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Prevalence and associated birth outcomes of co-use of *Cannabis* and tobacco cigarettes during pregnancy

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ABSTRACT

Use of *Cannabis* and use of tobacco overlap, and co-use of *Cannabis* and tobacco has increased over the past decade among adults. The current study aims to document the prevalence and correlates of co-use of *Cannabis* and tobacco cigarettes among adult pregnant women utilizing secondary data from a larger study that compared and validated screeners for illicit and prescription drug use during pregnancy. Pregnant women ($N = 500$; 71% African American; 65% never married, average age of 28 years) were recruited from two urban University obstetric clinics between January and December 2017. Participants self-reported demographic, *Cannabis*, and tobacco cigarette use characteristics, and provided urine and hair samples for drug testing. Within two weeks after due date, research staff reviewed participants' electronic medical records to collect birth outcome data. Results showed that 9.0% reported co-use of *Cannabis* and tobacco, 12.1% reported *Cannabis* only use, 7.8% reported tobacco cigarette only use, and 71.1% reported no *Cannabis* or tobacco cigarette use in the past month. The birth outcomes to emerge as significant correlates of co-use of *Cannabis* and tobacco cigarettes were small head circumference, and the occurrence of birth defects, with the co-use group having the highest odds of a small head circumference [aOR: 5.7 (1.1–28.9)] and birth defects [aOR: 3.1 (1.2–8.3)] compared with other use groups. The *Cannabis* only group had 12 times higher odds of a stillbirth or miscarriage (aOR = 12.1). Screening and interventions to address concurrent *Cannabis* and tobacco use during pregnancy are needed, particularly among subpopulations with higher co-use rates. It is imperative to further explore and highlight the possible health implications of maternal co-use given the high prevalence rates found in this study sample.

1. Introduction

Cannabis is the most commonly used illicit drug globally and in the United States (World Health Organization (WHO), 2016), and rates of *Cannabis* use among US adults have risen significantly in the past 15 years (Hasin et al., 2015). In contrast, tobacco use has declined (WHO, 2015), although it remains one of the world's biggest public health threats, contributing to the deaths of approximately 7 million people each year (WHO, 2017). In the US general population, co-use of *Cannabis* and tobacco has increased significantly over the past decade (Schauer et al., 2015). Co-use of *Cannabis* and tobacco can refer to many different behavioral patterns, including use in the same episode, use within the same product (i.e., blunt or spliff smoking), or use within the same time-period (in the past month). Co-use of *Cannabis* and tobacco, relative to use of either *Cannabis* or tobacco alone, is associated with several concerning clinical correlates, including increased risk of *Cannabis* use disorder (CUD), exacerbation of mental health symptoms, and poorer cessation outcomes (Agrawal et al., 2012; Agrawal and Lynskey, 2009; Coleman-Cowger et al., 2017; Montgomery, 2015; Peters et al., 2012; Ramo et al., 2012). Preliminary evidence also suggests that co-use of *Cannabis* and tobacco may be associated with additive, or even multiplicative, adverse health consequences relative to tobacco use only (Coleman-Cowger et al., 2017; Peters et al., 2016).

With rates of co-use of marijuana and tobacco increasing significantly in the US, a critical question is how prevalent co-use is among vulnerable populations who may be especially susceptible to associated negative health implications, such as pregnant women. Among pregnant women in the 2005–2014 data from the US National Survey on Drug Use and Health, co-use of *Cannabis* and tobacco was significantly more prevalent than *Cannabis* only use (3.3% vs. 1.0%) but less common than tobacco only use (13.3%) (Coleman-Cowger et al., 2017). Co-use of *Cannabis* and tobacco was associated with being younger and Black or Hispanic, and having past month use of alcohol and other illicit drugs (Coleman-Cowger et al., 2017). In other studies, substance use during pregnancy is more common in women who are younger, less educated, single, unemployed (Havens et al., 2009), socioeconomically

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disadvantaged, have a partner who smokes (Giglia et al., 2007), or belong to a racial or ethnic minority group (El Marroun et al., 2008; Ko et al., 2015), as well as in multigravid women (i.e., women who have been pregnant more than once) and women with unplanned pregnancies (El Marroun et al., 2008). Although co-use of *Cannabis* and tobacco during pregnancy appears to be higher among certain subpopulations characterized by demographic characteristics and by behaviors associated with adverse health effects, research on co-use of *Cannabis* and tobacco among high risk populations of pregnant women is limited.

The negative health consequences of smoking tobacco during pregnancy are well-known (US Department of Health and Human Services (USDHHS), 2014) but the evidence base for the health consequences of smoking *Cannabis* during pregnancy is less robust (Gunn et al., 2016). Extant findings suggest links to reduced birth weight (though with smaller effects than those seen with tobacco use), increased risk of babies small for gestational age, increased risk of neonatal intensive care admission, poorer cognitive performance in adolescence, and maternal anemia (Gunn et al., 2016); however, the limitations of extant research are significant and include the small number of studies, small samples, underreporting of use, and inability to control for confounding effects of other substance use (Volkow et al., 2014). Two notable longitudinal studies of prenatal marijuana exposure (Fried and Makin, 1987; Richardson et al., 2002) found no association between *Cannabis* use during pregnancy and increased miscarriage rates, premature deliveries or any other complications, but did find differences in neonatal behaviors (i.e., increased tremors and startles and poorer habituation to visual stimuli) and neuropsychological outcomes at 10 years of age (i.e., effects on learning, memory, and impulsivity). Most studies on the effects of *Cannabis* use on birth outcomes did statistically control for tobacco smoking, showing the independent effects of *Cannabis* use on outcomes. To our knowledge, no studies have examined the unique research question of how tobacco and *Cannabis* *interact synergistically* to influence birth outcomes; i.e., does co-use of *Cannabis* and tobacco, relative to use of either one alone, compound adverse health consequences to the mother and developing fetus?

Existing studies on the health consequences of smoking *Cannabis* during pregnancy were initiated over 30 years ago. In the past two decades, 29 US states have implemented medicinal *Cannabis* laws and 8 states plus the District of Columbia have legalized adult recreational use of *Cannabis*. The impact of changing state and local policies legalizing *Cannabis* remains unclear, but there is some evidence that these policies contribute to greater *Cannabis* availability and the increasing perception that *Cannabis* use is harmless (Budney and Borodovsky, 2017; Schulenberg et al., 2017), both of which could lead to changing *Cannabis* use patterns among pregnant women. Because *Cannabis* and tobacco are so closely associated, changing *Cannabis* use patterns could have downstream effects on tobacco use patterns. Furthermore, exponential increases in tetrahydrocannabinol (THC) potency, the primary psychoactive constituent of *Cannabis*, over the past decade, combined with the fact that maternal tissues act as a reservoir for THC and other cannabinoids which results in prolonged fetal exposure, could make *Cannabis* difficult to quit during pregnancy (Budney and Borodovsky, 2017; Schulenberg et al., 2017). For all of these reasons, current research on the prevalence and associated birth outcomes of co-use of *Cannabis* and tobacco use is needed.

The purpose of this study is to: 1) describe the prevalence of co-use of *Cannabis* and tobacco cigarettes reported by a convenience sample of pregnant women presenting to two urban prenatal clinics; 2) outline correlates of co-use of *Cannabis* and tobacco cigarettes; and 3) compare birth outcomes between pregnant women who co-use *Cannabis* and tobacco cigarettes, who currently smoke tobacco cigarettes but do not use *Cannabis*, who currently use *Cannabis* but do not smoke tobacco cigarettes, and who do not currently use *Cannabis* or tobacco cigarettes.

2. Materials and methods

2.1. Sample

This study's sample was recruited from two obstetric clinics in Maryland as part of a larger study to compare and validate screeners for illicit and prescription drug use during pregnancy. Pregnant women were enrolled in the study if they met the following criteria: 1) currently pregnant; 2) age 18 years or older; 3) able to speak and understand English sufficiently to provide informed consent; and 4) natural hair length at least 3 cm to allow for drug testing. Participants were compensated with a $50 gift card on completion of enrollment surveys and providing hair and urine samples. Data were collected between January and December 2017. Participants provided informed consent and signed a HIPAA release form to allow access to their and their baby's electronic medical records. All forms used in the study were approved by the Institutional Review Boards (IRB) of Battelle Memorial Institute and the University of Maryland-Baltimore. Details of study methodology have been published elsewhere (Coleman-Cowger et al., 2018).

2.2. Procedures

Women attending prenatal appointments at the two clinics were approached by study staff for interest in study participation, then evaluated for eligibility. Study staff administered informed consent to women who expressed interest and met the eligibility criteria. The informed consent detailed the nature of the study, potential benefits and risks, procedures and compensation. Once consented, participants signed a HIPAA release then completed a demographic questionnaire and the 4P's Plus questionnaire (Chasnoff et al., 2007), along with two additional questionnaires and an in-depth interview (not reported herein). Participants also provided urine and hair samples for drug testing, to allow for detection of short-term (urine) and longer-term (hair) substance use. Urine was tested onsite with iCup® Dx 14 Panel Drug Test Cup, and hair was shipped to Quest Diagnostics for testing. Within two weeks after due date, study staff conducted a review of the Electronic Medical Records (EMR) of participants to collect information on birth outcomes, including birthweight, birth length, head circumference, Apgar scores, gestational age (prematurity vs. term), occurrence of birth defects, stillbirths or miscarriages (vs. live births) and neonatal intensive care unit (NICU) admissions. These outcomes were selected based on previous associations with substance use found in the literature. A total of 1170 pregnant women were approached for this study in both sites, 719 met eligibility criteria, and 500 were enrolled.

2.3. Measures

Data was collected from 3 sources for this study: interviewer-administered demographic and 4P's Plus questionnaire, EMR chart review, and drug screen results. Additional measures collected but not reported in this paper were the Substance Use Risk Profile-Pregnancy (SURP-P) (Yonkers et al., 2010) and the NIDA Quick Screen and ASSIST (NIoD, 2011; Smith et al., 2010), along with an in-depth interview assessing patient perception of the presented screeners.

2.3.1. Demographics questionnaire

The demographics questionnaire collected information on age, marital status, education, race/ethnicity, and employment status. An obstetric history was also collected that detailed number of previous pregnancies, miscarriages, live births, birth defects, due date for current pregnancy, date of last menstrual period, and pregnancy intention.

2.3.2. 4P's plus questionnaire

The 4P's Plus is a validated questionnaire for substance use screening developed by Chasnoff and colleagues (Chasnoff et al., 2007).