



SEINÄJOEN AMMATTIKORKEAKOULU  
SEINÄJOKI UNIVERSITY OF APPLIED SCIENCES

James McDonald, Johanna Kuula & Katri Pölkki

---

# **The Risks of Prenatal Alcohol and Drug Use for the Fetus**

Descriptive Literature Review

Thesis

Spring 2021

SeAMK School of Health Care and Social Work  
Degree Programme in Nursing



SEINÄJOKI UNIVERSITY OF APPLIED SCIENCES

## Thesis abstract

Faculty: School of Health Care and Social Work

Degree Programme: Degree Programme in Nursing

Specialisation: Bachelor of Nursing/Registered Nurse

Authors: James McDonald, Johanna Kuula & Katri Pölkki

Title of thesis: The Risks of Prenatal Alcohol and Drug Use for the Fetus: Descriptive Literature Review

Supervisors: Sinikka Vainionpää, MHSc, M.Ed, Lecturer & Marjut Asunmaa, MNSc, Senior Lecturer.

Year: 2021

Number of pages: 34

Number of appendices: 1

---

The aim of this thesis was to study the harmful effects of prenatal drug and alcohol use for the exposed fetus. The purpose was to conduct a literature review, and with it raise awareness of the risks of prenatal substance use. Based on our results, a written guide for English speaking clients of maternity clinics was made. Descriptive literature review was the research method chosen. In order to answer our two research questions, a total of 15 articles were chosen and analyzed using inductive content analysis.

The results indicate that prenatal substance use poses various risks for the development and growth of the fetus. Extensive study of prenatal alcohol exposure offers well documented evidence, largely involving fetal alcohol spectrum disorder alongside other developmental and birth related issues. The comparatively newer field of prenatal illicit drug exposure focuses on developmental problems and birth related complications, mentioning irregular formation of the organs, complications with birth, withdrawal symptoms, and the fact that most substances can cross the placental barrier. In this thesis, we focused on studying the effects of the most common illicit drugs: cannabis, cocaine, amphetamine-type stimulants, and opioids.

According to our results, the effects of prenatal alcohol use have been researched more than the risks of prenatal drug use and more study in this area is essential. Alcohol consumption research often considers safe levels of consumption and fails to reach a consensus. However, implied in the consumption of illicit drugs is the fact that abstinence would be recommended. In both cases though, pregnant mothers need to be afforded the opportunity of access to information and professional care.

<sup>1</sup> Keywords: Pregnancy, alcohol, illicit drugs, prenatal, fetus

## TABLE OF CONTENTS

Thesis abstract .....	2
TABLE OF CONTENTS.....	3
Pictures, Figures and Tables .....	4
Terms and Abbreviations.....	5
1 INTRODUCTION.....	6
2 PRENATAL CARE IN FINNISH MATERNITY CLINICS .....	8
3 ALCOHOL CONSUMPTION.....	10
4 DRUG USE .....	13
5 IMPLEMENTATION OF THE THESIS.....	16
5.1 Goal and purpose of the thesis.....	16
5.2 Literature review.....	16
5.3 Data collection and selection.....	17
5.4 Analysis.....	18
5.5 Ethicality and reliability of the study.....	18
6 RESULTS OF THE STUDY.....	20
6.1 Harmful effects of prenatal alcohol exposure to the fetus .....	20
6.1.1 Fetal Alcohol Spectrum Disorder .....	20
6.1.2 Developmental problems .....	21
6.1.3 Birth related complications.....	22
6.2 Harmful effects of prenatal illicit drug exposure to the fetus.....	23
6.2.1 Developmental problems .....	23
6.2.2 Birth related complications.....	24
7 CONCLUSION AND FURTHER RECOMMENDATION.....	26
BIBLIOGRAPHY .....	29
BIBLIOGRAPHY FOR LITERATURE REVIEW.....	32
APPENDICES .....	34

## Pictures, Figures and Tables

Figure 1. Total alcohol per capita consumption (APC) (15+ years; in litres of pure alcohol), 2016 (WHO 2018).....	10
Figure 2. Trends in the primary drug of concern in drug treatment, by region and selected subregions, 2003, 2009, 2014 and 2018 (United Nations Office on Drugs and Crime [Ref. 28 January 2021]).....	13
Figure 3. Prevalence of drug use disorders, males versus females, 2017 (Ritchie & Roser 2018).....	14
Figure 4. The data selection process.....	17
Table 1. Women’s and men’s prevalence rates (in %) of current drinking in the WHO regions and the world, 2000–2016 (WHO 2018).....	11

## Terms and Abbreviations

<b>AFR</b>	WHO African region
<b>AMR</b>	WHO American region
<b>APC</b>	Average Per-capita Consumption
<b>AUDIT</b>	The Alcohol Use Disorders Identification Test
<b>EMR</b>	WHO Eastern Mediterranean region
<b>EUR</b>	WHO European region
<b>FAS</b>	Fetal Alcohol Syndrome
<b>FASD</b>	Fetal Alcohol Spectrum Disorder
<b>PAE</b>	Prenatal alcohol exposure
<b>SEAR</b>	WHO South East Asia region
<b>THCA</b>	Tetrahydrocannabinol acid
<b>UNODC</b>	United Nations Office on Drugs and Crime
<b>WHO</b>	World Health Organisation
<b>WPR</b>	WHO Western Pacific region

# 1 INTRODUCTION

Nowadays the substance use among young women is increasing and about one third of the illicit drug abusers are women. Problems with substance use among mothers is the main cause of child custody. In Finland, about 6% of mothers have substance abuse problems. That means that every year there are 3600-6000 pregnancies where the healthy development of the fetus is endangered. (The Federation of Mother and Child Homes and Shelters, [ref. 7 October 2020].)

All substance use during pregnancy is a major risk for the development and growth of the fetus. Research has shown that most of the disadvantages are caused by alcohol. Illicit drug use among expecting mothers is increasing in Finland, and new information is constantly coming about the effects of illicit drug abuse during pregnancy. (Tiitinen 2020)

This thesis is focusing on the risks of illicit drug and alcohol use during pregnancy and the harmful effects which can occur to the fetus. Specific drugs like cannabis, cocaine, methamphetamine, opioids, and psychostimulants were chosen, because these were the ones we were able to find the newest information on. The thesis topic was chosen because substance use among expecting mothers is increasing. There is a need to raise the awareness that alcohol and illicit drug use during pregnancy is always a risk for the fetus and the mother. Maternity clinics work as a key factor to recognize the situations when substance use has become a problem to expecting mothers. An immediate intervention is needed, and maternity clinics together with maternity out-patient clinics cooperate in order to organize holistic treatment for the mother. (Tiitinen 2020)

The objective for this thesis is to make a descriptive literature review about harmful effects of alcohol and illicit drug use during pregnancy. With this method, we are able to describe the risks that this substance abuse can cause for the fetus. Using a wide range of sources, we were able to find the newest information for our literature review.

The goal of this thesis is to provide knowledge with the help of literature review about the risk of harmful effects to the fetus when a pregnant woman is using alcohol or illicit drugs. We focused on the most common drugs, which are marijuana, cocaine, opioids, and amphetamine type stimulants. In addition, our goal was to create an English guide for the clients of maternity

clinics, which can raise the awareness about the topic among clients. Nurses can use it also as a tool in guidance work.

## 2 PRENATAL CARE IN FINNISH MATERNITY CLINICS

Finnish maternity clinics were invented already in 1920's by Arvo Ylppö and the Mannerheim League for Child Welfare. Gradually, it became an essential part of well-being of Finnish families and society. The Finnish system of maternity clinics is globally known, and it is one of the reasons why Finland has the lowest infant and maternal mortality rate. (Kouvalainen 1995)

The Ministry of Social Affairs and Health is supervising and controlling the maternity and child health clinic services, which are regulated by the health care law. Municipalities are organizing totally free maternity clinic services for all child expecting families. Maternity clinics are working as part of a multidisciplinary team together with social and child welfare, early childhood education and specialized health care providers. (Finnish Ministry of Social Affairs and Health, [Ref. 25 March 2021].)

The goal of the maternity clinic is to follow that pregnancy is progressing safely and provide health education that prepares parents for the birth of a child. Maternity clinics provide valuable information about pregnancy, childbirth, and how to care of a new-born. Professionals of the maternity clinics assess the well-being of the family and provide psychosocial support, if necessary. Pregnancy monitoring happens in a collaboration of doctors and nurses. It is recommended to have at least two appointments with a doctor, at the beginning and at the end of pregnancy. If necessary, more visits will be planned. Appointments with the nurse are planned individually, but usually there are 8 to 15 visits during pregnancy. At the first visit to the maternity clinic, professionals aim to survey the current health status and lifestyles of the expectant women. Maternity clinics also provide post-natal follow-up visits. The purpose of these visits is, for example, to assess how the mother is coping and fresh parents can share their experiences. Every year, only few expectant women are not using the services of maternity clinics. (Tiitinen 2020)

According to the policies, substance use during pregnancy is being surveyed from expecting mothers in maternity clinic visits, but there is no official statistics about the number of abusers (Kahila & Kivistö 2019). After a positive pregnancy test, most expectant women stop or reduce their alcohol intake. A small percentage of women are unable to stop without the support of professionals, and that is when the role of maternity clinic is essential. There has not been any evidence of a safety limit of alcohol consumption during pregnancy. However, several studies suggest that the limit of alcohol abuse during pregnancy is over 10 doses per week. This does

not mean that less amount of alcohol is safe for the fetus. (Aalto et al. 2015, 163-164.) Professionals at the maternity clinic should ask all pregnant women about their alcohol use. Expectant women sometimes attempt to belittle or deny their total alcohol consumption. Maternity clinic workers should strive to a trustworthy and open environment when talking about alcohol use, without accusing the mother. Structured surveys, such as the AUDIT test, can be used as an interview tool. If a pregnant woman gets from the AUDIT test more than 8 points, the situation requires further investigation. When the extra monitoring is required due to alcohol abuse, the maternity clinic's duty is to refer the pregnant woman to hospital care, where maternity outpatient clinic can provide more intensive treatment. Care is always planned individually based on the patient's needs. (Kahila 2018)

It would be essential for the well-being of the foetus that the expecting mother could be able to share about possible drug use in maternity clinic (Tiitinen 2020). Recognizing the substance use at an early stage of pregnancy is important in order to get the mother referred to a multidisciplinary team in maternity clinic (Kahila & Kivistö 2019). The expecting mother is motivated to drug rehabilitation as a client of outpatient or institutional care. Short-term involuntary treatment is possible if needed. Rehabilitation can be implemented in every stage of pregnancy. Some drug replacement medicines can be used. (Tiitinen 2020) The priority for expecting mothers is sobriety, but reducing the use is already decreasing the disadvantages of drugs. It is recommended that already during the pregnancy, in addition to health care providers, child welfare is working together with parents by offering ways to support a sober life after the childbirth (Kahila & Kivistö 2019). Drug abuse during pregnancy is always high-risk pregnancy (Sariola et al. 2014).

One of most important aspects in clinical work is to recognize the correlation between the exposure to substances and symptoms (Halmesmäki & Autti-Rämö 2005). Precocious support and help can decrease the risk for fetal disorders and make an impact on both the mother's and the child's stage of well-being. It can also decrease the later costs of social- and healthcare (Arponen, Hakulinen & Kahila 2020).

### 3 ALCOHOL CONSUMPTION

The use of alcohol is part of many cultural, religious, and social activities, and provides many consumers with apparent pleasure. Although less than half of the world's adults have consumed alcohol in recent times, the global burden of illness caused by its harmful use is significant. It outweighs those caused by many other risk factors and diseases high on the global health agenda, which is alarming. (Boyle et al. 2013)

As the new World Health Organization (WHO) data shows, the overall alcohol per capita consumption (APC) in the world population aged 15 years or older corresponds to an average of 6.4 litres of pure alcohol per year for consumption, which correlates to 13.9 grams of pure alcohol per day. There is, however, a wide variance in overall alcohol consumption across the WHO regions. In countries within the WHO European Region, the highest per capita intake of alcohol (10 litres or more) is observed. Relatively high levels of alcohol consumption (7.5-9.9 litres of pure alcohol per capita) are found mostly in high-income countries, especially in the WHO Region of the Americas and the Western Pacific Region, but also in some African countries. The lowest per capita population in the world (less than 2.5 liters) lives in the WHO Eastern Mediterranean Region or other Muslim-majority countries, such as Niger in the WHO African Region, Indonesia in the WHO South-East Asia Region (SEAR) or Azerbaijan in the WHO European Region. (WHO 2018.)

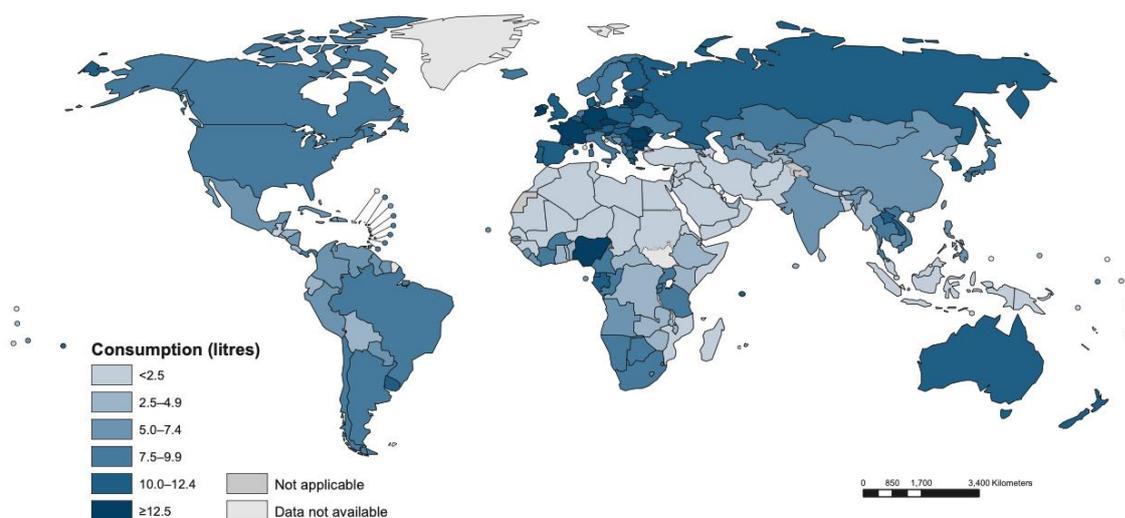


Figure 1. Total alcohol per capita consumption (APC) (15+ years; in litres of pure alcohol), 2016 (WHO 2018).

Around the world, consumption of alcohol is more prevalent amongst men when comparing the sexes. Upwards of half the world's female population aged 15 years or older abstain from alcohol use and are more frequently former drinkers. Furthermore, when women drink alcohol, they tend to drink less overall. (WHO 2018.)

Table 1. Women's and men's prevalence rates (in %) of current drinking in the WHO regions and the world, 2000–2016 (WHO 2018).

WHO Region		2000	2005	2010	2016
AFR	Men	50.9	48.3	46.1	43.6
	Women	27.6	25.5	23.4	21.0
AMR	Men	75.7	72.9	70.6	66.8
	Women	51.9	48.7	45.6	41.9
EMR	Men	6.2	5.7	5.3	4.6
	Women	1.7	1.5	1.4	1.2
EUR	Men	78.8	77.2	74.4	69.2
	Women	62.1	60.4	55.6	51.4
SEAR	Men	44.4	44.0	45.2	44.5
	Women	21.5	20.0	21.8	21.3
WPR	Men	63.4	61.0	67.4	66.5
	Women	39.3	36.4	42.0	40.7
World	Men	57.9	55.7	56.2	53.6
	Women	37.3	34.7	34.8	32.3

It is important to note that although the figures show a decrease in percentages, the world's population has grown. When population growth is factored into the equation, it actually tells that there are 91,000 more women and 245,000 more men drinking in 2016 compared to 2000. (WHO 2018.)

According to World Health Organization's global status report on alcohol and health, alcohol consumption in Finland is on European average level. In Finland, people are drinking alcohol slightly less frequently than in southern Europe, but higher amounts are consumed at once. Statistics from 2016 showed that in Finland over 15-year-old alcohol consumers total pure alcohol per capita was 20,6 litres among men and 7,2 litres among women. (WHO 2018)

A release from the Finnish Institute for Health and Welfare (THL) shows that total alcohol consumption has fallen sharply since 2007. Only between 2018 and 2019, total consumption of pure alcohol decreased 3,9 percent. The number of men who use alcohol weekly has

dropped from 60 percent to 53 percent. Similarly, the number of women who drink alcohol weekly fell from 35 percent to 28 percent. In addition, the number of abstainers is continuously increasing. However, in Finland, more than half a million people still drink above risk limits. The risk limits are defined for women as 7 doses or more per week, and for men as 14 doses or more per week. (Finnish Institute for Health and Welfare 2018)

## 4 DRUG USE

Around the world, nearly 36 million people are known to have issues with drug use. Usage of drugs is more prevalent in developed countries compared to developing countries. Within this scenario, there is also higher prevalence of drug use in wealthier segments of societies, while drug use disorders tend to develop amongst people that are socially and economically disadvantaged. (UNODC 2020)

As of 2018, 269 million people worldwide had used drugs at least once during the past year. Of the global population aged between 15 – 64, this represents 5.4% or roughly 1 in every 19 people. In terms of reformed drug users, between 2009 and 2018, estimates grew from 210 to 269 million people. This corresponds to around a 28% increase. Overall, there has been a growth of around 12% in the prevalence of adult drug use from 4.8% to 5.4% during this period. It is important to remember, however, that part of these increases can be attributed to growth in global population, and that the best available data relies on wide estimates. (UNODC 2020)

When discussing global drug use, it is also interesting to note the different types of usage in different regions. The four most commonly used drugs world-wide are: cannabis, opioids, cocaine and amphetamines. The roles played by these different drugs can be visualized in the following diagram.

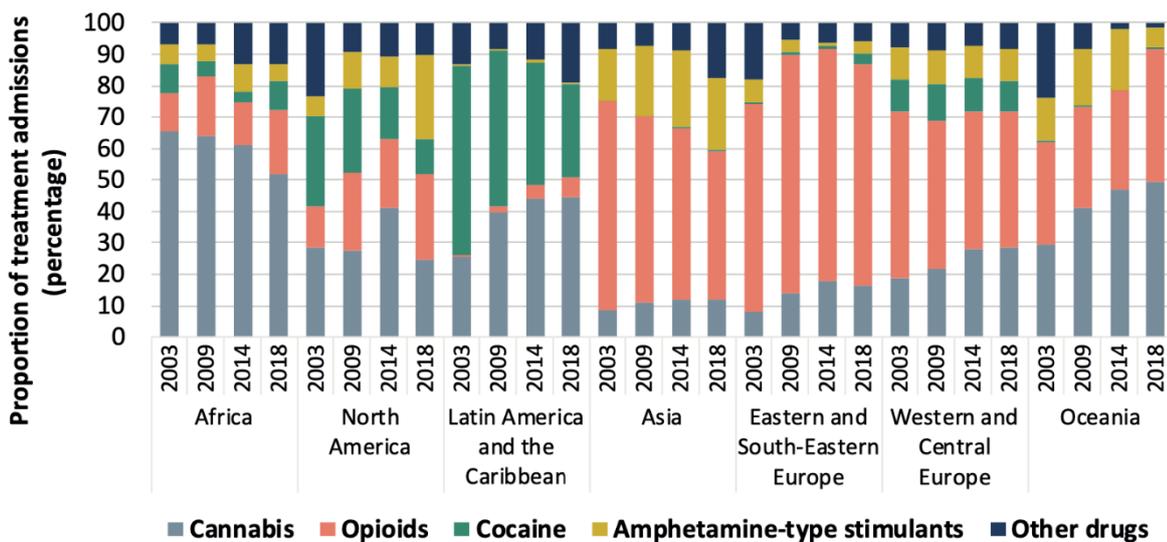


Figure 2. Trends in the primary drug of concern in drug treatment, by region and selected subregions, 2003, 2009, 2014 and 2018 (United Nations Office on Drugs and Crime [Ref. 28 January 2021]).

For the purposes of this research, it is also important to examine the differences of drug use between genders. Data clearly shows that globally, drug use is more common amongst men and less prevalent amongst women. Different regions of the world show different figures, but in every case, men are more often using drugs than women. (Ritchie et al. 2018)

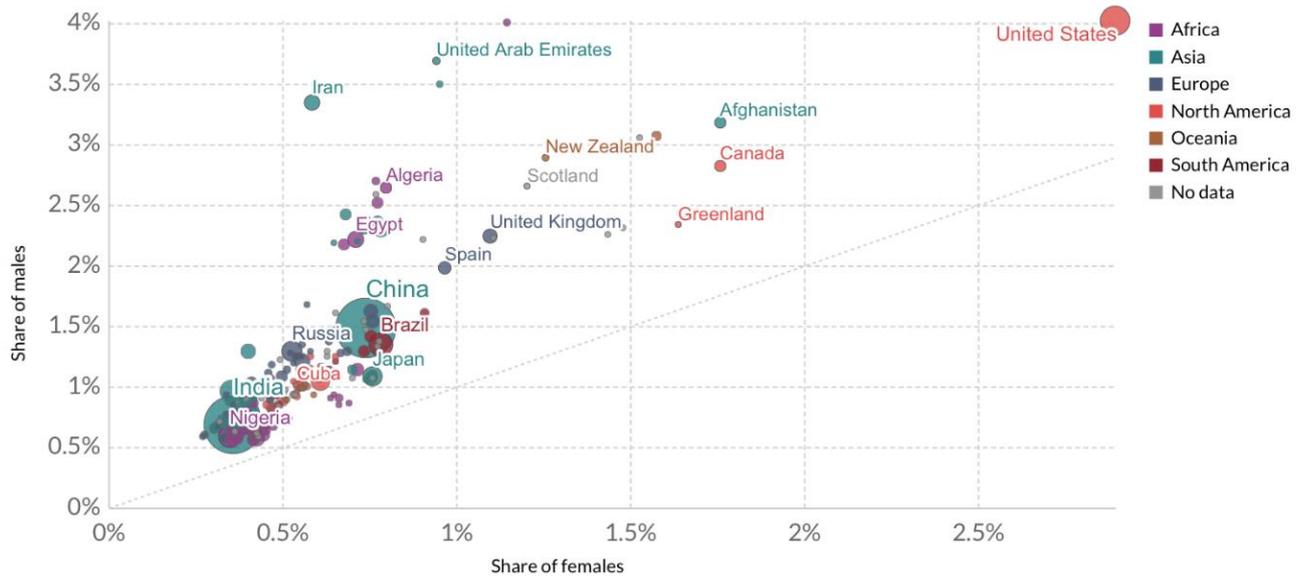


Figure 3. Prevalence of drug use disorders, males versus females, 2017 (Ritchie & Roser 2018).

According to several studies, most commonly Finnish drug addicts start with drinking alcohol at the average age of 13. After the use of alcohol, cannabis experiment takes place. These steps can lead to abuse of different kinds of medicines and illegal drugs. After cannabis, the most used drugs in Finland are stimulants such as amphetamines and cocaine, and opioids such as heroin. Most of opioid and amphetamine use happens intravenously but mixed-use also occurs. (Seppä et al. 2012, 10-22)

The Finnish Institute for Health and Welfare (THL) presented in statistical reports what kind of drug use behavior and attitudes Finnish people had in 2018 and pointed out a steady increase. The most common drug that has been used for experimental purposes was cannabis. Cannabis experiments have increased from 6% to 24% between 1992 and 2018. The use of stimulants has also become more common, but the number of experimental uses remains still under 5%. In 2018, every fourth Finn has used some illegal drug during their lifetime. Out of

that, 28% were men and 20% were women. However, these statistics included users whose drug experiments may be in the previous years or once in their lifetime. When looking at how many have used illegal drugs during the past year, 11% were men and 5% were women. Additionally, in a four-year comparison, the use of drugs has increased more among women than men (Karjalainen, Hakkarainen & Salasuo 2019).

## **5 IMPLEMENTATION OF THE THESIS**

### **5.1 Goal and purpose of the thesis**

The goal of this thesis is to provide knowledge with the help of a literature review about the risks of harmful effects to the fetus when a pregnant woman is using alcohol or illicit drugs. We focused on the most common drugs, which are marijuana, cocaine, opioids, and amphetamine type stimulants. In addition, our goal was to create an English guide for the clients of maternity clinics, which can raise the awareness about the topic among clients. Nurses can use it also as a tool in guidance work.

The research questions of this thesis are:

1. What are the harmful effects of prenatal alcohol exposure to the fetus?
2. What are the harmful effects of prenatal illicit drugs exposure to the fetus?

### **5.2 Literature review**

According to general characterization, literature review is a method and research technique for researching already existing studies. In order to gather study results which are the base of new study results, there is a need for methodological instructions and rules. Descriptive literature review, sometimes called traditional literature review, can work as an individual method for research, but it can be also used as a tool to research phenomenon for systematic literature review. (Salminen 2011)

There can be various reasons to choose literature review as a research method. The aim for literature review is to develop the already existing theory, build a new theory, and recognize the problems. Theory can also be evaluated with literature review and it helps build the overall picture of the subject area. Literature review offers an opportunity to describe the historical development of the theory. (Baumeister & Leary 1997, 312)

This thesis was implemented with descriptive literature review method. Descriptive literature review is a typical form of literature reviews. It can be characterized as a general view of the chosen topic. There are not strict rules in descriptive literature review. The used range of data

is wide, and it is not limited with methodological rules. The chosen phenomenon can be described widely and characteristics of it can be classified if necessary, even though research questions are broader than in systematic review or meta-analysis. (Salminen 2011)

### 5.3 Data collection and selection

When implementing this thesis, there were three stages of data collection and selection: search, selection and analysis of the data. Search engines used were SeAmk Finna, Cinahl, PubMed and Google scholar. Key words for data searching were pregnancy, drugs, alcohol, and fetus. Word combinations and synonyms of these words were used. Requirements for chosen articles were full-text availability and maximum 10 years from publication. Within these limitations, we were able to get the most recent information about our topic. Searches were done between 1st and 28th of February 2021. As a result of our data searching, 31 articles were retrieved. After this, we started analyzing the data and 15 most relevant articles were chosen. The criteria for this was the ability to answer to our research questions.

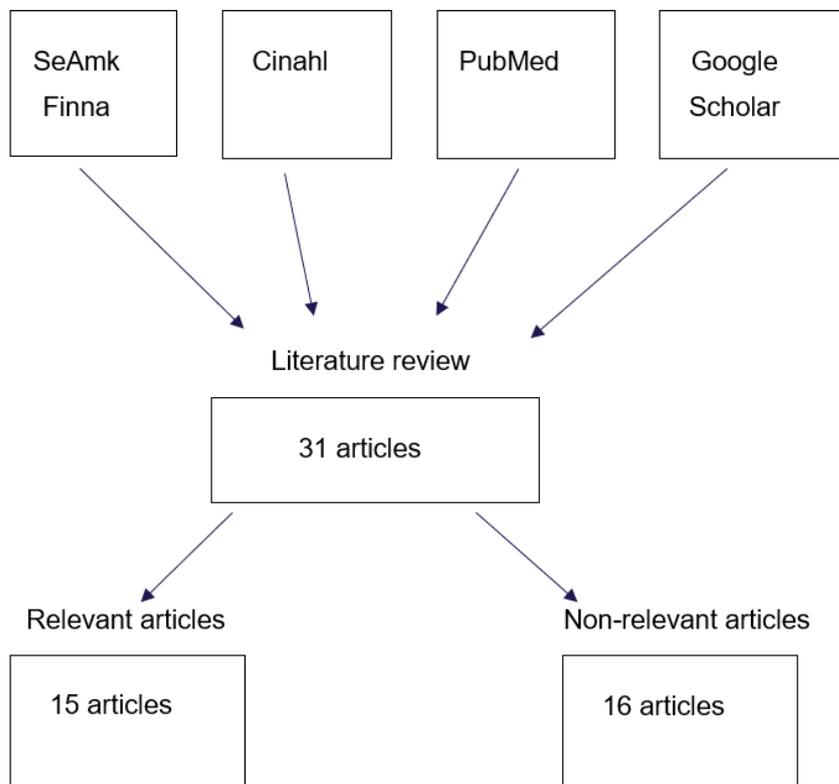


Figure 4. The data selection process

## 5.4 Analysis

In this thesis, inductive content analysis was used as an analysis method. Data reduction, data grouping and the formation of concepts, followed by comparison of similarities and differences of the extrapolated data, are the phases used by inductive content analysis in order to answer to the research questions (Kyngäs et al. 2020).

Reading our chosen research material thoroughly, and then marking key points and sections was our starting point, followed by initial, close examination of the strengths and weaknesses within each piece of source material (Aveyard 2014), and reading each of our chosen articles carefully and extrapolating the key points.

After checking each source individually, the next step was to compare them. Similarities and differences between different sources, comparison and contrast (Oliver 2012). It was important to see if our source materials were talking about the same topics, and whether they had similar findings. Organizing our chosen research material into a summarized form helped to visualize the different sources when placed next to each other.

Comparison led to themes within the research. These themes contributed to the structure of results. Presentation of these themes required organization, so that they showed relationship and logical order, contributing to the style in which our literature review answered to our research questions (Aveyard 2014).

## 5.5 Ethicality and reliability of the study

One of the fundamental pillars underlying research ethics encompasses issues pertaining to professional standards for ethical research. This implies sound scientific practice and publicly accountable research. In addition, terms such as credibility, dependability, confirmability, authenticity, and transferability play a central role in the trustworthiness of the research. (Kyngäs et al. 2020)

An inherent ethical concern of conducting a literature review is plagiarism. As a literature review is relying entirely upon people's work, it was important to maintain an ethical code of conduct. Careful use of citation and acknowledgment was essential. Referenced paraphrasing, quotation and a bibliography were used.

Usage of credible databases and confirmation of other sources ensured reliability of our source material. Searching for the most current information and its source material references also added to reliability. Following our university's official instructions for written work provided reliable structure. Participating in seminars during the writing process ensured that our study received guidance.

Furthermore, consideration must be applied to the output of this research. With the aim of providing a guide for nurses and patients, care must be taken to ensure that these elements are both reliable and ethical. The output must be trustworthy, in that it is presented clearly for both parties and representative of the evidence (Kyngäs et al. 2020).

Ethical concerns of the chosen topic were taken into consideration as well. According to Leppo (2012), uncontrolled use of substances is triggering fears and attitudes towards abusers. Lower social status seems to be an increasing factor for alcohol or drug problem. Because of women's key role in social reproduction, there is strong stigma towards prenatal substance use. It is an important ethical question how pregnant women with substance use problems are encountered in maternity clinic. Atmosphere should be respectful, non-moralizing and encouraging.

## **6 RESULTS OF THE STUDY**

### **6.1 Harmful effects of prenatal alcohol exposure to the fetus**

One of the most common and variable risk factors for somatic, behavioral, and neurological abnormalities is prenatal alcohol exposure (PAE) (Dörrie et al. 2014). Andersen et al. (2012) emphasizes that there are still disputes on whether there is a safe level of alcohol consumption during pregnancy. Alcohol, it is believed, may influence the foetus relative to levels of consumption (Ornoy et al. 2010). PAE causing a variety of problems for the foetus, is a significant public health concern and will agonize future generations without prosperous prevention, intervention, and handling. Awareness of risks of alcohol consumption before, during and after pregnancy should be increased and alcohol reduction and abstinence should be highlighted (Dejong, Olyaiei & O.Lo 2019).

Depending on the stage of the pregnancy and the levels of consumption, many organs and systems of an unborn child can be at risk when the mother consumes alcohol. For these reasons, it is pertinent for a mother to be aware of the risks and avoid the chance of harming their child. However, giving specific recommendations is difficult when the levels of consumption and exact dose response relationships, in terms of their effect on the unborn child, are unclear. (Ornoy et al. 2010)

Behnke et al. (2013) states that alcohol is still the most researched prenatal substance of abuse and that, although there is no definitive evidence of neonatal withdrawal syndrome, there are clear links to fetal growth rates, congenital anomalies and changes in infant neuro-behavior.

#### **6.1.1 Fetal Alcohol Spectrum Disorder**

It is known that alcohol use during pregnancy is the leading cause of nongenetic cognitive disability (Dejong, Olyaiei & O.Lo 2019). PAE can cause a wide variety of symptoms known as fetal alcohol spectrum disorder (FASD) (Dörrie et al. 2014; Dejong, Olyaiei & O.Lo 2019). According to Hoffman & Joshua (2011), FASD concerns perpetual and life-long brain damage and its most recognizable form is fetal alcohol syndrome (FAS). FASD characteristics may include, for example, complex pattern of facial dysmorphic features, growth deficiency and central nervous system dysfunction (Hoffman & Joshua 2011; Dörrie et al. 2014). Developing

both before and after birth, lower growth rates, distinct facial features, lower cognitive skills, behavioral issues and a range of anomalies, have a 6-10% chance of manifesting when large amounts of alcohol are consumed on a regular basis. Highlighted further is that lower levels of regular consumption usually result in “alcoholic effects” characterized by problems with growth, cognition and behavior, and that binge drinking may be associated with intellectual development. (Ornoy et al. 2010)

Making the diagnosis of fully developed fetal alcohol syndrome (FAS) is not a major challenge. Preliminary diagnosis of FASD can be performed in a case where the presence of mild symptoms and/or alcohol use during pregnancy cannot be witnessed (Dörrie et al. 2014). FASD will last a lifetime and there is no current treatment (Dörrie et al. 2014; Dejong, Olyaei & O.Lo 2019).

### **6.1.2 Developmental problems**

According to Hepper, Dornan and Lynch (2012), maternal alcohol intake and its negative neurobehavioral effects on the fetus have mainly been studied in the after-childbirth period, after the alcohol exposure has ended. Their research looked at the fetus' brain activity at the time of alcohol consumption, to see if it influenced information processing and performance. The findings of the study suggest that maternal alcohol intake has an effect on the brain function of the fetus. The study set a limit of 22.5 units per week for heavy drinking and 7.5 units per week for moderate drinking. Drinking heavily had a greater impact on results than drinking moderately. Notably, heavy drinking weakened the brain's functional stability and raised performance variability. The fetus is exposed to the alcohol ingested by the mother, and the placenta provides no significant defense against alcohol.

Behnke et al. (2013) states that alcohol is still the most researched prenatal substance of abuse and that although there is no definitive evidence of neonatal withdrawal syndrome, there are clear links to fetal growth rates, congenital anomalies and changes in infant neurobehavior. Dörrie et al. (2014) presents that a variety of somatic findings and structural abnormalities might be present in the cerebrum and cerebellum, caused by teratogenic effects of PAE. According to Ross et al. (2015), reduced brain volume, corpus callosum abnormalities and cognitive delays and impairments might have a connection with PAE.

According to Gauthier (2015), human and animal research shows evidence that ingesting alcohol during pregnancy may weaken the fetal immune system, raising the risk of infections and diseases in newborns. These effects may last a lifetime. In animal studies, it is shown that alcohol exposure has direct effect on the developing immune system. There is a need for further research in order to create comprehensive knowledge about the mechanisms of alcohol exposure and how it is affecting fetal immune system in uterus.

Alcohol can have a consequential impact on the immune system by increasing the risk of premature birth. That itself is a risk factor for immune-related problems. A number of severe medical conditions, such as respiratory, cardiac, neurological, and gastrointestinal problems, can be outcomes of premature birth. Alcohol consumption during pregnancy may worsen these problems. The theory that alcohol use during pregnancy can alone increase the risk of premature birth, is still being investigated. (Gauthier 2015)

### **6.1.3 Birth related complications**

Andersen et al. (2012) assessed in a Danish pregnancy cohort-study that maternal alcohol intake has an effect on fetal mortality, such as spontaneous abortion and stillbirth. Similar findings were presented by Ross et al. (2015), where they highlighted the link between premature birth, spontaneous abortion, reduced fetal growth and PAE. The results of the study carried out by Andersen et al. (2012) pointed out that the risk of spontaneous abortion was significantly higher when women were consuming low to moderate levels of alcohol during pregnancy. The findings suggest that in early pregnancy (the first 16 weeks), the risk of miscarriage is the highest, because that is the time when the fetus is the most vulnerable to alcohol exposure. There was no evidence of a correlation between moderate alcohol consumption and later spontaneous abortion or stillbirth.

Bailey et al. (2011) examined the link between alcohol exposure during pregnancy and risks of miscarriage, stillbirth, and preterm delivery. It was noted that sociodemographic and lifestyle factors, tending to coexist with alcohol consumption during pregnancy, cloud the direct link to biological factors and may, in turn, create synergy, compounding the problem. At least in part, a direct physical mechanism could be hypothesized by observing tightly controlled human trials, animal studies and research of structural/chemical alterations.

## **6.2 Harmful effects of prenatal illicit drug exposure to the fetus**

Ross et al. (2015) have presented that the majority of illicit drugs can cross the human placenta and influence the developing brain and nervous system of the fetus by causing long-lasting implications for structure and function. This article was considering opiates, cannabinoids, and psychostimulants. They highlighted that the type of drug, timing, dosage, and pattern of intake will determine the long-term effects on the developing brain of the fetus and child. Drug abuse is also affecting the organs of the expecting mother and this can cause indirect effects for the fetus. Behnke et al. (2013) proposes that some general extrapolatory conclusions can be drawn from the current knowledge base, but the fact remains that methodological differences and limited data make it difficult to generalize impacts of several drugs.

### **6.2.1 Developmental problems**

Different from the consequences for adult physiology, the effects of prenatal substance abuse influence irregular change on the undeveloped nervous system of the fetus before homeostatic regulatory systems are established. Long term anatomical and functional development of the fetal brain and nervous system have been noted to be at risk of consequence, due to the fact that most illicit drugs can pass freely from mother to child in utero. As an example, brain abnormalities were noted as a possible result of prenatal psychostimulant use. (Ross et al. 2015)

Problems in neurological development are noted as possible effects of prenatal use of opiates (Behnke et al. 2013; Ross et al. 2015). Having an effect on the brain's development of various senses and reflexes, attenuated myelination was proven to be hindered by prenatal opiate use (Ross et al. 2015). While researching the women's health effects of prenatal methamphetamine use, it was noted that there was a significant increase in the risks of neurodevelopmental issues (The American College of Obstetricians and Gynecologists 2011).

Investigations into the prenatal effects of substance abuse has shown that negative changes in infant neurobehavior are likely. Mothers who used methamphetamine, cocaine, opiates, or marijuana alike, gave birth to children demonstrating irregular patterns of neurobehavior. In some cases, the further reaching risk of long-term behavioral problems have been documented. (Behnke et al. 2013)

Respiratory insufficiency and heart defects have been cataloged as effects of illicit drug use during pregnancy. Demonstrated links between prenatal opiate use and both heart and lung abnormalities have been witnessed. During examination of prenatal psychostimulant use, it was also noted that the function of the fetus' heart was affected. (Ross et al. 2015)

Methamphetamine use significantly raises the risk for low birth weight and small gestational age (The American College of Obstetricians and Gynecologists 2011). According to the cohort study from Wright et al. (2015), methamphetamine is one of the most frequently used illicit drug during pregnancy. The result of the study pointed out the fact that drug-free pregnancy had better outcomes with longer gestational age, and an average birth was even 176g heavier than in methamphetamine or other drug exposed pregnancies. Women who used methamphetamine through their whole pregnancy were more likely to give birth with lower birth weight and shorter gestational age. According to Gouin et al. (2014), cocaine use during pregnancy is causing similar problems with birth weight and gestational age. Santos et al. (2018) agrees with previous statement and points out that reduced head circumference and placental displacement were correlated with prenatal cocaine use as well. Santos highlights that the number of children who have been exposed to cocaine during pregnancy has shown an increase.

Prenatal exposure to methamphetamine is still a new topic requiring more study. The early investigations have shown links between prenatal exposure to methamphetamine and fetal growth. Likewise, prenatal opiate and cocaine use may have slight effects on fetal growth as well (Behnke et al. 2013). In this study, it was addressed that there is no evidence of prenatal cannabis use and decreased foetal growth, but few years later Ross et al. (2015) presents that it may cause problems with that issue.

### **6.2.2 Birth related complications**

A cohort study of methamphetamine exposed pregnancies showed that women who used methamphetamine during the whole pregnancy time were the most vulnerable for preterm delivery. On the study, 86% stopped using methamphetamine at some point during the pregnancy, and it noticeably improved birth outcomes when comparing to those who continued throughout the whole pregnancy. The risk for preterm delivery together with fetal developmental problems had a correlation with neonatal morbidity and stillbirth (Wright et al.

2015). When the outcomes of smoking and illicit drug exposed pregnancies were compared on a population-based study, the research noted that THCA, which is found from cannabis, had a significant connection with stillbirth (Varner et al. 2014).

Gouin et al. (2014) compared research on the outcomes of cocaine exposed pregnancies and non-cocaine exposed pregnancies. The results of the research presented that cocaine use during pregnancy significantly increases the risk of preterm birth. The study made by Santos et al. (2018) found a correlation between prenatal crack cocaine use and preterm birth. In addition, it offers strong evidence that prenatal crack cocaine use is linked to other poor pregnancy outcomes. According to Ross et al. (2015), prenatal psychostimulant use as well as prenatal opiate use can lead to preterm birth, but also connections to other possible obstetric problems have been detected.

Research by Behnke et al. (2013) and Ross et al. (2015) studied the connection between prenatal illicit drug use and withdrawal symptoms of an infant. They both agreed that there is a connection between prenatal opiate use and neonatal abstinence syndrome. According to Behnke et al. (2013), neonatal abstinence syndrome is the most significant effect of prenatal opiate exposure. Neonatal abstinence syndrome is the withdrawal effect when a baby no longer receives substances it received as a fetus. Sweating, muscle tone, activity, irritability, feeding problems, diarrhea and seizures have been observed as a result. Lengthy medical treatment and hospitalisation are often required to care for an infant who has been influenced by opiates as a foetus. Prenatal cannabis, methamphetamine, cocaine use and possible neonatal withdrawal symptoms have been studied in this same research. A small connection between prenatal cocaine use and withdrawal symptoms is present, but no evidence of cannabis or methamphetamine causing same kind of symptoms.

## 7 CONCLUSION AND FURTHER RECOMMENDATION

The aim of this thesis was to study the harmful effects of prenatal drug and alcohol use for the fetus. The purpose of this thesis was to make a literature review and with it, raise the awareness of the risks of prenatal substance use. We provided a guide in English about the chosen topic. Our guide can help with raising awareness among pregnant women who are using the services of maternity clinics, and it can be used as a tool in counselling work.

Alcohol use in Finland is on European average level, but still more than half million people drink more than risk limitations. Statistics of illicit drug users have shown a slight increase. Substance use among young women is an increasing problem, and therefore, every year there are around 3600-6000 pregnancies where the healthy development of the fetus is endangered because of substance use during pregnancy. (The Federation of Mother and Child Homes and Shelters, [ref. 7 October 2020])

Prenatal substance use is always a risk for the development and growth of the fetus and maternity clinics play an important role in identifying cases where expecting mothers need the help of a multidisciplinary team (Tiitinen 2020). In this thesis, we focused on prenatal alcohol and illicit drug use and what can be the harmful effects for the developing fetus. Common drugs chosen for this study were: marijuana, cocaine, opioids, and amphetamine type stimulants.

The risks of alcohol exposure for the unborn child are well known. Research makes clear the correlations between alcohol consumption and various negative outcomes. Definitely the most obvious and well documented consequence of alcohol consumption during pregnancy is FASD. Encompassing negative effects, such as dysmorphic facial features, growth deficiency, cognitive problems, behavioral issues and anatomical changes, FASD has stood out in this area of research for a long time.

Alongside FASD, there is a range of other individual developmental risks and birth related complications associated with PAE. The link between consumption of alcohol during the early stages of pregnancy and miscarriage has been documented. Stillbirth too, is a documented risk. Preterm birth and the heightened associated risks such as respiratory, cardiac, neurological, and gastrointestinal problems are evident. Direct effects on brain activity and the fetus' immune system have also been discovered. Alcohol use during pregnancy really stands out as something that health care professionals need to monitor in their communities.

Most of illicit drugs can go through the placenta and affect the development of the fetus and cause long-term effects to the health of a newborn. Prenatal substance abuse is a significant risk to the development of organs and nervous system of the fetus. Drug exposed pregnancies are also more vulnerable for complications. The type of drug together with duration of exposure, influence on the birth outcome. Furthermore, drug use is harmful for the organs of a mother and so indirectly affecting the wellbeing of the fetus.

Methamphetamine, which is the most commonly used drug during pregnancy, has significant risk for various developmental issues, such as neurological development, low birth weight and small gestational age. Continuous prenatal use of methamphetamine was also a major risk for preterm delivery and stillbirth. Cannabis use as well during pregnancy was a risk for poor fetal growth and stillbirth. The results showed that cocaine exposed pregnancies are increasing and causing same risks as prenatal methamphetamine use. Yet, other developmental issues and withdrawal symptoms are related to prenatal cocaine use. Prenatal psychostimulant use, as well as opiate use, can endanger the development of many essential organs of the fetus. In addition, there was a link to other obstetric problems, like preterm birth. Opiate use had a significant connection to neonatal abstinence syndrome, whose withdrawal effects are a reason for various physical symptoms of a newborn.

The effects of prenatal alcohol use have been a topic of research for much longer than the risks of prenatal drug use. It was obvious here that, although prenatal alcohol use has been studied for longer, a lot of the resources were older than our ten-year resource criteria limit. On the other hand, it was easy to find information for prenatal drug use within the last ten years, but the research was new and often stating that more examination is required.

More research into the effects of prenatal substance use is essential. With some of the effects such as withdrawal and congenital anomalies, it is easy to witness cause and effect, but with others, it has been noted that coexisting factors cloud results. Some of the coinciding sociodemographic and lifestyle factors of research participants have been suggested to play a role. For instance, when researching causal relationships between prenatal drug and alcohol consumption and preterm delivery, miscarriage, stillbirth, growth rates and neurobehavior. More research is needed to shed light on these areas of concern.

Based on our results, use of alcohol and drugs during pregnancy poses significant risks. In this thesis, we focused specifically on the effects to the exposed fetus, but noticed during our

analysis that these effects are often reported including risks for further development of children. We think it would be worthwhile to follow on from this research into examining the specific risk for children.

## BIBLIOGRAPHY

- Aalto, M., Alho, H., Kiinanmaa, K. & Lindroos, L. 2015. Alkoholiriippuvuus. 3rd ed. Helsinki: Kustannus Oy Duodecim.
- Arponen, A., Hakulinen, T. & Kahila, H. 2020. Alkoholien käytön aiheuttamia sikiövaurioita voidaan ehkäistä - kulutusta mittaava verikoe pitäisi ottaa osaksi äitiysneuvoloiden seulontatutkimuksia. [Blog entry]. THL-Blogi. [Ref. 23 January 2021]. Available at: <https://blogi.thl.fi/alkoholin-kayton-aiheuttamia-sikiovaurioita-voidaan-ehkaista-kulutusta-mittaava-verikoe-pitaisi-ottaa-osaksi-aitiysneuvoloiden-seulontatutkimuksia/>
- Aveyard, H. 2014. Doing a Literature Review in Health and Social Care: A Practical Guide. [E-Book] Maidenhead: McGraw-Hill Education. [Ref. 8 February 2021] Available in the Ebsco eBook Collection. Registration required.
- Baumeister, R. F. & Leary, M. R. 1997. Writing Narrative Literature Reviews. [Online article]. Review of General Psychology. [Ref. 11 January 2021]. Available at: [https://www.researchgate.net/publication/230853004\\_Writing\\_narrative\\_literature\\_reviews](https://www.researchgate.net/publication/230853004_Writing_narrative_literature_reviews)
- Boyle, P., Boffetta, P., Albert, B., Lowenfels, Burns, H., Brawley, O., Zatonski W., & Rehm, J. 2013. Alcohol: Science, Policy and Public Health. [E-Book] Oxford: OUP Oxford. Available in Ebsco eBook Collection. Registration required.
- Finnish Institute for Health and Welfare (THL). 5.9.2018. Suomalaisten alkoholinkulutus on vähentynyt, mutta edelleen yli puoli miljoonaa juo yli riskirajojen. [Web page]. [Ref 9 January 2021]. Available at: <https://thl.fi/fi/-/suomalaisten-alkoholinkulutus-on-vahentynyt-mutta-edelleen-yli-puoli-miljoonaa-juo-yli-riskirajojen>
- Finnish Ministry of Social affairs and Health. Undated. Maternity and Child Health Clinics. [Web page]. [Ref 25 March 2021]. Available at: <https://stm.fi/en/maternity-and-child-health-clinics>
- Halmesmäki, E. & Autti-Ramö, I. 2005. Fetaali-alkoholisyyndrooma: Voidaanko lapsen ennustetta parantaa. [Online article]. Duodecim. [Ref. 20 January 2021]. Available at: <https://www.duodecimlehti.fi/lehti/2005/1/duo94715?keyword=voidaanko%20lapsen%20ennustetta%20parantaa>
- Kahila, H. 2018. Raskaana oleva päihteidenkäyttäjä. [Online article]. Lääkärin käsikirja. [Ref. 15 March 2021]. Available in the Duodecim Terveystietä database. Registration required.
- Kahila, H & Kivistö, K. 2019. Huumeet ja raskaus. [Online article]. Lääketieteellinen aikakauskirja Duodecim 135 (2), 131–7. Available in the Duodecim Terveystietä database. Registration required.
- Karjalainen, K., Hakkarainen, P. & Salasuo, M. 2019. Suomalaisten huumeiden käyttö ja huumeasenteet 2018 [Online publication]. Helsinki: Finnish Institute for Health and

- Welfare (THL). [Ref 10 January 2021]. Available at: [https://www.julkari.fi/bitstream/handle/10024/137660/Suomalaisten\\_huumeiden\\_k%C3%A4ytt%C3%B6\\_ja\\_huumeasenteet\\_2018\\_tilastoraportti.pdf?sequence=3&isAllowed=y](https://www.julkari.fi/bitstream/handle/10024/137660/Suomalaisten_huumeiden_k%C3%A4ytt%C3%B6_ja_huumeasenteet_2018_tilastoraportti.pdf?sequence=3&isAllowed=y)
- Kouvalainen, K. 1995. Neuvolatoimintojen haasteet ja uhat. [Online article]. Lääketieteellinen aikakausikirja Duodecim 111 (1), 32-. Available at: <https://www.duodecimlehti.fi/duo50007>
- Kyngäs, H. Mikkonen, K. & Kääriäinen, M. 2020. The Application of Content Analysis in Nursing Science Research. [E-Book]. Cham: Springer. [Ref. 18 March 2021]. Available in the Ebsco eBook Collection. Registration required.
- Leppo, A. 2012. Precarious Pregnancies: Alcohol, Drugs and The Regulation of Risks. [E-Book]. Helsinki: Unigrafia. [Ref. 8 April 2021]. Available at: <https://helda.helsinki.fi/bitstream/handle/10138/29236/precario.pdf?sequence=1&isAllowed=y>
- Oliver, P. 2012. Succeeding with Your Literature Review: A Handbook for Students. [E-Book] Maidenhead: McGraw-Hill Education. [Ref. 8 February 2021] Available in Ebsco eBook Collection. Registration required.
- Ritchie, H., Roser, M. 2019. Opioids, Cocaine, Cannabis and Illicit Drugs 2018. [Online publication]. [Ref 14 January 2021]. Available at: <https://ourworldindata.org/illicit-drug-use#citation>
- Salminen, A. 2011. Mikä kirjallisuuskatsaus? Johdatus kirjallisuuskatsauksen tyypeihin ja hallintotieteellisiin sovelluksiin. [Online article]. Vaasan Yliopiston Julkaisuja. [Ref. 7 January 2021]. Available at: [https://www.univaasa.fi/materiaali/pdf/isbn\\_978-952-476-349-3.pdf](https://www.univaasa.fi/materiaali/pdf/isbn_978-952-476-349-3.pdf)
- Sariola, A., Nuutila, M., Sainio, S., Saisto, T. & Tiitinen, A. 2014. Odottavan äidin käsikirja. 1st ed. Helsinki: Duodecim.
- Seppä, K., Aalto, M., Alho, H. & Kiinanmaa, K. 2012. Huume- ja lääkeriippuvuudet. 1st ed. Helsinki: Kustannus Oy Duodecim.
- The Federation of Mother and Child Homes and Shelters. Undated. [Web page]. Päihteet odotus- ja vauva-aikana. [Ref. 7 October 2020]. Available at: <https://ensijaturvakotienliitto.fi/tukea-ammattilaiselle/paihteet-odotus-ja-vauva-aikana/>
- Tiitinen, A. 2020a. Raskaus ja huumeet. [Online article]. Lääkärikirja Duodecim. [Ref. 16 March 2021]. Available at: <https://www.terveyskirjasto.fi/dlk00944>
- Tiitinen, A. 2020b. Äitiysneuvolaseuranta. [Online article]. Lääkärin käsikirja. [Ref. 25 March 2021]. Available in the Duodecim Terveysportti database. Registration required.
- United Nations Office on Drugs and Crime (UNODC). Undated. World Drug Report 2020. [Web page]. [Ref. 28 January 2021]. Available at: <https://wdr.unodc.org/wdr2020/>

World Health Organization (WHO). 27 September 2018. Global status report on alcohol and health 2018. [Web page]. [Ref. 9 January 2021]. Available at: <https://www.who.int/publications/i/item/9789241565639>

## BIBLIOGRAPHY FOR LITERATURE REVIEW

- Andersen, A. N., Andersen, P. K., Olsen, J., Grønbaek, M. & Standberg-Larsen, K. 2012. Moderate alcohol intake during pregnancy and risk of fetal death. [Online article]. *International Journal of Epidemiology* 41 (2), 405–413. [Ref. 3 March 2021]. Available at: <https://academic.oup.com/ije/article/41/2/405/691800>
- Bailey, B. A. & Sokol, R. J. 2011. Prenatal alcohol exposure and miscarriage, stillbirth, preterm delivery and sudden infant death syndrome. [Online article]. *Alcohol Res Health* 34 (1), 86–91. [Ref. 1 March 2021]. Available at: <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3860553/>
- Behnke, M. & Smith, V. 2013. Prenatal substance abuse: short and long-term effects on the exposed fetus. [Online article]. Committee on substance abuse, committee on fetus and newborn, *Pediatrics* March 2013, 131 (3) e1009–e1024. [Ref. 1 March 2021]. Available at: <https://pediatrics.aappublications.org/content/131/3/e1009.long>
- Dejong, K., Olyaei, A & O Lo, J. 2015. Prenatal Alcohol Exposure and the Developing Immune System. [Online article]. *Alcohol research: Current reviews* 37 (2), 279–285. [Ref. 4 March 2021]. Available at: <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4590623/>
- Dörrie, N., Föcker, M., Freunscht, I. & Hebebrand, J. 2014. Fetal alcohol spectrum disorders. [Online article]. *European child & adolescent psychiatry* 23 (10). [Ref. 3 March 2021]. Available at: [https://www.researchgate.net/publication/263431143\\_Fetal\\_alcohol\\_spectrum\\_disorders](https://www.researchgate.net/publication/263431143_Fetal_alcohol_spectrum_disorders)
- Gauthier, T. W. 2015. Prenatal Alcohol Exposure and the Developing Immune System. [Online article]. *Alcohol research: Current reviews* 37 (2), 279–285. [Ref. 4 March 2021]. Available at: <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4590623/>
- Gouin, K., Murphy, K. & Shah, P. S. 2011. Effects of cocaine use during pregnancy on low birth weight and preterm birth: systematic review and metaanalyses. [Online Article]. *American journal of obstetrics and gynaecology* March 2011. [Ref. 1 March 2021]. Available at: <https://www.issues4life.org/pdfs/20110100ajog.pdf>
- Hepper, P. G., Dornan, J. C. & Lynch, C. 2012. Fetal brain function in response to maternal alcohol consumption: Early evidence of damage. [Online article]. *Alcoholism, clinical and experimental research* 36 (12), 2168–2175. [Ref. 3 March 2021]. Available at: <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3521078/>
- Hoffman, J. D. 2011. *Pregnancy and Alcohol Consumption*. [E-Book]. New York: Nova Science Publishers. [Ref. 8 March 2021]. Available in the Ebsco eBook Collection. Registration required.
- Ornoy, A., Ergaz, Z. 2010. Alcohol abuse in pregnant women: effects on the fetus and newborn, mode of action and maternal treatment. [Online article]. *International journal of*

environmental research and public health, 7 (2), 364–379. [Ref. 1 March 2021]. Available at: <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC2872283/>

Ross, E., Graham, D., Money, K. & Stanwood, G. D. 2015. Developmental Consequences of Fetal Exposure to Drugs: What We Know and What We Still Must Learn. [Online article]. *Neuropsychopharmacol* 40, 61–87. [Ref. 15 March 2021]. Available at: <https://www.nature.com/articles/npp2014147>

Santos, J. F., Melo Bastos Cavalcante, C., Barbosa, F. T., Leite Góes Gitaí, D., Duzzioni, M., Tilelli, C. Q., Shetty, A. K. & Wagner de Castro, O. 2018. Maternal, fetal and neonatal consequences associated with the use of crack cocaine during the gestational period: a systematic review and meta-analysis. [Online article]. *Archives of Gynecology and Obstetrics* 298, 487–503. [Ref. 4 March 2021]. Available at: [https://www.researchgate.net/profile/Olagide-Castro/publication/326018749\\_Maternal\\_fetal\\_and\\_neonatal\\_consequences\\_associated\\_with\\_the\\_use\\_of\\_crack\\_cocaine\\_during\\_the\\_gestational\\_period\\_a\\_systematic\\_review\\_and\\_meta-analysis/links/5b36ab2f4585150d23e505c7/Maternal-fetal-and-neonatal-consequences-associated-with-the-use-of-crack-cocaine-during-the-gestational-period-a-systematic-review-and-meta-analysis.pdf](https://www.researchgate.net/profile/Olagide-Castro/publication/326018749_Maternal_fetal_and_neonatal_consequences_associated_with_the_use_of_crack_cocaine_during_the_gestational_period_a_systematic_review_and_meta-analysis/links/5b36ab2f4585150d23e505c7/Maternal-fetal-and-neonatal-consequences-associated-with-the-use-of-crack-cocaine-during-the-gestational-period-a-systematic-review-and-meta-analysis.pdf)

The American College of Obstetricians and Gynecologists. 2011. Methamphetamine Abuse in Women of Reproductive Age. [Online article]. Committee Opinion No. 479. [Ref. 4 March 2021]. Available at: [https://journals.lww.com/greenjournal/Citation/2011/03000/Committee\\_Opinion\\_No\\_479\\_Methamphetamine\\_Abuse.44.aspx](https://journals.lww.com/greenjournal/Citation/2011/03000/Committee_Opinion_No_479_Methamphetamine_Abuse.44.aspx)

Varner, M. W., Silver, R. M., Rowland Hogue, C. J., Willinger, M., Parker, C. B., Thorsten, V. R., Goldenberg, R. L., Saade, G. R., Dudley, D. J., Coustan, D., Stoll, B., Bukowski, R., Koch, M. A., Conway, D., Pinar, H. & Reddy, U. M. 2014. Association between stillbirth and illicit drug use and smoking during pregnancy. [Online article]. *Obstetrics and Gynecology* 123 (1), 113–125. [Ref. 4 March 2021]. Available at: <https://pubmed.ncbi.nlm.nih.gov/24463671/>

Wright, T. E., Schuetter, R., Tellei, J., & Sauvage, L. 2015. Methamphetamines and pregnancy outcomes. [Online article]. *Journal of addiction medicine* 9 (2), 111–117. [Ref. 4 March 2021]. Available at: <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4374990/>

# APPENDICES

Appendix 1. Guide: Risks of prenatal alcohol and drug use

## Appendix 2. Guide: Risks of prenatal alcohol and drug use

### SOURCES

- Andersen, A. N., Andersen, P. K., Oisen, J., Grønbaek, M. & Standberg-Larsen, K. 2012. Moderate alcohol intake during pregnancy and risk of fetal death. *International Journal of Epidemiology* 41 (2), 405–413.
- Bailey, B. A. & Sokol, R. J. 2011. Prenatal alcohol exposure and miscarriage, stillbirth, preterm delivery and sudden infant death syndrome. *Alcohol Res Health* 34 (1), 86-91.
- Behnke, M. & Smith, V. 2013. Prenatal substance abuse: short and long-term effects on the exposed fetus. Committee on substance abuse, committee on fetus and newborn, *Pediatrics* March 2013, 131(3) e1009-e1024.
- DeJong, K., Olyaei, A & O Lo, J. 2015. Prenatal Alcohol Exposure and the Developing Immune System. *Alcohol research: Current reviews* 37 (2), 279-285.
- Dörrie, N., Föcker, M., Freunscht, I. & Hebebrand, J. 2014. Fetal alcohol spectrum disorders. *European child & adolescent psychiatry* 23 (10).
- Gauthier, T. W. 2015. Prenatal Alcohol Exposure and the Developing Immune System. *Alcohol research: Current reviews* 37 (2), 279-285.
- Gouin, K., Murphy, K. & Shah, P. S. 2011. Effects of cocaine use during pregnancy on low birth weight and preterm birth: systematic review and metaanalyses. *American journal of obstetrics and gynaecology* March 2011.
- Hepper, P. G., Dornan, J. C. & Lynch, C. 2012. Fetal brain function in response to maternal alcohol consumption: Early evidence of damage. *Alcoholism, clinical and experimental research* 36 (12), 2168–2175.
- Hoffman, J. D. 2011. *Pregnancy and Alcohol Consumption*. New York: Nova Science Publishers.
- Ornoy, A., Ergaz, Z. 2010. Alcohol abuse in pregnant women: effects on the fetus and newborn, mode of action and maternal treatment. *International journal of environmental research and public health*, 7(2), 364-379.
- Ross, E., Graham, D., Money, K & Stanwood G. D. 2015. *Developmental Consequences of Fetal Exposure to Drugs: What We Know and What We Still Must Learn*. *Neuropsychopharmacol* 40, 61–87.
- Santos, J. F., Melo Bastos Cavalcante, C., Barbosa, F. T., Leite Goes Gitali, D., Duzioni, M., Tleili, C. Q., Shetty, A. K. & Wagner de Castro, O. 2018. Maternal, fetal and neonatal consequences associated with the use of crack cocaine during the gestational period: a systematic review and meta-analysis. *Archives of Gynecology and Obstetrics* 298, 487–503.
- The American College of Obstetricians and Gynecologists. 2011. *Methamphetamine Abuse in Women of Reproductive Age*. Committee Opinion No. 479.
- Varner, M. W., Silver, R. M., Rowland Hogue, C. J., Willinger, M., Parker, C. B., Thorsten, V. R., Goldenberg R. L., Saade G. R., Dudley D. J., Coustan D., Stoll, B., Bukowski, R., Koch M. A., Conway D., Pinar, H. & Reddy U. M. 2014. Association between stillbirth and illicit drug use and smoking during pregnancy. *Eunice Kennedy Shriver National Institute of Child Health and Human Development Stillbirth Collaborative Research Network*. *Obstet Gynecol* 123 (1), 113-125.
- Wright, T. E., Schueter, R., Tellei, J., & Sauvage, L. 2015. Methamphetamines and pregnancy outcomes. *Journal of addiction medicine* 9 (2), 111–117.

# Risks of prenatal alcohol and drug use



## Alcohol

- Passes placenta
- Fetal Alcohol Spectrum Disorder (FASD)
- Problems brain function and neurobehaviour development
- Reduced fetal growth and organ development
- Congenital anomalies
- Weakened immune system
- Increased risk for miscarriage and stillbirth
- Premature birth



## Amphetamine-type stimulants

- Reduced fetal growth and organ development
- Neurodevelopmental problems
- Stillbirth
- Small gestational age and low birth weight
- Premature birth



## Cocaine

- Reduced fetal growth
- Low birth weight
- Preterm Birth
- Small gestational age
- Placental displacement
- Infant withdrawal

## Opioids

- Reduced fetal growth and organ development
- Neurological problems
- Preterm birth
- Infant withdrawal

## Cannabis

- Decreased fetal growth
- Stillbirth
- Irregularities in infant neurobehaviour