timing was coordinated, study staff obtained informed consent in a private room. Participants completed the 4P's Plus (interviewer administered and entered directly into an iPad) and then provided a urine sample that was tested on-site for drugs (opioids, methamphetamines, cocaine, marijuana, benzodiazepines, barbiturates and tricyclic antidepressants) with Alere iCup® point of care testing.

Measures: The 4P's Plus

The 4P's Plus is a validated screener for prenatal drug use designed by Chasnoff et al. (2007). The questionnaire was administered to all 500 enrolled pregnant women and opens with the following primer questions:

Did Either of Your Parents Have Any Problems with Drugs, Marijuana or Alcohol?

Does Your Partner Have Any Problem with Drugs, Marijuana or Alcohol?—The
intent of these 2 questions is to prime the participant for the more direct questions that follow. The questionnaire then continues with questions about ever use of alcohol, and any substance use in the month before the participant knew she was pregnant. An affirmative response to these questions is followed up with questions probing the quantity of use in the past month. Our analysis utilizes responses from the first 2 questions (about parent and partner substance use); comparing to responses from the other questions in the 4P's Plus to assess prevalence and diagnostic validity.

Analysis

As part of our study sample description, participant characteristics were compared by self-reported problematic parent and partner substance use, using student's t-test for continuous variables and Fisher's Exact and Chi-Square tests, as appropriate, for nominal variables. We calculated the sensitivity and specificity of the primer questions on problematic parent and partner substance use. We did this to examine the potential of these questions, considered singly or in combination, to serve as proxy for detecting prenatal drug use. We then compared diagnostic validity between the 4P's Plus when used as designed, i.e., without consideration of the primer questions on partner and parent substance use; and the 4P's Plus used with these 2 questions included in risk stratification. Urine drug testing was used as reference (gold) standard. The above described analyses of diagnostic validity were carried out in the following sequence: (1) self-reported problematic partner use as a single screening question; (2) self-reported problematic parent use as a single screening question; (3) self-

reported partner and/or parent use as screening questions; (4) 4P's Plus screener used conventionally; and (5) 4P's Plus screener with the inclusion of parent and partner use in risk stratification.

For diagnostic validity we computed: sensitivity, the probability that a woman who is using drugs while pregnant is positive on the screen; specificity, the probability that a woman who is not using drugs while pregnant is negative on the screen; positive predictive value (PPV), the probability that a woman with a positive screening is using drugs while pregnant; and negative predictive value (NPV), the probability that a woman with a negative screening is not using drugs while pregnant.

We conducted a logistic regression analysis to explore the associations between perceptions of partner/parent substance use and biochemically verified drug use in current pregnancy. For covariate selection for the multivariable regression models, we utilized a stepwise selection approach to identify independent variables to be added to the model. Forward selection method was utilized for covariate selection, and covariates were added to the model one at a time and all covariates with p-value < 0.1 were added to the final model. For the multivariable regression models, self-reported smoking and alcohol use were considered as covariates even though these can be considered "substance use" in the strictest sense. Our dependent variable was biochemically verified drug use based on a urine drug screen which did not include biologically testing for metabolites from smoking or alcohol use. Our main independent variable ("exposure") was self-reported problematic partner use for the first model, self-reported problematic parent use for the second model and self-reported problematic parent and/or partner use for the third model. As such, our multivariable regression models covaried self-reported smoking/alcohol use and biologically verified drug use—opioids, methamphetamines, cocaine, marijuana, benzodiazepines, barbiturates and tricyclic antidepressants. For all results, p values of 0.05 or lower were considered statistically significant. Statistical analyses were conducted with STATA version 13.

Ethics and Dissemination

The study was approved by the Institutional Review Boards of the University of Maryland, Baltimore (HP-00072042); and Battelle Memorial Institute (0619-100106433). All participants gave their informed consent prior to engagement in any study procedure. The study was conducted in accordance with the ethical standards stipulated by 1964 Helsinki Declaration and its subsequent amendments.

Results

Demographic Characteristics

Of the 500 women consented and enrolled, 5 were excluded from analysis for missing data on the 4P's Plus or urine drug screen. Table 1 presents data on demographic characteristics by responses to the first 2 questions on the 4P's Plus. Exploring sample characteristics by self-reported problematic partner substance use, participants differed meaningfully by marital status, employment status, educational achievement, race, smoking status and pregnancy intention (i.e., whether the pregnancy was planned) (Table 1). Similarly, for self-

reported problematic parent substance use, participants differed by marital status, employment status, race, smoking status and pregnancy intention (Table 1).

Prevalence of Self-Reported Problematic Parent and Partner Substance Abuse

Prevalence of self-reported problematic partner substance use was 20%, whereas prevalence of problematic parental substance use was 45% (Table 2). Fifty-one percent (51%) reported either partner or parental problematic substance use. Overall, 27% of pregnant women tested positive on a urine test for prenatal drug use.

Diagnostic Validity of Problematic Parent and Partner Substance Abuse

Table 2 shows diagnostic validity of self-reported problematic partner and parent substance use with urine drug screens as Reference Standard. When self-reported problematic partner substance use was considered as a proxy for prenatal drug use, we found sensitivity of 35% and specificity of 85%. For self-reported problematic parent substance use, sensitivity was 57% and specificity was 60%. Using either parent or partner substance use as proxy, sensitivity was 65% and specificity was 55%. For the 4P's Plus used as intended without the 2 questions on parent or partner substance use, sensitivity was 94% and specificity was 29%. When self-reported problematic partner or parent substance use were considered in addition to traditionally evaluated responses on the 4P's Plus, we obtained a combined sensitivity of 96% and specificity of 19%.

Multivariable Analysis of Factors Associated with Substance Use in Women who Report Problematic Parent and Partner Substance Abuse

Table 3 shows results of logistic regressions. Self-reported problematic partner substance use was associated with prenatal drug use, odds ratio (OR) of 2.9 (95% CI 1.8, 4.5). Parent substance use was associated with prenatal drug use, OR of 2.0 (1.8, 3.0). Self-report of either partner or parent use was associated with prenatal drug use, OR of 2.3 (1.5, 3.5). After adjusting for smoking, race, trimester, marital status, employment and education using multivariable logistic regression models, partner substance use remained associated with prenatal drug use with an adjusted odds ratio (aOR) of 2.0 (1.2, 2.4). Parent substance use was no longer associated with prenatal drug use, aOR of 1.4 (0.9, 2.2). When combined, partner or parent use was associated with drug use in multivariable analyses, aOR of 1.6 (1.1, 2.5).

Discussion

Results from our study indicate that among a convenience sample of pregnant women presenting for prenatal care at one of two urban sites, self-reported perception of problematic partner and parent substance use is high. Over half of women reported either problematic parent or partner use or both. We also found that the rate of substance use within the studied population was high with positive urine drug tests for 27% of our sample.

The 4P's Plus performed moderately better in this population compared to the original validation in terms of sensitivity and false negative rates but not negative predictive validity even though both were satisfactorily high (NTI Upstream 2011). The low specificity of the

screener in both instances - when used conventionally and when the primer questions were included in risk stratification (29 and 19% respectively)—is somewhat unsurprising, given the high prevalence of substance use in our sample. Neither of the partner/parent questions performed well enough independently to warrant use as a proxy screener but adding these questions to the risk stratification using the 4P's Plus moderately improves the sensitivity, false negative rate, and negative predictive validity. In settings where these factors are more important, for example, high-risk settings in which a false alarm (false positive) is less concerning than a "missed diagnosis" (false negative), the expanded screener could be considered such that a positive response to the partner/parent questions would warrant further exploration of potential maternal substance use.

Both self-reported partner and combined parent and partner problematic use were correlated with maternal (prenatal) substance use. These findings are in alignment with previous reports of correlation between partner substance use and use during pregnancy (Chang et al. 2006; Hutchins and Dipietro 1997; Passaro et al. 1998). Parental use alone did not correlate with maternal substance use when controlling for other risk factors. One possible reason is that quality of parental relationships varies widely (for example some may or may not have contact or meaningful relationships with their parents), but a partner relationship is usually more recent and a more deliberate choice. Perhaps women who chose to initiate or stay in relationships with partners who use drugs could potentially view drug use less negatively when compared to women who are not in intimate relationships with persons who use drugs.

The initial intention of adding partner and parent questions to the 4P's Plus screener was to serve as a primer to improve self-report in the screening questions regarding patient use. The improvement in validity of the screening test when adding these questions to the interpretation was not remarkable, but the prevalence of self-reported problematic parental and partner substance use was significant; and self-reported problematic partner substance use predicted drug use in pregnancy in both bivariable and multivariable analyses adjusting for relevant potential confounders.

The increased likelihood of other comorbidities such as mental health disorders or intimate partner violence (IPV) with parental and partner substance abuse indicates that these questions may have utility beyond acting as primers or aiding in the identification of maternal substance use. (Boden et al. 2012; Chasnoff et al. 2007; Mason et al. 2017; Straussner and Fewell 2018). Given the association between history of maternal trauma and stress with poor pregnancy outcomes (Cook et al. 2018; Glover 2014, Su et al. 2015), further investigation to determine maternal and child outcomes in women who report problematic partner or parent substance use in the absence of maternal substance use is warranted. Although our study did not address the sensitivity or specificity of these questions to identify other comorbidities, providers may wish to consider follow up screening questions regarding IPV and mental health disorders when women screen positive on the first two questions, regardless of the ultimate determination regarding their substance use.

Screening for maternal substance use is often focused on protecting the child from toxic exposure in utero. However, given that substance use by either parent or any caretaker can lead to negative consequences for the child after birth (Barnard and McKeganey 2004),

consideration to universal screening for substance use for any members of the house-hold may be warranted to improve child safety, especially in high prevalence settings such as the studied population.

It is important to note that the 4P's Plus is a screening rather than a diagnostic tool, and a positive screen is not necessarily indicative of maternal substance use. Given the potential legal implications of a positive drug screen in pregnancy, care should be taken to ensure that positive screening tests are not over interpreted or used to label or punish women (Terplan and Minkoff 2017). The purpose of screening is to assist clinicians in identifying individuals who may be at higher risk of substance use so that additional questions can be asked, and appropriate intervention and/or education offered. The ultimate goal of antenatal drug screening is to improve maternal and neonatal health outcomes through supportive approaches rather than punitive ones.

Our study is not without limitations. First, the screener asks about perceptions of problematic partner and parent drug use rather than actual partner and parent drug use. Also, it is unclear whether perception of problematic use is a better predictor of prenatal substance use than partner/parent use itself as our study was unable to determine actual use in parents and partner. Second, we utilized a large convenience sample, which consisted of a high percentage of African-American and unemployed women. These characteristics are often considered to be high-risk factors for prenatal substance use; thus, our results may not be generalizable to other populations. Despite these limitations, we believe our study offers important insight into the associations between perception of problematic partner and parent substance use and maternal substance use. A strength of our work is reliance on biochemically verified substance use rather than self-report to more accurately capture maternal substance use. Future research should further examine problematic partner use, how it aligns with actual partner substance use, and how prenatal care interventions can address partner use within the context of maternal substance use.

Acknowledgements

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Table 1

Sample characteristics by responses to the questions problematic parent or partner substance use on the 4P's plus, n = 495

	4P's plus question on partner substance use			4P's plus question on parent substance use		
	Yes	**No**	**p-value**	**Yes**	**No**	**p-value**
Age, n (%)						
18–25 years	37 (35.9)	134 (34.2)	0.74	77 (34.5)	94 (34.6)	0.99
26 years and above	66 (64.1)	258 (65.8)		146 (65.5)	178 (65.4)	
Marital status, n (%)						
Never married	80 (78.4)	240 (61.9)	0.002 *	161 (73.2)	159 (58.9)	0.001 *
Ever married	22 (21.6)	148 (38.1)		59 (26.8)	111 (41.1)	
Employment, n (%)						
Unemployed	50 (49.5)	114 (29.7)	< 0.001 *	79 (36.6)	85 (31.6)	0.25
Employed	51 (50.5)	270 (70.3)		137 (63.4)	184 (68.4)	
Education, n (%)						
Less than high school	18 (17.7)	23 (5.9)	< 0.001 *	29 (13.2)	12 (4.5)	< 0.001 *
High school/some college	73 (71.6)	232 (60.0)		155 (70.5)	150 (55.8)	
College graduate or more	11 (10.8)	132 (34.1)		36 (16.4)	107 (39.8)	
Race/ethnicity, n (%)						
Non-Hispanic White	11 (10.8)	93 (23.9)	0.005 *	31 (14.0)	73 (27.0)	0.001 *
Black/African American	87 (85.3)	263 (67.6)		177 (80.1)	173 (64.1)	
Hispanic	0 (0.0)	5 (1.3)		2 (0.9)	3 (1.1)	
Other	4 (3.9)	28 (7.2)		11 (5.0)	21 (7.8)	
Trimester, n (%)						
1st Trimester	29 (28.4)	121 (31.0)	0.18	69 (31.2)	81 (29.9)	0.60
2nd Trimester	43 (42.2)	127 (32.6)		80 (36.2)	90 (33.2)	
3rd Trimester	30 (29.4)	142 (36.4)		72 (32.6)	100 (36.9)	
Smoking status, n (%)						
Smoker	32 (31.1)	52 (13.3)	< 0.001 *	55 (24.7)	29 (10.7)	< 0.001 *
Quitter	13 (12.6)	45 (11.5)		34 (15.3)	24 (8.9)	
Nonsmoker	58 (56.3)	294 (75.2)		134 (60.1)	218 (80.4)	

Pregnancy intention, n (%) wanted to be pregnant

	4P's plus question on partner substance use			4P's plus question on parent substance use		
	Yes	No	p-value	Yes	No	p-value
Sooner	13 (12.8)	70 (18.0)	0.004 *	43 (19.5)	40 (14.8)	0.003 *
Later	47 (46.1)	137 (35.2)		86 (38.9)	98 (36.3)	
Then	23 (22.6)	142 (36.5)		57 (25.8)	108 (40.0)	
Did not want to be pregnant	19 (18.6)	40 (10.3)		35 (15.8)	24 (8.9)	
Self-reported alcohol use in pregnancy, n (%)						
No use	77 (74.8)	322 (82.1)	0.09	174 (78.0)	225 (82.7)	0.20
Use	26 (25.2)	70 (17.9)		49 (22.0)	47 (17.3)	
No of prior pregnancies, n (%)						
0–4	67 (65.1)	298 (76.0)	0.02 *	150 (67.3)	215 (79.0)	0.003 *
5 +	36 (35.0)	94 (24.0)		73 (32.7)	57 (21.0)	
No of births, n (%)						
0–4	83 (80.6)	276 (70.4)	0.04 *	174 (78.0)	185 (68.0)	0.01 *
5 +	20 (19.4)	116 (29.6)		49 (22.0)	87 (32.0)	

*
Statistically significant at α = 0.05

Table 2

Diagnostic validity of self-reported partner and parent problematic substance use using urine drug screens as reference standard

	Partner use n = 491	Parent use n = 491	Partner/parent use n = 491	4P's Plus (conventional use) n = 491	4P's Plus (inclusive of parent and partner use questions), n = 491
Positive screen, % (n)	20.1% (102)	45.0% (221)	50.5% (248)	77.6 (381)	85.1% (418)
Sensitivity	35%	57%	65%	94%	96%
Specificity	85%	60%	55%	29%	19%
Positive predictive value (PPV)	46%	35%	36%%	34%	31%
Negative predictive value (NPV)	77%	78%	81%	92%	93%
False negative rate	65%	43%	35%	6%	4%

Prevalence of prenatal drug use is 27% (136/497)

Table 3

Multivariable analysis of relationship between perceptions of problematic partner/parental substance use and positive urine drug screen in pregnancy

	Unadjusted odds ratio (OR) (95% CI)	p-value	Adjusted odds ratio (aOR) (95% CI)[b]	p-value
Partner use	2.9 (1.8, 4.5)[a]	< 0.001	2.0 (1.2, 2.4)[a]	0.006
Parent use	2.0 (1.3, 3.0)[a]	0.001	1.4 (0.9, 2.2)	0.14
Partner and parent use	2.3 (1.5, 3.5)[a]	< 0.001	1.6 (1.1, 2.5)[a]	0.04

[a]Statistically significant at α = 0.05

[b]Adjusted for smoking status, race, trimester, marital status, employment and education