Prevalence of Illicit Drug Use During Pregnancy: A Global Perspective

RONAN A. TAVELLA, VICTÓRIA O.M. DE ABREU, ANA LUIZA MUCCILLO-BAISCH & FLÁVIO M.R. DA SILVA JÚNIOR

Abstract: The World Drug Report 2019 presented an alarming figure to the world: more than 5% of the world’s population has been using some type of illicit drug, and that number is growing every year. While its use increases, its abuse during pregnancy has become a global public health problem, resulting in medical and social challenges related to maternal and child health. In this context, the objective of this review was to determine the prevalence of illicit drug use during gestation across the globe, alongside with a critical review of the evaluated studies. Research was performed by simultaneously searching terms (“pregnant woman OR pregnant” OR “gestation” OR “pregnancy” AND “illicit drugs” OR “street drugs”) in the databases of the Scientific Electronic Library Online, PubMed, and Web of Science. Comparisons between studies were performed in software Statistica 10.0. The data presented worrying results in relation to the variation in prevalence of illicit drug use during pregnancy, when comparing studies based on interviews or questionnaires (self-reported) (1.65%) and studies based on toxicological analysis (12.28%). In addition, we emphasize the high prevalence (5.16%) of illicit drug use among adolescent pregnant women and the low number of studies on this population. This study reveals worrying data about pregnant drug-user population, mainly the underestimation of prevalence in studies that use only questionnaires or similar methods in comparison to studies that use toxicological analysis of biological matrices. This scenario reveals necessity for health systems in different countries to establish specific public health policies for this population.

Key words: pregnant women, drugs, gestation, substance use disorder, adolescent pregnancy.

INTRODUCTION

The World Drug Report 2019 presented by the United Nations Office on Drugs and Crime (UNODC) reported that, in 2017, about 271 million people were using illicit drugs around the globe, which is 5.5% of the world population (UNODC 2019). The same report shows that, from 2010 to 2017, the number of drug users rose from 226 million (5% of the world population) to 271 million (5.5% of the world population) (UNODC 2019). It is a cause for concern that illicit drug use in the world is increasing every year.

In the 1971 United Nations Convention on Psychotropic Substances the expression “psychotropic substance” was the term used to refer to those natural or synthetic substances or any natural material listed in the four schedules of the convention, which have been prohibited from commercialization except for prescribed use (UNODC 1971). Thus, as Asimakopoulous et al. (2016) stated in his review, licit drugs are those for which the prescription for medical use is permitted by law, while illicit drugs are those for which non-medical use is prohibited by law.
However, it is important to note that depending on the region, there may be permissive legislation for the use of illicit substances in different scenarios.

Substance use disorder is a medical condition in which the use of one or more substances leads to a clinically significant impairment or distress (APA 2013). Drug dependence has been considered an important issue in recent decades, but its history stretches back for millennia and it is now identified by the World Health Organization (WHO) to be among the 20 highest risk factors for health problems (WHO 2009).

The use of illicit drugs is expanding and has reached major proportions. Their use and abuse during pregnancy has become a global public health problem in the last two decades, generating several medical and social challenges related to illicit drug use and maternal and child health (WHO 2009). Pregnancy combined with the use of psychotropic substances, whether legal or illicit, may cause obstetric complications, including placental abruption and increased incidence of premature rupture of membranes, as well as abortion, increased maternal mortality, stillbirth and neonatal mortality (Schempf 2007, Kassada et al. 2013). Despite knowing the risks, illicit drug use among women has increased. Among drug users, 90% are of childbearing age, between 15 and 40 years old, and 30% started using illicit drugs before the age of 20 (Melo et al. 2014).

An accurate estimate of the prevalence of illicit drug use during pregnancy is difficult given the abuse of polysubstances and the overlapping of social factors (Melo et al. 2014). However, it is known that the illicit substances most used in pregnancy include cocaine, opioids, and marijuana (Kassada et al. 2013).

Gestation is a period of great transformation in a woman’s life, causing significant changes to her body, her psyche, and her socio-familial role (Rocha et al. 2016). The use of illicit drugs during pregnancy can lead to insufficient nutrition in the mother and fetus. In addition, the risk of infection and body fluid transmitted diseases increases if non-sterile needles are used (Slamberova 2012). More frequent occurrences of anemia, hepatitis, and preeclampsia, and an increased tendency for hypertension, have been demonstrated in women who abuse drugs during pregnancy (Slamberova 2012). Therefore, the risk of miscarriage, stillbirth, preterm birth, low birth weight, and decreased head circumference is increased (Rocha et al. 2016).

Some illicit drugs can act on the maternal cardiovascular system, causing adrenergic hyperstimulation and vasoconstriction. In this case, there is an increase in heart rate and maternal blood pressure, with a consequent decrease in blood flow to the uterus and a risk of intrauterine growth restriction (Oliveira et al. 2016). Other illicit drugs can act on the central nervous system and its use during pregnancy may increase the risk of a congenital malformation and may be associated with preterm birth, intrauterine growth disturbances and neonatal morbidity. There is also a possibility that drug exposure can affect brain development with long-term neuropsychological harm as a result (Källén et al. 2013). As can be seen, the complications of illicit drug use are not restricted to pregnant women, but also affect their fetuses.

As stated by Slamberova (2012), the number of babies with congenital defects due to drugs has been increasing over the years. This is due not only to an increase in the prevalence of drug abuse among pregnant women, but also to an increase in behavioral disorders, such as smoking and alcohol consumption, and social aspects, such as lack of prenatal care and low socioeconomic status (Oliveira et al. 2016). The diagnosis of drug-related problems
must be made during anamnesis in prenatal consultation, where a non-judgmental approach is prerequisite for obtaining the necessary details (Wright & Walker 2001, Rocha et al. 2016). Although it is a growing problem in the world population, there are few published studies on the use of illicit drugs during pregnancy and it is a public health problem that is little discussed. It should also be noted that clinical trials are generally restricted to statistical comparisons because scientific research on pregnant women is performed carefully. The absence of epidemiological studies addressing the use of, and dependence on, illicit drugs during pregnancy, limits the analysis of their effects on the mother and newborn (Slamberova 2012).

In this context, use, abuse, and dependence on psychotropic substances represents a great concern for different institutions and spheres of society, as it is a behavior capable of causing potentially serious physical and psychological consequences for both mother and child (Rocha et al. 2016). Faced with this new challenge in obstetric care, we aimed to determine the prevalence of illicit drug use during gestation across the globe, alongside with a critical review of the evaluated studies.

MATERIALS AND METHODS

This study presents a critical review of the literature on the topic of illicit drug use during pregnancy, highlighting the prevalence of use pointed out in the studies, and considering differences in subject age, geographic position (continent), and type of study (interviews/questionnaires or toxicological analysis).

The search strategy aimed to find published studies from any country and language. The following computerized databases were searched in August 2019: PubMed, Web of Science, and Scientific Eletronic Library Online (SciELO). The search terms used were: “pregnant woman OR pregnant” OR “gestation” OR “pregnancy” AND “illicit drugs” OR “street drugs”.

To delimit the study, the following inclusion criteria were used to select articles: published since 2000; presenting data regarding pregnant women who used illicit drugs during pregnancy or within a period of 3 months prior to pregnancy. As exclusion criteria: be a review article, monograph, dissertation or thesis; be an article that addresses the use of two or less illicit drugs among the individuals surveyed; be a comparative study of biological matrices and/or analytical methods; article in case study; article on animal experimentation. The exclusion of studies that addressed only one or two types of illicit drugs was performed in order to minimize overestimations in prevalence caused when including researches were all participants used illicit drugs. Furthermore, there were no restrictions on language.

Two reviewers, working independently and in duplicate screened abstracts and titles for eligibility using standardized instructions. Articles included by at least one reviewer were retrieved. Following abstract screening, eligibility of reports was assessed through full-text screening. We assessed the eligibility of each study using the criteria that were previously described. To find additional relevant articles, the reference lists of all of the retrieved studies were examined. Authors were contacted when it was unclear whether full-text manuscripts were eligible for inclusion in this review and if the necessary data was missing. Authors were contacted by an email to the corresponding author. At the level of full-text screening, any disagreements were resolved by consensus between the two reviewers (R.A.T. and V.O.M.A.) with a third reviewer acting as the arbiter (F.M.R.S-J.). The flowchart of the review process
can be found in the Supplementary Material - Flowchart.

Reviewers rated the quality of each study based on established criteria and a modified version of the Newcastle-Ottawa Scale (NOS) (modified to meet the needs of this study) including 9 items divided in selection, comparability and exposure (Wells et al. 2019). Each item could score one time. Then, the studies were classified as high risk (1-3 points), intermediate risk (4-5 points) and low risk of bias (6-9 points). Only studies classified as low risk of bias were included in the review. The modified NOS are presented in the Supplementary Material - Modified Newcastle - Ottawa Quality Assessment Scale.

Data extraction was performed independently using a standardized form. The following outcomes were recorded from each selected article: year of publication; total number of study participants (n); prevalence of illicit drug users, either reported in interviews or found by toxicological analysis; the illicit drug most found in the study; mean age or the age interval with the largest number of study participants (the median age was used where neither of these were available); the method of obtaining information on illicit drug use; and the place where the study was conducted. It is worth mentioning that the percentage presented for the most commonly reported drug is related to the prevalence of its use during pregnancy.

Presentation and analysis of data
Prevalence data were presented individually and the weighted arithmetic averages were calculated. Comparisons between studies were performed in software Statistica 10.0 using means of comparison tests (ANOVAs, t-test for dependent or independent samples, or their non-parametric equivalents). It is important to emphasize that when there were two ways of obtaining information (interview versus toxicological analysis) the highest prevalence among the different forms was considered to calculate the weighted arithmetic average.

RESULTS AND DISCUSSION

Using the descriptors presented, 719 articles were found in the platforms database. Of these, 589 were excluded after abstract and title screening, 41 were duplicates, 21 were excluded for not meeting the criteria and 2 did not meet the quality assessment score. In addition, 4 articles were added through reference lists. Thus, 70 articles were included in the review.

Prior to the 2000s, few studies have investigated the use of different illicit drugs by pregnant woman. Here is possible to emphasize the research by National Institute on Drug Abuse performed in 1992 and published in 1996, found that 5.5% of pregnant women surveyed used an illicit drug. Despite this, most studies at that time sought to verify the use of some specific drugs and their outcomes, and thus did not add the other drugs to their conclusions. As a result, in this review we chose to only add the published articles from the 2000s.

Table I shows the list of studies included in this review, revealing the state of art at this date. The total number of studies published between 2000 and 2019, addressing the selected topic, was 70, representing a total of 689553 participants from 14 different countries. The prevalence found when we considered the sample size of each study was 1.83%. The illicit drug reported as the most frequent in the studies was marijuana (42.85% of studies), followed by cocaine (14.29%). We emphasize that marijuana is the most commonly used illicit drug around the world (UNODC 2016).
Table I. Review of the literature from the years 2000 to 2019 on the subject of pregnant women and use of illicit drugs.

| Year | N   | Prevalence of illicit drug use from interview (%) | Prevalence of illicit drug use found in the analysis (%) | Most reported drug | Mean age ± SD, Interval with higher prevalence of age or median | Way of obtaining the information | Country | Reference                        |
|------|-----|-------------------------------------------------|--------------------------------------------------------|--------------------|-------------------------------------------------------------|----------------------------------|---------|----------------------------------|
| 2001 | 2002 | 4.6                                            | -                                                      | The author did not specify | 20 - 25 (40.3 %)                                            | Interview USA                    | USA     | (Chasnoff et al. 2001)          |
| 2002 | 456  | 20.4                                           | -                                                      | Marijuana (100 %)       | 12 - 17 (100 %)                                              | Interview Australia              | Australia | (Quinlivan & Evans 2002)        |
| 2002 | 318  | 0.96                                           | -                                                      | The author did not specify | 20 - 34 (69.8 %)                                            | Interview Brazil                 | Brazil   | (Gama et al. 2002)              |
| 2003 | 432  | 1.2                                            | -                                                      | Marijuana (100 %)       | 25 - 34 (76 %)                                              | Interview Denmark                | Denmark  | (Kesmodel et al. 2003)          |
| 2003 | 1249 | 2.8                                            | -                                                      | Marijuana (64 %)        | 21 - 30 (61 %)                                              | Interview USA                    | USA     | (Ebrahim & Gfroerer 2003)        |
| 2003 | 5159 | 23                                             | -                                                      | The author did not specify | The author did not specify | Interview USA                    | USA     | (Peters et al. 2003)            |
| 2004 | 1083 | 11.7                                           | -                                                      | Cocaine (34.5)         | 19-29 (70%)                                                 | Interview USA                    | USA     | (Kerker et al. 2004)            |
| 2005 | 549  | 2.5                                            | 10.9                                                   | Opioids (79.8 %)        | 28.9 ± 6.2                                                  | Interview and meconium Spain     | Spain   | (Pichini et al. 2005)           |
| 2005 | 145  | 6.2                                            | -                                                      | The author did not specify | 15 - 18 (100 %)                                             | Interview USA                    | USA     | (Kaiser & Hays 2005)            |
| 2005 | 160  | 6                                               | -                                                      | Marijuana (100%)        | 23.4 ± 5.2                                                  | Interview USA                    | USA     | (Bernstein et al. 2005)         |
| 2005 | 1812 | 16.3                                           | -                                                      | The author did not specify | 27.9*                                                       | Interview Europe                 | Europe   | (Hankin et al. 2005)            |
| 2006 | 2000 | 6                                               | 6                                                       | Marijuana (66%)         | 11 - 19 (100 %)                                             | Hair Brazil                       | Brazil   | (Mitsuhiro et al. 2006)         |
| 2006 | 413  | 0.5                                            | -                                                      | Marijuana (100%)        | 25.20 ± 5.52                                                | Interview Russia                 | Russia   | (Chambers et al. 2006)          |
| 2006 | 1631 | 11                                             | -                                                      | Marijuana (54%)         | 25 - 34 (47 %)                                               | Interview USA                    | Russia   | (Arria et al. 2006)             |
| 2007 | 1000 | 1.7                                            | -                                                      | Marijuana and cocaine (100%) | 11 - 19 (100 %)                                           | Interview Brazil                 | Brazil   | (Chalem et al. 2007)            |
| 2007 | 1013 | 12                                             | -                                                      | The author did not specify | 25.1 ± 5.4                                                  | Interview USA                    | USA     | (Blake et al. 2007)             |
| 2007 | 976  | 6                                              | -                                                      | Marijuana (83%)         | 26-39 (74%)                                                  | Interview Australia              | Australia | (Wallace et al. 2007)           |
| 2007 | 244  | 18.9                                           | -                                                      | The author did not specify | 31.6*                                                       | Urine or serum USA               | USA     | (Kunins et al. 2007)            |
| 2008 | 218  | 6                                              | -                                                      | Marijuana (50%)         | 27 ± 6.6                                                     | Interview Puerto Rico            | Puerto Rico | (Vélez et al. 2008)            |
| 2008 | 913  | 16                                             | -                                                      | Cocaine (67.8 %)       | 23.7 ± 5                                                     | Interview USA                    | USA     | (Orr et al. 2008)               |
| 2008 | 498  | -                                              | 32                                                      | Opioids (53.5 %)       | The author did not specify                                  | Umbilical cord EUA               | EUA     | (Montgomery et al. 2008)        |
Table I. Continuation

| Year | Sample Size | Age | Gender | Drug Type | Percentage | Methodology | Location | Reference |
|------|-------------|-----|--------|-----------|------------|-------------|----------|-----------|
| 2009 | 1209        | 2.9 | 10.9   | Marijuana | 64%        | Interview and meconium | Spain    | (Garcia-Algar et al. 2009) |
| 2009 | 623         | 18.8| -      | The author did not specify | 32 ± 3 | Interview | Spain    | (Ibieta et al. 2009) |
| 2010 | 5871        | 3.6 | -      | Marijuana | 90%        | Interview USA | (Van Gelder et al. 2010) |
| 2010 | 4094        | 5.3 | -      | The author did not specify | 20 - 34 (78.7%) | Interview USA | (Dott et al. 2010) |
| 2010 | 142         | -   | 30.3   | Marijuana | 67.4%      | Hair and blood serum | Spain    | (Falcon et al. 2010) |
| 2010 | 154924      | 11  | -      | The author did not specify | The author did not specify | Interview Canada | (Burstyn et al. 2010) |
| 2010 | 194         | -   | 12     | Methamphetamine (70%) | 23.35* | Meconium Uruguay | (Hutson et al. 2010) |
| 2010 | 1476        | 7   | -      | Marijuana | 82%        | Interview USA | (Chung et al. 2010) |
| 2010 | 868         | 3.4 | -      | Methamphetamine (70%) | 26.9 ± 6.2 | Interview USA | (Wright & Tam 2010) |
| 2011 | 25049       | 3.2 | -      | Marijuana | 78.8%      | Interview Australia | (Hayatbakhsh et al. 2011) |
| 2011 | 503         | 0.4 | -      | Marijuana | 100%       | Interview Italy | (De Santis et al. 2011) |
| 2011 | 23          | 35  | -      | The author did not specify | 29.8 ± 5.1 | Interview Brazil | (Gardenal et al. 2011) |
| 2011 | 248         | 33.3| -      | Marijuana | 94%        | Interview Canada | (Muckle et al. 2011) |
| 2011 | 36          | 30.5| -      | Cocaine (45.5%) | 26.1 ± 5.4 | Interview Brazil | (Manenti et al. 2011) |
| 2011 | 500         | 20.2| -      | The author did not specify | 23.6 ± 4.5 | Interview USA | (El-Mohandes et al. 2011) |
| 2011 | 11852       | 0.1 | -      | The author did not specify | 30.2 ± 4.8 | Interview Canada | (Crane et al. 2011) |
| 2012 | 347         | -   | 2.6    | Cocaine | 100%       | Hair Spain | (Joya et al. 2012) |
| 2012 | 107         | -   | 16     | Marijuana | 64.7%      | Hair Spain | (Friguls et al. 2012) |
| 2012 | 811         | 4.1 | -      | The author did not specify | 20 - 35 (68.3%) | Interviews Brazil | (Lobato et al. 2012) |
| 2012 | 280         | -   | 28.9   | Marijuana | 74.1%      | Hair EUA | (Falcon et al. 2012) |
| 2013 | 115         | -   | 34.8   | Marijuana | 90%        | Urine USA | (Gaalema et al. 2012) |
| 2013 | 209         | 4.3 | 15.4   | Cocaine | 80.5%      | Interview and hair | Spain | (Lendoiro et al. 2013) |
| 2013 | 394         | 1.5 | -      | Crack, marijuana and cocaine (33 % cada) | 25.28 | Interview Brazil | (Kassada et al. 2013) |
Table I. Continuation

| Year | Sample Size | Range | Drug | Percentage | Type of Analysis | Country | Source |
|------|-------------|-------|------|------------|-----------------|---------|--------|
| 2013 | 415         | -     | Cocaine (78%) | Pregnant women who died soon after birth | Blood and urine | USA | (Hardt et al. 2013) |
| 2013 | 8961        | 0.5   | - | The author did not specify | 20 - 34 (78%) | Interview | Brazil | (Viellas et al. 2013) |
| 2013 | 1040        | 11.8  | - | The author did not specify | 24.6* | Interview | USA | (Shneyderman & Kiely 2013) |
| 2013 | 175         | -     | Cocaine (87.5%) | The author did not specify | Hair | Spain | (Concheiro et al. 2013) |
| 2013 | 898         | 6.9   | - | The author did not specify | 24.8 ± 5.9 | Interview | USA | (Masho et al. 2013) |
| 2014 | 845         | 7.6   | Crack (59.9%) | >= 25 (57.8%) | Interview | Brazil | (Melo et al. 2014) |
| 2014 | 200         | -     | Marijuana (83.8%) | 26 (Median) | Urine | USA | (Schauberger et al. 2014) |
| 2014 | 1367        | 1.2   | - | The author did not specify | 11 - 19 (100%) | Interview | Brazil | (Jorge et al. 2014) |
| 2014 | 299         | 10    | - | The author did not specify | 20 - 24 (52.8%) | Interview | Brazil | (Miranda et al. 2014) |
| 2014 | 1240        | 1.3   | - | The author did not specify | 20 - 24 (65%) | Interview | Brazil | (Ribeiro et al. 2014) |
| 2014 | 13545       | 1.2   | Marijuana (100%) | 25 - 34 (63.6%) | Interview | France | (Saurel-Cubizolles et al. 2014) |
| 2015 | 451         | 1.9   | Marijuana (100%) | 31.4 ± 5.2 | Interview | Spain | (Blasco-Alonso et al. 2015) |
| 2015 | 1085        | -     | 2.2 | The author did not specify | 31 (Median) | Interview and urine | China | (Lam et al. 2015) |
| 2015 | 165         | 10.9  | - | The author did not specify | 10 - 16 (100%) | Interview | Mexico | (Sam-Soto et al. 2015) |
| 2016 | 166         | 1.9   | Crack (55.4%) | 26.6 ± 6.7 | Interview | Brazil | (Oliveira et al. 2016) |
| 2016 | 1447        | 1.5   | Crack (35%) | 20 - 34 (81%) | Interview | Brazil | (Rocha et al. 2016) |
| 2016 | 314         | 12.1  | Marijuana (65.8%) | The author did not specify | Interview | Brazil | (Renner et al. 2016) |
| 2016 | 727         | -     | 17.1 | (Cocaine 50%) | The author did not specify | Hair and Meconium | Spain | (Concheiro et al. 2016) |
| 2016 | 295         | -     | 8.5 | Marijuana (53%) | 33 (Median) | Urine | USA | (Kreshak et al. 2016) |
| 2017 | 422         | 19.7  | Marijuana (77%) | 25 (Median) | Interview and urine | USA | (Chang et al. 2017) |
Table I. Continuation

| Year | N     | Mean | Standard Deviation | Drug            | Method          | Location       | Authors               |
|------|-------|------|--------------------|------------------|-----------------|----------------|-----------------------|
| 2017 | 3578  | 0.8  | -                  | Marijuana        | Interview and urine | Thailand       | (Assanangkornchai et al. 2017) |
| 2018 | 436   | -    | 0.9                | Marijuana        | The author did not specify | Blood | Denmark | (Aagaard et al. 2018) |
| 2018 | 494   | -    | 27.4 (81.39%)      | Marijuana        | Urine           | USA            | (Oga et al. 2018) |
| 2019 | 174   | 15.8 | -                  | The author did not specify | Interview     | USA            | (Wisner et al. 2019) |
| 2019 | 33    | 66.2 | -                  | Heroin (37.5)    | Interview       | USA            | (Sanjuan et al. 2019) |

* Mean without the presence of the standard deviation.
** Prevalence of a sample of 488 women within the study population in which urine sample was obtained for evaluation.
*** From the data of the article it was not possible to define the percentage of users of illicit drugs that used marijuana.

According to the previously stated about the difference of licit and illicit drugs, a drug may fall under both categories of licit drug or illicit drug, depending on its usage. The presence of this distinction makes it possible to reduce possible overestimations of drug use values in some studies, especially in those that contain toxicological analyses, since in the studies with interviews the question makes it clearer as to which illicit drug was used. The main illicit drug that could end up having its values overestimated in toxicological analyses is the opioids, because their use during pregnancy can be commonly associated with prescribed drugs used to alleviate the pain. However, almost all the selected studies, which performed analyses in biological matrices, stated that the women may not have reported drug use (when using opioids) because they were unaware of the constituents of the medication they have taken legitimately (Kreshak et al. 2016, Assanangkornchai et al. 2017). Only Pichini et al. (2005) and Montgomery et al. (2008) do not mention this fact in their studies, but their research included an interview in which a question about the use of illicit drug was presented. Furthermore, these studies were the only ones in this review in which the majority of the population evaluated used opioids.

Most of the studies presented in this review (91.43%) were performed with adult pregnant women (older than 20 years), whereas only 8.57% focused on adolescents. In 68.57% of the studies, only questionnaires or interviews were used, whereas 31.43% of the studies evaluated the presence of illicit drugs in biological materials collected from the mother and/or child. Different biological matrices were used in toxicological analysis present in the studies in this review. Among these matrices are: hair, urine, serum, whole blood, umbilical cord and meconium. Most used matrix were urine and hair, being present in 40.9% and 36.36% of the studies that used toxicological analysis, respectively. Hair and urine are biological matrices characteristic for use in toxicological analyzes that seek to verify the presence of illicit drugs. Hair is mainly used due to its high window of detection, being possible to find substances up to 3 months after its use. However, in this matrix, the concentrations of substances are remarkably low. Thus, these hair techniques require methods and equipment that have low limits of quantification (Concheiro et al. 2013).

The reported prevalence of illicit drug use in pregnant women was 7.4 times higher in studies that used toxicological examination compared to those that used only questionnaires or
interviews to obtain data. In the latter form of data collection, the weighted prevalence (considering the sample size) was 1.65%. On the other hand, studies that used toxicological analysis the weighted prevalence was 12.28%.

Figure 1 shows the prevalence of illicit drug use in pregnancy in studies that compared the two forms of data collection (Pichini et al. 2005, Garcia-Algar et al. 2009, Hardt et al. 2013, Chang et al. 2017, Assanangkornchai et al. 2017). In these studies, there was a significant increase in prevalence when the data were obtained by toxicological analysis (3.8 times higher; weighted average 2.84% versus 10.77%). Among these studies, we highlight two that presented 9.6 (Assanangkornchai et al. 2017) and 4.4 (Pichini et al. 2005) times more pregnant women using illicit drugs than the data reported in interviews or questionnaires. It can also be observed that this is a recurrent behavior in studies on pregnant women because, over the years from 2001 to 2019, there seems to be consistent underestimation regarding the use of illicit drugs during gestation.

These underestimated rates when the outcome is obtained through interview or questionnaire can be attributed to the mother’s feelings of fear, shame, and guilt at the possibility of harming the fetus, and also to their fear of being judged, rather than supported, by the professionals who attend them (Kassada et al. 2014). Along with it, there are different laws and programs in many countries that determine procedures for the evaluation and subsequent notification to child protection agencies when there is a newborn exposed to illicit substances. As an example, we can quote “The Child Abuse Prevention and Treatment Act” (CAPTA), present in multiple states of the USA (Child Welfare Information Gateway 2016). After this notification, different actions can be taken by child protection services, they can offer direct assistance to the family of the newborn, including them in different government programs, or sending the mother to a referral treatment. But if this does not work, they can issue the request to the state to take legal custody over the child reporting maltreatment to the health and well-being of the newborn (Child Welfare Information Gateway 2014). From this information it is possible to imply that the underestimated rates may, also, be attributed to the mother’s feeling of fear at the possibility of losing their child to the State.

Moreover, a recent study by Ondersma et al. (2019) compared five existing instruments for ability to identify illicit drug, opioid and alcohol use, under privacy expectations consistent with applied practice and using a gold standard incorporating toxicological analysis, showed that all screening instruments (interviews) for substance use in pregnancy tested (Substance Use Risk Profile—Pregnancy (SURP-P), CRAFFT, 5Ps, Wayne Indirect Drug Use Screener (WIDUS) and the National Institute on Drug Abuse (Quick Screen)) did not presented both high sensitivity and high specificity, and area under the curve.
was low for nearly all measures, demonstrating a clear failure of the self-report screening instruments used to obtaining this information.

From these data, it is evident that toxicological analysis is the more reliable method of determining the actual prevalence of illicit drug use during pregnancy. On the other hand, we stress that this technique is costly and not always economically viable in less wealthy or underdeveloped regions. In addition, biological sampling is challenging due to the fact that it does not address windows of detection and does not make diagnosis of substance use disorders, only providing a point prevalence on day of testing.

The stratified results for continent and age group are presented in Table II. The total prevalence (using the weighted average of the 70 studies) was 1.83%, and the studies were carried out on all continents except Africa. The prevalence of illicit drug use during pregnancy is similar across continents (Figure 2: Europe, North America, and South America), but the small number of studies in Oceania and Asia hinders a better understanding. Another important point is the high prevalence of illicit drug use during pregnancy in adolescents, though the number of studies is extremely low. The weighted average prevalence among adolescents is three times higher than among women over 20 (Table II).

As a limitation of this research, multiple studies included in this review were screening women who were at high risk for substance use. Therefore, the statistics derived for usage rate presented in this study can be an overestimate since there is a wide variation between the prevalence found in the studies in this review. However, the use of the weighted average allows to minimize, even a little, this overestimation through calculations that give greater influence to the prevalence of studies with larger sample numbers. Moreover, multiple risk factors associated with illicit drug use and abuse are described in the literature. Among them, some social and demographic characteristics, such as: young women, especially adolescents, under 18 years; single women; low schooling, with less than 8 years of completed studies (U.S Department of Health and Human Services 2013, Rocha et al. 2016). Other social factors include: family history of substance use disorder, user partner, risky sexual behavior, victims of domestic violence (U.S Department of Health and Human Services 2013, Melo et al. 2014, Rocha et al. 2016). Some factors were related to health care, more specifically to prenatal care. The late prenatal start and the large number of absences at consultations were considered a risk factor (U.S Department of Health and Human Services 2013, Rocha et al. 2016).

It is also important to highlight that the studies that presented prevalence of illicit drug use above 30% in interviews, were performed in populations with characteristics that predispose them to a greater consumption of illicit drugs (Gardenal et al. 2011, Muckle et al. 2011, Manenti et al. 2011, Sanjuan et al. 2019). The study by Gardenal et al. (2011) presented a prevalence of 35%, however, it included only pregnant women with hepatitis C and marginalized population characteristics. The study by Muckle et al. (2011) presented a prevalence of 33.3% for drug use during pregnancy, although this study was carried out in an Inuit population (Eskimo) from a region of Canada already known for its high percentage (30%) of illicit drug use (mostly marijuana) (Jetté 1994). The study by Manenti et al. (2011) had a prevalence of 30.5% for the use of illicit drugs during pregnancy. However, it concerned a population of pregnant women who were HIV-positive, and also displaying marginalized population characteristics. The study by Sanjuan et al. (2019) had a prevalence of 66.2% (the higher prevalence found in this
Table II. Weighted average prevalence of illicit drug use in different continents and age group.

| N° of studies | Continent        | Prevalence (from the weighted average) | Range of prevalence (%) |
|---------------|------------------|----------------------------------------|-------------------------|
| 4             | Oceania          | 1.25%                                  | 1.05 - 20.4             |
| 17            | South America    | 2.03%                                  | 0.5 - 35                |
| 31            | North America    | 2.7%                                   | 0.1 - 66.2              |
| 15            | Europe           | 4.87%                                  | 0.4 - 30.3              |
| 3             | Asia             | 5.94%                                  | 0.5 - 7.7               |
| 70            | All articles     | 1.83%                                  | 0.1 - 66.2              |
|               | **Age group**    | **5.16%**                               | **1.2 - 20.4**          |
|               | Adolescents (10-19 years) |                     |                          |
| 64            | Older than 20 years | 1.81%                                  | 0.1 - 66.2              |

* The studies that did not specify any data about the age of the participants were included in the section “older than 20 years”.

Figure 2. Prevalence of illicit drug use across continents (weighted mean of the studies).
review), mainly because it was performed in pregnant women with substance use disorder and prior trauma exposure. It is noteworthy that the other studies that presented prevalences above 30%, were studies which used toxicological analytical techniques (Montgomery et al. 2008, Falcon et al. 2010, Gaalema et al. 2012, Chang et al. 2017), which, as previously described, usually present higher prevalence.

As stated before, the most frequent illicit drug reported was marijuana and cocaine, and both may cause deleterious effects on the foetus. Pollard (2007) allege that illicit drugs affect the fetus by crossing the placenta in varying amounts and may permanently affect brain structure and function. Marijuana exposure may modify neuronal structure and function via endocannabinoid receptors, which are widely distributed in the fetal brain (Behnke & Smith 2013). Cocaine, on the other hand, by interacting with monoaminergic transmitters, alters neuronal growth, development, and cytoarchitecture (Ackerman et al. 2010). The neonatal effects of prenatal drug exposure range from deficits in growth to acute withdrawal symptoms (Shankaran et al. 2004). One review reported that marijuana is not generally associated with growth reduction, but is accompanied by an increased startle response and tremors (Behnke & Smith 2013). Abnormal neurobehavior is commonly described in cocaine exposed infants, who also demonstrate irritability, poor alertness, and orientation (Behnke & Smith 2013).

From this review, it is possible to verify that the most commonly consumed illicit drug worldwide among pregnant women is marijuana, followed by cocaine, and crack cocaine. It is also possible to verify that the use of illicit drugs during pregnancy is carried out by women of all ages, in all regions of the world, and with only a few regional changes in the type of drug consumed or the life habits in some populations.

It is important to make health professionals aware of the importance of comprehensive, humanized and qualified care for pregnant women, with a view to promoting health, preventing harm, diagnosis of drug abuse, early treatment and social reintegration. These support actions are efficient, since they reduce the level of stress, anxiety and depression among pregnant women, creating an environment less prone to the use of psychotropic substances (Schempf 2007, Kassada et al. 2014).

Furthermore, early detection of illicit drug use during pregnancy using toxicological analysis in biological matrices or effective screening programs, combined with the participation of qualified professionals and the development of further studies on the subject, possibly will help find the correct direction of the necessary measures to improve quality in pregnancy. Moreover, these actions may contribute to the reduction of obstetric complications and, consequently, reduce health costs.

CONCLUSION

This study reveals worrying data about the pregnant drug-user population. We particularly emphasize two points: the underestimation of prevalence in studies that use only questionnaires, interviews, or similar methods in comparison to studies that use the toxicological analysis of biological matrices; and the high prevalence of illicit drug use among adolescent pregnant women. The average prevalence of illicit drug use in pregnant women, among the studies that conducted questionnaires or interviews, was 1.65%, whereas in studies that performed toxicological analysis it was 12.28% (7.4 times higher).
However, the high costs, complexity of techniques, and need for specialized equipment and personnel make toxicological analysis an unattractive option in routine examinations on pregnant women. In order to reduce the serious effects of illicit drug use during pregnancy, the development of different approaches should be encouraged. These could include cheaper techniques to detect compounds or social inclusion techniques in basic care that reduce the omission of information by pregnant women to health professionals. Health professionals can improve on two fronts: by implementing policies and actions to reduce drug use during pregnancy, and by reducing underestimations of drug use in this context.

Acknowledgments
This study was financed in part by the Coordenação de Aperfeiçoamento de Pessoal de Nível Superior - Brazil (CAPES) - Finance Code 001.

REFERENCES

AAGAARD SK ET AL. 2018. Prevalence of xenobiotic substances in first-trimester blood samples from Danish pregnant women: a cross-sectional study. BMJ open 8(3): e018390. http://dx.doi.org/10.1136/bmjopen-2017-018390.

ACKERMAN JP, RIGGINS T & BLACK MM. 2010. A review of the effects of prenatal cocaine exposure among school-aged children. Pediatrics 125(3): 554-565. https://doi.org/10.1542/peds.2009-0637.

APA - AMERICAN PSYCHIATRIC ASSOCIATION. 2013. Diagnostic and statistical manual of mental disorders (5th ed.). Washington, DC: Author.

ARRIA AM ET AL. 2006. Methamphetamine and other substance use during pregnancy: preliminary estimates from the Infant Development, Environment, and Lifestyle (IDEAL) study. Matern Child Healt J 10(3): 293. https://doi.org/10.1007/s10995-005-0052-0.

ASSANANGKORNCHAI S, SAINGAM D, APAKUPAKUL N & EDWARDS JG. 2017. Alcohol consumption, smoking, and drug use in pregnancy: Prevalence and risk factors in Southern Thailand. Asia-Pacific Psychia 9(1). http://dx.doi.org/10.1111/appy.12247.

ASIMAKOPOULOS AG, KANNAN K, MIYASHITA SI, MUROTA C, KONDO K, FUJIIWARA S & TSUZUKI M. 2016. Neuropsychiatric pharmaceuticals and illicit drugs in wastewater treatment plants: a review. Environ Chem 13(4). https://doi.org/10.1071/EN15202.

BEHNEKE M & SMITH VC. 2013. Prenatal substance abuse: short- and long-term effects on the exposed fetus. Pediatrics 131(3): 1009-1024. https://doi.org/10.1542/peds.2012-3931.

BERNSTEIN IM, MONGEON JA, BADGER GJ, SOLOMON L, HEIL SH & HIGGINS ST. 2005. Maternal smoking and its association with birth weight. Obstet Gynecol 106(5): 986-991. https://doi.org/10.1097/01.AOG.0000182580.78402.d2.

BLAKE SM, KIELY M, GARD CC, EL-MOHANDES AA, EL-KHORAZATY MN & NIH-DC INITIATIVE. 2007. Pregnancy intentions and happiness among pregnant black women at high risk for adverse infant health outcomes. Perspect Sex Repro H 39(4): 194-205. http://dx.doi.org/10.1363/3919407.

BLASCO-ALONSO M ET AL. 2015. Exposición a tabaco, alcohol y drogas de abuso en gestantes. Estudio de prevalencia en gestantes de Málaga (España). Adicciones 27(2): 99-108. Available from: http://adicciones.es/index.php/adicciones/article/view/695.

BURNS L, MATTICK RP & WALLACE C. 2008. Smoking patterns and outcomes in a population of pregnant women with other substance use disorders. Nicotine Tob Res 10(6): 969-974. https://doi.org/10.1080/14622200802097548.

BURSTYN I, KAPUR N & CHERRY NM. 2010. Substance use of pregnant women and early neonatal morbidity: where to focus intervention?. Can J Public Health: 149-153. Available from: http://www.jstor.org/stable/41996129.

CHALEM E, MITSUHIRO SS, FERRI CP, BARROS MCM, GUINSBURG R & LARANEIRA R. 2007. Gravidez na adolescência: perfil sócio-demográfico e comportamental de uma população da periferia de São Paulo, Brasil. Cad Saude Publica 23: 177-186. http://dx.doi.org/10.1590/S0102-311X2007000100019.

CHAMBERS CD, KAVTELADZE L, JOUTCHENKO L, BAKHIREVA LN & JONES KL. 2006. Alcohol consumption patterns among pregnant women in the Moscow region of the Russian Federation. Alcohol 38(3): 133-137. https://doi.org/10.1016/j.alcohol.2006.06.002.

CHANG JC, HOLLAND CL, TARR JA, RUBIO D, RODRIGUEZ KL, KRAEMER KL, DAY N & ARNOLD RM. 2017. Perinatal illicit drug and marijuana use: an observational study examining prevalence, screening, and disclosure. Am J Health Promot 31(1): 35-42. http://dx.doi.org/10.4278/ajhp.141215-QUAL-625.
CHASNOFF IJ, NEUMAN K, THORNTON C & CALLAGHAN MA. 2001. Screening for substance use in pregnancy: a practical approach for the primary care physician. Am J Obstet Gynecol 184(4): 752-758. https://doi.org/10.1067/mob.2001.109939.

CHILD WELFARE INFORMATION GATEWAY. 2014. Parental substance use and the child welfare system. Washington, DC: U.S. Department of Health and Human Services, Children’s Bureau. Available from: https://www.childwelfare.gov/pubs/factsheets/parentalsubabuse/.

CHILD WELFARE INFORMATION GATEWAY. 2016. Parental drug use as child abuse. Washington, DC: U.S. Department of Health and Human Services, Children’s Bureau. Available from: https://www.childwelfare.gov/topics/systemwide/laws-policies/statutes/drugexposed/.

CHUNG EK, NURMOHAMED L, MATHEW L, ELO IT, COYNE JC & CULHANE JF. 2010. Risky health behaviors among mothers-to-be: the impact of adverse childhood experiences. Acad Pediatr 10(4): 245-251. https://doi.org/10.1016/j.acap.2010.04.003.

CONCHEIRO M, GONZÁLEZ-COMMENERO E, LENDOIRO E, CONCHEIRO-GUISÁN A, DE CASTRO A, CRUZ-LANDEIRA A & LÓPEZ-RIVADULLA M. 2013. Alternative matrices for cocaine, heroin, and methadone in utero drug exposure detection. Ther Drug Monit 35(4): 502-509. https://doi.org/10.1097/FTD.0b013e31828a6148.

CONCHEIRO M ET AL. 2016. Bioanalysis for cocaine, opiates, methadone, and amphetamines exposure detection during pregnancy. Drug Test Anal 9(6): 898-904. https://doi.org/10.1002/dta.2087.

CRANE JMG, KEOUGH M, MURPHY P, BURRAGE L & HUTCHENS D. 2011. Effects of environmental tobacco smoke on perinatal outcomes: a retrospective cohort study. BJOG-Int J Obstet Gy 118(7): 865-871. http://dx.doi.org/10.1111/j.1471-0528.2011.02941.x.

DE SANTIS M, DE LUCA C, MAPPA I, QUATTROCCHI T, ANGELO L & CESARI E. 2011. Smoke, alcohol consumption and illicit drug use in an Italian population of pregnant women. Eur J Obstet Gyn R B 159(1): 106-110. https://doi.org/10.1016/j.ejogr.2011.07.042.

DOTT M, RAMMUSSEN SA, HOGUE CJ & REEFHUIS J. 2010. Association between pregnancy intention and reproductive-health related behaviors before and after pregnancy recognition, National Birth Defects Prevention Study, 1997–2002. Matern Child Health J 14(3): 373-381. https://doi.org/10.1007/s10995-009-0458-1.

EBRAHIM SH & GFROERER J. 2003. Pregnancy-related substance use in the United States during 1996–1998. Obstet Gynecol 101(2): 374-379. https://doi.org/10.1016/S0029-7844(02)02588-7.

EL-MOHANDES AA, EL-KHORAZATY MN, KIELY M & GANTZ MG. 2011. Smoking cessation and relapse among pregnant African-American smokers in Washington, DC. Matern Child Health J 15(1): 96-105. https://doi.org/10.1007/s10995-011-0825-6.

FALCON M ET AL. 2010. Exposure to psychoactive substances in women who request voluntary termination of pregnancy assessed by serum and hair testing. Forensic Sci Int 196(1): 22-26. https://doi.org/10.1016/j.forsciint.200912.042.

FALCON M ET AL. 2012. Maternal hair testing for the assessment of fetal exposure to drug of abuse during early pregnancy: comparison with testing in placental and fetal remains. Forensic Sci Int 218(1-3): 92-96. https://doi.org/10.1016/j.forsciint.201110.022.

FRIGULS B, JOYA X, GARCIA-SERRA J, GÓMEZ-CULEBRAS M, PICHINI S, MARTINEZ S, VALL O & GARCIA-ALGAR O. 2012. Assessment of exposure to drugs of abuse during pregnancy by hair analysis in a Mediterranean island. Addiction 107(8): 1471-1479. http://dx.doi.org/10.1111/j.1360-0443.2012.03828.x.

GAALEMA DE, HIGGINS ST, PEPIN CS, HEIL SH & BERNSTEIN IM. 2012. Illicit drug use among pregnant women enrolled in treatment for cigarette smoking cessation. Nicotine Tob Res 15(5): 987-991. https://doi.org/10.1093/ntt/ntr220.

GARCIA-ALGAR O, COMBELLES OV, SOLA CP, SIERRA AM, SCARAVELLI G, PACIFICI R, MONLEÓN GETINO T & PICHINI S. 2009. Exposición prenatal a drogas de abuso a través del análisis de meconio en una población de bajo nivel socioeconómico en Barcelona. An Pediatr 70(2): 151-158. http://dx.doi.org/10.1590/S0037-86822010000100016.

GARDENAL RVC, FIGUEIRÓ-FILHO EA, LUFT JL, PAULA GLSAD, VIDAL FG, TURINE NETO P & SOUZA RAAD. 2011. Hepatite C e gestação: análise de fatores associados à transmissão vertical. Rev Soc Bras Med Trop 44(1): 43-47. http://dx.doi.org/10.1590/S0037-686220110000100011.

HANKIN C, THORNE C & NEWELL ML. 2005. Does exposure to antiretroviral therapy affect growth in the first 18 months of life in uninfected children born to HIV-infected women?. JAIDS – J Acq Imn Def (1999) 40(3): 364-370. https://doi.org/10.1097/01.qai.0000162417.62748.cd.
HARDT N, WONG TD, BURT MJ, HARRISON R, WINTER W & ROTH J. 2013. Prevalence of Prescription and Illicit Drugs in Pregnancy-Associated Non-natural Deaths of Florida Mothers, 1999–2005. J Forensic Sci 58(6): 1536-1541. http://dx.doi.org/10.1111/j.1556-4029.2012.02219.x.

HAYATBAKHSH MR, KINGSBURY AM, FLENADY V, GILSHENAN KS, HUTCHINSON DM & NAJMAN JM. 2011. Illicit drug use before and during pregnancy at a tertiary maternity hospital 2000–2006. Drug Alcohol Rev 30(2): 181-187. http://dx.doi.org/10.1111/j.1465-3362.2010.00214.x.

HUTSON JR, MAGRI R, GARET JN & KOREN G. 2010. The incidence of prenatal alcohol exposure in Montevideo Uruguay as determined by meconium analysis. Ther Drug Monit 32(3): 311 317. http://doi.org/10.1097/FTD.0b013e3181dda52a.

IBIETA MF ET AL. 2009. Malformaciones congenitas en una cohorte de ninos no infectados, hijos de madres infectadas por el virus de la inmunodeficiencia humana. An Pediatr 70(3): 253-264. https://doi.org/10.1016/j.anpedi.2008.10.021.

JETTE MA. 1994. Health Profile of the Inuit; Report of the Santé Québec. Health Survey Among the Inuit of Nunavik. Ministère de la santé et des services sociaux, Santé Québec, Montreal. Available from http://www.stat.gouv.qc.ca/statistiques/sante/etat-sante/sante-globale/inuit_tome2_an.pdf.

JORGE M, LAURENTI R, GOTLIB ELD, OLIVEIRA BZD & PIMENTEL EC. 2014. Características das gestações de adolescentes internadas em maternidades do estado de São Paulo, 2011. Epidemiol Serv Sau 23(2): 305-315. http://dx.doi.org/10.1590/1414-8145.2014000200012.

JOYA X ET AL. 2012. Cocaine use during pregnancy assessed by hair analysis in a Canary Islands cohort. BMC pregnancy childb 12(1): 1. https://doi.org/10.1186/1471-2393-12-2.

KAISER MM & HAYS BJ 2005. Health-risk behaviors in a sample of first-time pregnant adolescents. Public Health Nurs 22(6): 483-493. https://doi.org/10.1111/j.0737-1209.2005.220611.x.

KALLÉN B, BORG N & REIS M. 2013. The use of central nervous system active drugs during pregnancy. Pharmaceuticals 6(10): 1221-1286. https://doi.org/10.3390/ph6101221.

KASSADA DS, MARCON SS, PAGLIARINI MA & ROSSI RM. 2013. Prevenalência do uso de drogas de abuso por gestantes. Acta Paul Enferm 26(5): 467-471. http://dx.doi.org/10.1590/S0103-21002013000500010.

KASSADA DS, MARCON SS & WAIDMAN MAP. 2014. Percepções e práticas de gestantes atendidas na atenção primária frente ao uso de drogas. Escola Anna Nery 18(3): 428-434. https://dx.doi.org/10.5935/1414-8145.20140061.

KERKER BD, HORWITZ SM & LEVENTHAL JM. 2004. Patients’ characteristics and providers’ attitudes: Predictors of screening pregnant women for illicit substance use. Child Abuse Neglect 28(2): 209-223. https://doi.org/10.1016/j.chiabu.2003.07.004.

KESMODEL U, KESMODEL PS, LARSEN A & SECHER NJ. 2003. Use of alcohol and illicit drugs among pregnant Danish women, 1998. Scand J Soc Med 31(1): 5-11. https://doi.org/10.1080/1434940210134202.

KRESHAK A, VILLANO J, CLARK A, DEAK P, CLARK R & MILLER C. 2016. A descriptive regional study of drug and alcohol use in pregnant women using results from urine drug testing by liquid chromatography-tandem mass spectrometry. Am J Drug Alcohol Ab 42(2): 178-186. http://dx.doi.org/10.3109/00952990.2015.1116540.

KUNINS HV, BELLIN E, CHAZOTTE C, DU E & ARNSTEN JH. 2007. The effect of race on provider decisions to test for illicit drug use in the peripartum setting. J Womens Health 16(2): 245-255. https://doi.org/10.1089/jwh.2006.0070.

KUSHNIR H, BELLIN E, CHAZOTTE C, DU E & ARNSTEN JH. 2007. The effect of race on provider decisions to test for illicit drug use in the peripartum setting. J Womens Health 16(2): 245-255. https://doi.org/10.1089/jwh.2006.0070.

KUNINS HV, BELLIN E, CHAZOTTE C, DU E & ARNSTEN JH. 2007. The effect of race on provider decisions to test for illicit drug use in the peripartum setting. J Womens Health 16(2): 245-255. https://doi.org/10.1089/jwh.2006.0070.

LAM LP ET AL. 2015. Validation of the Drug Abuse Screening Test (DAST-10): A study on illicit drug use among Chinese pregnant women. Sci Rep-UK 5: srep11420. http://dx.doi.org/10.1038/srep11420.

LEDOIR E, GONZÁLEZ-COLMENERO E, CONCHEIRO-GUISÁN A, DE CASTRO A, CRUZ A, LÓPEZ-RIVADULLA M & CONCHEIRO M. 2013. Maternal hair analysis for the detection of illicit drugs, medicines, and alcohol exposure during pregnancy. Ther Drug Monit 35(3): 296-304. http://dx.doi.org/10.1097/FTD.0b013e318288453f.

LOBATO G, MORAES CL, DIAS AS & REICHENHEIM ME. 2012. Alcohol misuse among partners: a potential effect modifier in the relationship between physical intimate partner violence and postpartum depression. Soc Psych Psych Epid 47(3): 427-438. https://doi.org/10.1007/s00127-011-0346-z.

MANENTI SA ET AL. 2011. Epidemiologic and clinical characteristics of pregnant women living with HIV/AIDS in a region of Southern Brazil where the subtype C of HIV-1 infection predominates. Braz J Infect Dis 15(4): 349-355. https://doi.org/10.1541/3143-8670(11)70203-3.

MASHO SW, BISHOP DL, KEYSER-MARCUS L, VARNER SB, WHITE S & SVIKIS D. 2013. Least explored factors associated with prenatal smoking. Matern Child Health J 17(7): 1167-1174. https://doi.org/10.1007/s10812-011-1103-y.

MELO VH, BOTELHO APM, MAIA MMM, CORREA JÚNIOR MD & PINTO JA. 2014. Uso de drogas ilícitas por gestantes
infectadas pelo HIV. Rev Bras Ginec Obstet 36(12): 555-561. https://dx.doi.org/10.1590/S0100-720320140005155.

MIRANDA AE, PINTO VM & GAYDOS CA. 2014. Trichomonas vaginalis infection among young pregnant women in Brazil. Braz J Infect Dis 18(6): 669-671. http://dx.doi.org/10.1016/j.bjid.2014.07.002.

MITSUHIRO SS, CHALEM E, BARROS MM, GUINSBURG R & LARANJEIRA R. 2006. Teenage pregnancy: use of drugs in the third trimester and prevalence of psychiatric disorders. Rev Bras Psiquiatr 28(2): 122-125. http://dx.doi.org/10.1590/S1516-44462006000200009.

MONTGOMERY DP ET AL. 2008. Using umbilical cord tissue to detect fetal exposure to illicit drugs: a multicentered study in Utah and New Jersey. J Perinatol 28(11): 750-753. https://doi.org/10.1038/jp.2008.97.

MUCKLE G, LAFLAMME D, GAGNON J, BOUCHER O, JACOBSON JL & JACOBSON SW. 2011. Alcohol, smoking, and drug use among Inuit women of childbearing age during pregnancy and the risk to children. Alcohol Clin Exp Res 35(6): 1081-1091. http://dx.doi.org/10.1111/j.1530-0277.2011.01441.x.

OGA EA, MARK K & COLEMAN-COWGER VH. 2018. Cigarette smoking status and substance use in pregnancy. Matern Child Health J 22(10): 1477-1483. https://doi.org/10.1007/s10995-018-2543-9.

OLIVEIRA TA, BERSUSA AAS, SANTOS TFD, AQUINO MMAD & MARIANI NETO C. 2016. Perinatal Outcomes in Pregnant Women Users of Illegal Drugs. Rev Bras Ginec Obstet 38(4): 183-188. https://dx.doi.org/10.1055/s-0036-1580710.

ONDERSMA SJ, CHANG G, BLAKE-LAMB T, GILSTAD-HAYDEN K, ORAV J, BEATTY JR, GOYERT GL & YONKERS KA. 2019. Accuracy of five self-report screening instruments for substance use in pregnancy. Addiction 114(9): 1683-1693. https://dx.doi.org/10.1111/add.14651.

ORR ST, JAMES SA & REITER JP. 2008. Unintended pregnancy and prenatal behaviors among urban, black women in Baltimore, Maryland: the Baltimore preterm birth study. Ann Epidemiol 18(7): 545-551. https://doi.org/10.1016/j.annepidem.2008.03.005.

PETERS V ET AL. 2003. Missed opportunities for perinatal HIV prevention among HIV-exposed infants born 1996-2000, pediatric spectrum of HIV disease cohort. Pediatrics 111(Supplement 1): 1186-1191. Available from: http://pediatrics.aappublications.org/content/111/Su Damien 1186.short.

PICHINI S ET AL. 2005. Assessment of exposure to opiates and cocaine during pregnancy in a Mediterranean city: preliminary results of the “Meconium Project”. Forensic Sci Int 153(1): 59-65. https://doi.org/10.1016/j.forsciint.2005.04.013.

POLLARD I. 2007. Neuropharmacology of drugs and alcohol in mother and fetus. Seminars of Fetal and Neonatal Medicine 12(2): 106-113. https://doi.org/10.1016/j.siny.2006.12.001.

QUINLIVAN JA & EVANS SF. 2002. The impact of continuing illegal drug use on teenage pregnancy outcomes—a prospective cohort study. BJOG-Int Obstet Gy 109(10): 1148-1153. http://dx.doi.org/10.1111/j.1471-0528.2002.01536.x.

RENNER FW, COSTA BP, FIGUEIRA FP, EBERT JP, NASCIMENTO LS, FERRARI L, GROSSI M & FRANCA VT. 2016. Evaluation of drug use by pregnant women in a teaching hospital in the countryside of Rio Grande do Sul. Revista De Epidemiologia E Controle de Infecção 6(2): 68-73. http://dx.doi.org/10.1590/S0021-75572010000500006.

RIBEIRO MRC ET AL. 2014. Psychological violence against pregnant women in a prenatal care cohort: rates and associated factors in São Luís, Brazil. BMC Pregnancy Childb 14(1): 66. https://doi.org/10.1186/1471-2393-14-66.

ROCHA PC, BRITTO E ALVES MTSSD, CHAGAS DCD, SILVA AAMD, BATISTA RFL & SILVA RAD. 2016. Prevalência e fatores associados ao uso de drogas ilícitas em gestantes da coorte BRISA. Cad Saude Publica 32(1): e00192714. https://dx.doi.org/10.1590/0021-75572010000500006.

SANCHEZ S, SÁMANO R, FLORES-RAMOS M, RODRIGUEZ-BOSCH M, GARCÍA-SALAZAR D, HERNÁNDEZ-MOHAR G & GARCÍA-ESPINOSA V. 2015. Ganancia de peso durante la gestación y resultados perinatales en adolescentes embarazadas con antecedente de abuso sexual. Nutr Hosp 32(3): 1075-1081. Available from: http://www.redalyc.org/pdf/3092/309241035016.pdf.

SAUNEUL PM, PEARSON MR, POREMBA C, AMARO HDLA & LEEMAN L. 2019. An ecological momentary assessment study examining posttraumatic stress disorder symptoms, prenatal bonding, and substance use among pregnant women. Drug Alcohol Depen 195: 33-39. https://doi.org/10.1016/j.drugalcdep.2018.11.019.

SAUREL-CUBIZOLLES MJ, PRUNET & BLONDEL B. 2014. Cannabis use during pregnancy in France in 2010. BJOG-Int Obstet Gy 121(8): 971-977. https://doi.org/10.1111/1471-0528.12626.

SCHAUBERGER CW, NEWBURY EJ, COLBURN J & AL-HAMADANI M. 2014. Prevalence of illicit drug use in pregnant women in a Wisconsin private practice setting. Am J Obstet Gynecol 211(3): 255-e1. https://doi.org/10.1016/j.ajog.2014.03.023.
SCHEMPF AH. 2007. Illicit drug use and neonatal outcomes: a critical review. Obstet Gynecol Surv 62(11): 749-57. http://dx.doi.org/10.1097/01.ogx.0000286562.31774.76.

SHANKARAN S, DAS A, BAUER CR, BADA HS, LESTER B, WRIGHT LL & SMERIGLIO V. 2004. Association between patterns of maternal substance use and infant birth weight, length and head circumference. Pediatrics 114(2): e226-e234. https://doi.org/10.1542/peds.114.2.e226.

SHNEYDERMAN Y & KIELY M. 2013. Intimate partner violence during pregnancy: victim or perpetrator? Does it make a difference?. BJOG-Int J Obstet Gynaecol 120(11): 1375-1385. http://dx.doi.org/10.1111/1471-0528.12357.

SLAMBEROVA R. 2012. Drugs in pregnancy: the effects on mother and her progeny. Physiol Res 61: S123. Available from: http://www.biomed.cas.cz/physiolres/pdf/61%20Suppl%201/61_S123.pdf.

UNODC - UNITED NATIONS OFFICE ON DRUGS AND CRIME. 1971. Conference on Psychotropic Substances. Nova York: United Nations. Available from: https://www.unodc.org/pdf/convention_1971_en.pdf.

UNODC - UNITED NATIONS OFFICE ON DRUGS AND CRIME. 2016. World drug report 2016. Nova York: United Nations. Available from: http://www.unodc.org/doc/wdr2016/ WORLD_DRUG_REPORT_2016_web.pdf.

UNODC - UNITED NATIONS OFFICE ON DRUGS AND CRIME. 2019. World drug report 2019. Nova York: United Nations. Available from: https://www.unodc.org/wdr2019/index.html.

U.S. DEPARTMENT OF HEALTH AND HUMAN SERVICES. 2013. Center for Behavioral Health Statistics and Quality. Substance Abuse and Mental Health Services Administration. Results from the 2012 National Survey on Drug Use and Health: summary of national findings, NSDUH Series H-46, HHS Publication No. (SMA) 13-4795. Rockville: U. S. Department of Health and Human Services, Substance Abuse and Mental Health Services Administration. Available from: http://store.samhsa.gov/home.

VAN GELDER MM, REEFHUIS J, CATON AR, WERLER MM, DRUSCHEL CM & ROELEVELD N. 2010. Characteristics of pregnant illicit drug users and associations between cannabis use and perinatal outcome in a population-based study. Drug Alcohol Depen 109(1): 243-247. https://doi.org/10.1016/j.drugalcdep.2010.01.007.

VÉLEZ NM, GARCIA IE, GARCIA L & VALCARCEL M. 2008. The use of illicit drugs during pregnancy among mothers of premature infants. P R Health Sci J 27(3). Available from: http://prhsj.rcm.upr.edu/index.php/prhsj/article/view/70.

VIELLAS EF, GAMA SGH, CARVALHO ML & PINTO LW. 2013. Factors associated with physical aggression in pregnant women and adverse outcomes for the newborn. J Pediatr 89(1): 83-90. https://doi.org/10.1016/j.jspedd.2012.08.009.

WALLACE C, BURNS L, GILMOUR S & HUTCHINSON D. 2007. Substance use, psychological distress and violence among pregnant and breastfeeding Australian women. Aust NZ J Publ Heal 31(1): 51-56. http://dx.doi.org/10.1111/j.1753-6405.2007.00010.x.

WELLS GA, SHEA B & O’CONNELL D. 2019. The Newcastle-Ottawa Scale (NOS) for assessing the quality of nonrandomised studies in meta-analyses. Available from: http://www.ohri.ca/programs/clinical_epidemiology/oxford.asp.

WHO - WORLD HEALTH ORGANIZATION. 2009. Global health risks: mortality and burden of disease attributable to selected major risks. Geneva: WHO. Available from: http://www.who.int/healthinfo/global_burden_disease/GlobalHealthRisks_report_full.pdf.

WISNER KL, SIT D, O’SHEA K, BOGEN DL, CLARK CT, PINHEIRO E, YANG A & CIOLINO JD. 2019. Bipolar disorder and psychotropic medication: Impact on pregnancy and neonatal outcomes. J Affect Disorders 243: 220-225. https://doi.org/10.1016/j.jad.2018.09.045.

WRIGHT A & WALKER J. 2001. Drugs of abuse in pregnancy. Best Pract Res Clin Obstet Gynaecol 15(6): 987-998. https://doi.org/10.1053/beog.2001.0242.

WRIGHT TE & TAM E. 2010. Disparate rates of persistent smoking and drug use during pregnancy of women of Hawaiian ancestry. Ethnic Dis 20(1): 215. Available from: http://www.ishib.org/journal/20-1s1/ethn-20-01s1-215.pdf.

SUPPLEMENTARY MATERIAL

Flowchart
Modified Newcastle - Ottawa Quality Assessment Scale

How to cite
TAVELLA RA, DE ABREU VOM, MUCCILLO-BAISCH AL & DA SILVA JÚNIOR FM. 2020. Prevalence of Illicit Drug Use During Pregnancy: A Global Perspective. An Acad Bras Cienc 92: e20200302. DOI 10.1590/0001-37652020200302.

Manuscript received on March 2, 2020; accepted for publication on August 24, 2020
Author contributions

The author Ronan Adler Tavella is responsible for the development and execution of the research, as well as for the writing of the article. Victória Oliveira Melo de Abreu is responsible for the second review and verification of the agreement of the obtained data. Authors Ana Luiza Muccillo-Baisch and Flávio Manoel Rodrigues da Silva Júnior are advisor of the research project and are responsible for reviewing the article.