



## Short Communication

## Underreporting of use of cocaine and marijuana during the third trimester of gestation among pregnant adolescents

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## ABSTRACT

**Objective:** The aim of this study is to check the validity of the self-report of drug use by pregnant adolescents, by comparing their responses to a structured interview about their use of cocaine and marijuana during the pregnancy with an analysis of their hair.

**Results:** Hair analysis detected the use of cocaine and/or marijuana in the third trimester of pregnancy in 60 (6%) patients. 40 (4%) patients used only marijuana, 17 (1.7%) used only cocaine, and 3 (0.3%) used both drugs. None of the patients had reported the use of these substances in their interviews with healthcare professionals.

**Conclusion:** Although the prevalence of the use of drugs during pregnancy is significant despite consistent evidence about the compromise of the neurobehavioral development of the newborns that are exposed to drugs during the prenatal period, drug use is frequently not reported. Therefore, more sensitive methods of detection should be used so that appropriate medical and psychosocial interventions can be implemented for the mothers as well as for their children.

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## 1. Introduction

The number of people consuming drugs has been increasing in recent decades, particularly in developing countries such as Brazil, according to the United Nations Office on Drugs and Crime, World Drug Report – 2008. This epidemic use of substances such as cocaine and marijuana has included pregnant women, resulting in increased exposure of the unborn babies to these substances, jeopardizing their development (Fried & Smith, 2001; Behnke, Eyler, Garvan, & Wobie, 2001; Bauer et al., 2002; Covington, Nordstrom-Klee, Ager, Sokol, & Delaney-Black, 2002; Barros et al., 2006). Therefore, the identification of prenatal exposure to these drugs is critical for the implementation of appropriate medical and psychosocial intervention for the mothers and the children before and after birth.

The prevalence of drug use among female teenagers in Brazil is 4.1% for cannabis, 1.3% for cocaine and 0.4% for crack (Carlini, et al., 2006).

The underreporting of drug use by pregnant women is very frequent and it has been documented in several studies. As an example, in a sample of over 3000 subjects, in which 43% tested positive for illegal

substances, Ostrea, Brady, Gause, Raymundo, and Stevens (1992) found that only 11% of the mothers admitted the use of illicit drug and Kokotailo, Langhough, Smith Cos, Davidson, and Fleming (1994), found that pregnant adolescents underreport substance use. These data suggest that more sensitive methods of screening should be used.

There are many biological methods of identifying prenatal exposure of babies to cocaine and marijuana, two of the most prevalent illicit drugs in Brazil. Prenatal exposure to these substances can be established by analysis of the blood, urine, hair, meconium and, more recently, gastric aspirate and amniotic fluid. However, hair analysis provides a window of detection that extends over a period of time that is longer than for any other way.

Estimates of substance use among pregnant adolescents range from 11% to as high as 52%, similar to those for nonpregnant adolescent females (Teagle & Brindis, 1998; Ebrahim & Gfroerer, 2003). The relevance of identification of this use in the third trimester is shown by that: recent users are frequent users (Kuhn, Kline, Ng, Levin, & Susser, 2000), pregnant adolescent underreport substance use and exposure to cocaine, (Kokotailo et al., 1994). And relative proportion of women who abstained from illicit drug use after they realize they were pregnant increased from about one-fourth during the first trimester to 93% during the third trimester (Ebrahim & Gfroerer, 2003).

The aim of this study is to check the validity of the self-report of drug use by pregnant adolescents, by comparing their responses to a structured interview about the use of cocaine and marijuana during their pregnancy with the results of their hair analysis.

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## 2. Material and methods

A convenience sample of 1000 pregnant teenage women, ages 11 to 19, who were inpatients of Mario Moraes Altenfelder Silva Maternity Hospital – Brazil, was interviewed. All the patients were informed about the aim of the study and that all information was confidential. After all doubts were elucidated the participants were invited to sign a written informed consent. None of the patients refused to participate. Data were collected through interviews in the hospital after the women had recovered from labor and the effects of anesthesia. This period varied between 4 and 48 h after delivery. The study was approved by the ethics committee of the hospital and the ethics committee of the Federal University of São Paulo. The socio-demographic, socio-economic psychosocial characteristics of the population served by this facility were assessed by a questionnaire used in Perinatal Needs Assessment – PNA and are described in detail in a previous paper (Chalem et al., 2007).

Hair samples allow detection of drug use over the widest interval. The period measured is limited only by the length of the hair, since the drugs metabolites are permanently deposited in the protein matrix of hair (Kuhn et al., 2000). Head hair grows at an average rate of 1.3 cm/month (Kline, Ng, Schittini, Levin, & Susser, 1997). The research staff cut a sample of hair as close to the scalp as possible near the crown of the head, before delivery. The length of hair was cut to a maximum of 3.9 cm. Considering that the hair grows 1 cm per month, and that the analysis can be made on segments up to 3 cm, it is possible to trace the consumption of drugs throughout the 3 trimesters of pregnancy.

### 2.1. Instruments

The use of cocaine and marijuana during the last trimester of pregnancy was assessed by hair analysis and by a questionnaire. Responses to the questionnaire were compared with the results of the hair analysis, which was performed using a combination of enzyme-linked immunosorbent assay (ELISA) and gas chromatography mass spectrometry (GCMS). These methods are effective for tracing and confirmation of cocaine and/or marijuana use, respectively (Huestis & Cone, 1998). Analyses were conducted at the Tricho-Tech laboratory, Cardiff, UK.

The analysis was only qualitative, so it does not determine what level of substance was used. Only marijuana and cocaine were tested because these are the most prevalent illicit drugs in Brazil. Cut-off limits (sensitivity) adopted were 0.2 ng/mg of hair for cocaine and 0.025 ng/mg for cannabis. The specificity of the tests is 100% for both drugs.

Ostrea et al. (2001) found that hair analysis had a sensitivity of 100% for cocaine and 80% for opiate detection and concluded that hair analyses had the highest sensitivities for detecting perinatal use of cocaine and opiate, but not for cannabinoid.

A questionnaire was used to obtain information about the patients' drug consumption during the pregnancy. This instrument was translated and adapted from the Perinatal Needs Assessment – PNA (Zahnd, Klein, & Needell, 1997), a large study carried out in California that assessed the alcohol and drug use patterns, as well as socio-demographic, socio-economic psychosocial, sexual behavior with information about age, addresses, place of birth, marital status, schooling, age at beginning of sexual activity, and number of children, and the unmet service needs of low-income pregnant and parenting women. This study in an analysis of a sample of 1147 pregnant women found that 401 (35%) were screened in for at-risk alcohol or drug use.

The PNA was identified as a validated survey instrument to assess non-clinical support services needs among pregnant women enrolled in state-based, drug treatment center (Klein & Zahnd, 1997).

The questionnaire was administered by four professional psychologists and the hair samples were collected by them immediately after the interviews.

**Table 1**

Result of comparing of self-report of substance use and hair test during the third trimester of gestation among pregnant adolescents.

	Hair test		Total
	Negative	Positive	
<i>Cocaine (self-report)</i>			
No	980	20	1000
Yes	0	0	0
Total	980	20	1000
<i>Marijuana (self-report)</i>			
No	957	43	1000
Yes	0	0	0
Total	957	43	1000
<i>Cocaine and marijuana (self-report)</i>			
No	997	3	1000
Yes	0	0	0
Total	997	3	1000

## 3. Results

Hair analysis detected the use of cocaine and/or marijuana in the third trimester of the pregnancy in 60 (6%) patients, 40 (4%) patients used only marijuana, 17 (1.7%) used only cocaine and 3 (0.3%) used both drugs. None of them had reported the use of these substances in the interviews.

Table 1 shows these results.

## 4. Discussion

The prevalence of cocaine and marijuana use found in this study (6%) is very alarming, because the prevalence of drug use among female teenagers in Brazil is 4.1% for cannabis, 1.3% for cocaine and 0.4% for crack (Carlini et al., 2006). According to Tavares, Béria and Lima (2001) prevalence of frequent use of drugs among teenage students in Brazil is around 2.6% for marijuana and 0.3% for cocaine – considering both genders.

Moreover, according to Ebrahim and Gfroerer (2003), pregnant women tend to reduce their use of drugs after they realize that they are pregnant. In fact, admitting the use of an illegal substance during the pregnancy is always an issue for the mother as well as for the medical and legal systems. Pregnant drug users tend to deny or diminish their use (Richardson, Fendrich, & Johnson, 2002; Kuhn et al., 2000; Kline et al., 1997). This tendency is enhanced by the associated guilt of the mothers, particularly when the unborn or newborn infant shows some problem. (Eylera, Behnke, Wobie, Garvan, & Tebbett, 2005). There are many other factors associated with underreporting such as fear of legal consequences (Ostrea et al., 1992; Kokotailo, Hoover, Duggan, Repke & Joffe, 1992), social desirability, memory failure (Hser, 1997), mode of interview (Aquilino, 1994), characteristics of the interviewer and respondents (Johnson, Fendrich & Shaliram, 2000). Recall bias plays a significant role in these studies because most of them are retrospective. There is a natural tendency to recall more recent events better than more distant events (Hser, 1997). Repression or memory loss can cause inaccuracies of recall, especially about details such as time, frequency, and quantity of drug consumption (Hser, 1997) and if the respondent is a heavy user (Harrel, 1997). Finally, Richardson et al. (2002) found that respondents from more segregated neighborhoods would be likely to disclose drug use than those from diverse neighborhoods and that mistrust should be considered an important factor underlying reveal of drug use, especially among racial/ethnic groups.

The placenta does not protect the fetus against the marijuana and cocaine that is consumed by the mother. These substances have high potential for placental transfer. During consumption of a drug by the mother, the serum levels of the fetus quickly reach levels close to hers. Therefore, researchers have concluded that it is quite likely that there

is no safe amount of these drugs to be consumed during pregnancy (Little & VanBeveren, 1996).

Behavioral and cognitive changes have been observed in children exposed in the uterus to marijuana, (Fried, 1986). Several studies have demonstrated the relationship between the use of marijuana during pregnancy and neurobehavioral disorders in the development of the child. (Goldschmidt, Day & Richardson, 2000). The executive functions of the brain comprise a complex system of organization, integration and implementation of cognitive processes as the child develops, and they are severely affected by drug use, although the effects may not become evident immediately. The impairment of the function of the pre-frontal lobe may not be evident until 4 years of age. Some of these symptoms can be traced in the newborn through the use of specific neurobehavioral instruments (Barros et al., 2006). Follow-up studies assessing children exposed in the uterus to marijuana provide consistent evidence of its detrimental effects (Fried, 1986, 2002; Smith et al., 2004).

Regarding the use of cocaine during pregnancy, the current scientific evidence points to subtle signs and symptoms instead of severe congenital anomalies or teratogenic anatomical changes (Behnke et al., 2001). These symptoms include hyperarousal, restlessness, irritability and tremors, suggesting, as reported for marijuana, that neurobehavioral disorders can develop in the child's future (Bauer et al., 2002). There is also evidence of physical changes that do not involve birth defects in infants from exposure to cocaine during the prenatal period. According to Covington et al. (2002), birth weight and length are significantly affected by cocaine use during pregnancy, even after adjusting for potential confounding factors.

Since the prevalence of the use of drugs during pregnancy is high and the consequences of exposure to these substances during the prenatal period compromises the neurobehavioral development of the newborns, more sensitive methods of detection should be used. Biological methods such as hair analysis provide a wide window of detection, and drug trapping by hair is also highly efficient, allowing detection of even sporadic low-level (Baumgartner, Hill, & Blahd, 1989). Kline et al. (1997) show that the majority of false negative hair tests were related to women reporting small amounts of cocaine or more distant use (first trimester of pregnancy). Ostrea et al. (2001) found that hair analysis had a sensitivity of 100% for cocaine and 80% for opiate detection. However, it had a false-positive rate of 13% for cocaine and 20% for opiate, probably as a result of passive exposure. Hair analyses had low sensitivity in detecting cannabinoid exposure (21%–22.7%), most probably because of the sporadic use of cannabinoid. Thus, Ostrea et al. (2001) concluded that hair analysis had the highest sensitivities for detecting perinatal use of cocaine and opiate, but not for cannabinoid. And that the principal drawback of hair analysis is its potential for false-positive test results associated with passive exposure to drugs. Musshoff et al. (2006) came to a quite similar conclusion. Another study admitted that cocaine hair test appears to be highly sensitive and specific in identifying past cocaine use in the setting of a negative urine test (Ursitti, Klein, Sellers, & Koren, 2001). For Gambelungho, Rossi, Ferranti, Rossi, and Bacci (2005) hair test (technique GC/MS/MS) has proved to be a highly sensitive and specific technique for the detection of very low concentrations of such drugs in hair. And Koren, Klein, Forman and Graham (1992) indicate that contamination from passive exposure to smoke from crack is not a source of false positives.

Drug abuse during teenage pregnancy is a major health problem and the identification of infants born from these mothers should be done right after birth so that appropriate intervention can be performed. The correct diagnosis will help the exposed children to receive specialized treatment and care. These data are important for the identification of adolescents who will need postnatal support and may also assist in preventing the same mother from having another drug-exposed child.

#### 4.1. Limitations

However, this study has some limitations. The estimates of underreporting are based on one single sample of pregnant teenagers

in São Paulo; hence the extent to which the results found here could be generalized to pregnant adolescents of other parts of the country is unknown. Another limitation is that hair analysis has some problems that are discussed above and it is necessary for further research to determine if positive cases detected by this analysis represent primarily regular users or more occasional users who are just at the threshold for detection of drug use. Finally, there are many factors that can influence the underreporting of drug use, especially in pregnancy. One of these is the environment where the questionnaire is administered. In our case we cannot measure the consequences of reporting drug use in a hospital setting. However, despite these limitations, this study was designed with a large sample from an at-risk population, and it used a structured diagnostic interview that assured the reliability of the data. Therefore, we hope that this paper will support the planning and implementation of mental health services and public policies in order to reduce their negative impact.

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#### Contributors

Marco Bessa, Sandro Mitsuhiro, Elisa Chalem, Marina M. Barros, Ruth Guinsburg and Ronaldo Laranjeira designed the study, collected and examined data. Marco Bessa, Sandro Mitsuhiro conducted literature searches and provided summaries of previous research studies. Marco Bessa conducted the statistical analysis. Marco Bessa and Sandro Mitsuhiro wrote the first draft of the manuscript and all authors contributed to and have approved the final manuscript.

#### Conflict of Interest

There are no conflicts of interest of any author.

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