

Paternal Marijuana Use:

Use among men prior to conception is understudied and may impact pregnancy and health outcomes

Takeaways:

- Concerns about marijuana and pregnancy usually focus on impacts from maternal use. Our work and others' shows that paternal use prior to conception may also pose reproductive health risks and developmental health risks for their children. However, refraining from use for at least 3 months before pregnancy may reduce some risks.
- Dad's preconception marijuana use needs to be part of discussions between medical practitioners and patients.
- The CIPHERS Project at Duke University is doing some of the first studies on the effects of paternal preconception marijuana use on sperm health and on the development of his children. Researchers found changes in the sperm epigenome in men who use marijuana.

Why study marijuana and pregnancy?

Tobacco and alcohol use during pregnancy are generally viewed as harmful, but there is no such ingrained view when it comes to marijuana. The belief that marijuana is safe to use during pregnancy persists despite recommendations from the American College of Obstetricians and Gynecologists and the U.S. Surgeon General to refrain from use during pregnancy and breastfeeding. These organizations recommend against maternal marijuana use during pregnancy because it has been linked with a higher risk of low birth-weight infants and preterm birth, although factors such as tobacco use and poverty may also contribute to these risks. The State of California has designated marijuana smoke and THC as known developmental toxicants.¹

While health concerns exist, legalization of marijuana has many potential benefits as well. These include decreased incarceration rates,

particularly among people of color, and the medicinal value of marijuana to treat pain and inflammation, among some other symptoms.

Public health messaging and scientific research have struggled to keep pace with the changing landscape of marijuana in the U.S. Research on marijuana is often hindered by both federal and institutional policies. The federal government classifies marijuana as a Schedule I drug along with heroin and LSD, which significantly restricts the kind of research that can be done. Many academic institutions also have drug-free laws which further curb researchers' efforts.²

Even though pregnant people seek out information on how marijuana use may impact their pregnancy and their child's development, few report receiving helpful information from health care providers or social workers. Instead, internet searches, advice from friends and family, and anecdotal experiences are commonly reported information sources.³ There is still little attention paid to potential health concerns from

paternal preconception marijuana use, but recent research indicates that paternal use may matter for pregnancy and developmental outcomes.

Why study paternal marijuana use around pregnancy?

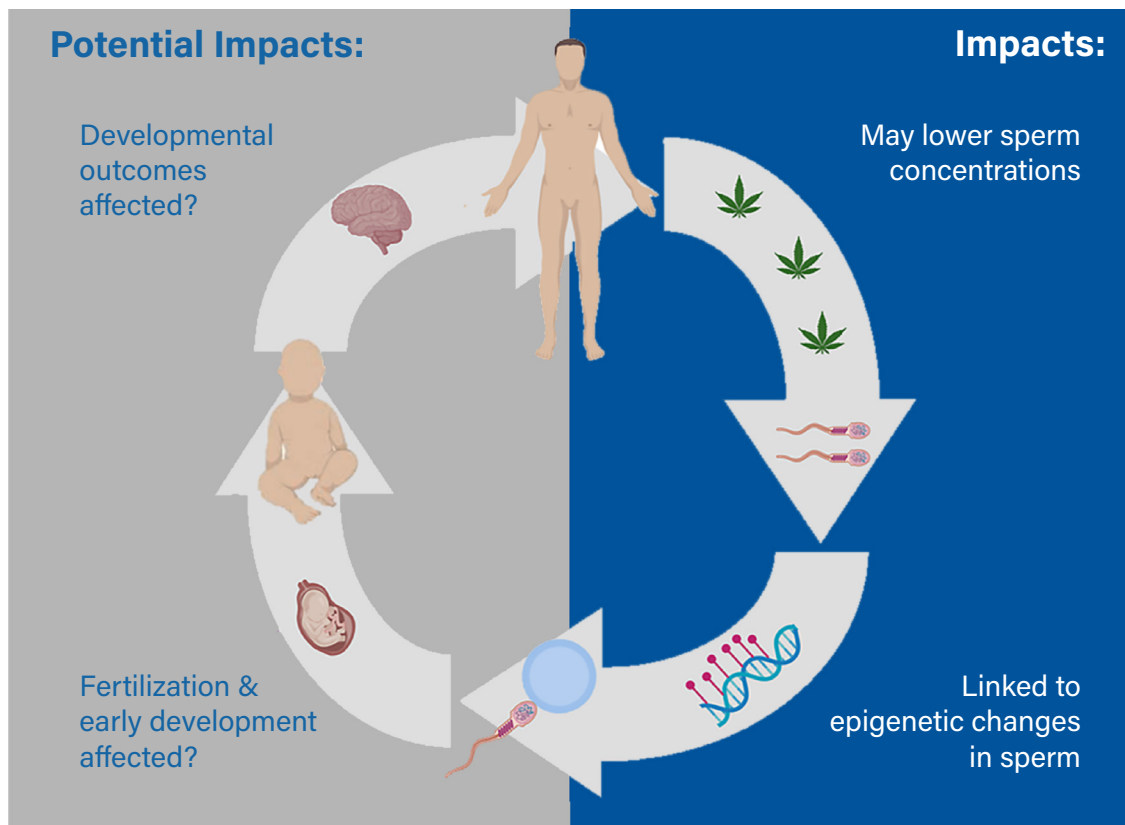
When considering the full picture of potential exposure to marijuana prior to and during pregnancy, men are an understudied group. A Dutch study found that for women who use marijuana prior to pregnancy, 56% of male partners also used. Even pregnant people who do not use may have male partners who do use. The same study found that about 9 in 10 men who use marijuana during pregnancy have a non-using partner.⁴ A 2018 survey found that 16.2% of men in the U.S., ages 26 and up, used marijuana in the past year.⁵ **This shows the need for a greater focus on male preconception use.**

Research has shown that the preconception health and exposures of both parents can influence birth outcomes and a child's health and development. A variety of

The Changing Landscape of Marijuana

As of February 2022, cannabis is legal for medical use in 38 states in the U.S., and for recreational use in 18 states for those over the age of 21.⁸ Increased legal access to cannabis and a rising perception of the drug as safe have led to higher rates of use by the general public, including by pregnant people, people considering becoming pregnant, and their partners. Additionally, average cannabis potency has increased six or sevenfold since the 1970's,⁹ and threefold in the past two decades alone.¹⁰

paternal health conditions are associated with negative birth outcomes.⁶ For example, there is evidence that men who are obese at the time of conception may contribute to altered metabolism and a higher likelihood of obesity in their children.⁷ Preconception health is still a relatively new area of investigation, and paternal preconception health in particular needs further study.



Impacts of preconception male marijuana use.¹¹

Developmental health implications of paternal marijuana use:

The Cannabis-Induced Potential Heritability of Epigenetic Revisions in Sperm (CIPHERS) Project at Duke University is studying:

- epigenetic changes in the sperm of men who use marijuana,
- whether these changes are passed on to the users' children, and
- if there are any associated health impacts in children of fathers who used.

Researchers are comparing the sperm of men who use marijuana to the sperm of non-users. There are significant changes in the sperm epigenome of men who use marijuana, a finding that is supported by similar changes seen in male rats exposed to THC.¹² Epigenetic changes were seen in genes associated with organ growth, neurodevelopment and cancer in both humans and rats. A followup study found that a specific gene associated with autism also undergoes changes in the sperm of male marijuana users.¹³ Further study is occurring to determine if

What is epigenetics?

All of our cells carry the same genes, but cells in different parts of the body look different and do different things. This is in large part because of epigenetics. Epigenetic mechanisms control how and when genes in the body are used to allow us to develop, grow, and function.

Our health status, lived experiences, and exposures throughout life can alter epigenetic marks, without changing our genes. These alterations can be passed on to our children and possibly even our grandchildren.

epigenetic changes can be passed to offspring and if those changes can impact health, but Duke CIPHERS researchers have already found long-lasting detrimental behavior effects in the offspring of male rats exposed to THC.¹⁴

Another CIPHERS study found that stopping marijuana use for three months could minimize the epigenetic effects in sperm.¹⁵ These results suggest that abstaining from use for as long as possible before conceiving a child could be a good idea for men who use marijuana.

Recommendations:

Healthcare providers and public health professionals:

- Engage in discussions with patients about marijuana use at their prenatal and routine visits, and discuss how maternal and paternal use may affect pregnancy and childhood development. Consider advising men who are planning to conceive that they cease marijuana use for as long as possible prior to conception.
- Consider emphasizing to patients that the risk of secondhand smoke still exists for marijuana use, just like it does for cigarettes, if the preferred method of consumption is smoking.

Public health agencies and medical associations:

- When crafting health recommendations and guidance for marijuana use around pregnancy, consider expanding the focus to include preconception use in general, and use by male partners, specifically.

Policymakers:

- Fund and remove barriers to research on the impacts of marijuana use and perception of use in pregnancy so that health professionals are fully equipped with information to advise patients and protect public health.

Learn More & Stay in Touch:

This brochure is produced by the CIPHERS project. CIPHERS is affiliated with the Duke University School of Medicine and is funded by the John Templeton Foundation.

Visit our website for more information about the project, to view additional materials on reproductive health and marijuana use, or to request a presentation from the CIPHERS team: <https://sites.duke.edu/ciphers/>

Copyright March 2022. Cannabis-Induced Potential Heritability of Epigenetic Revisions in Sperm (CIPHERS) Project at Duke University

1. California Office of Environmental Health Hazard Assessment. Chemicals Listed Effective January 3, 2020 As Known to The State of California To Cause Reproductive Toxicity (Developmental Endpoint): Cannabis (Marijuana) Smoke and Delta-9-Tetrahydrocannabinol (Delta-9-THC). <https://oehha.ca.gov/proposition-65/cnr/chemicals-listed-effective-january-3-2020-known-state-california-cause>. Published January 1, 2020. Accessed March 30, 2020.
2. Oweremohle, Sarah. Why we don't know much about pot. Politico. Published October 14, 2019. <https://www.politico.com/agenda/story/2019/10/14/cannabis-medical-marijuana-research-000984/>
3. Jarlenski M, Tarr JA, Holland CL, Farrell D, Chang JC. Pregnant women's access to information about perinatal marijuana use: A qualitative study. *Womens Health Issues*. 2016;26(4):452-459. <https://doi.org/10.1016/j.whi.2016.03.010>
4. El Marroun H, Brown QL, Lund IO, Coleman-Cowger VH, Loree AM, Chawla D, Washio Y. An epidemiological, developmental and clinical overview of cannabis use during pregnancy. *Preventative Medicine*. 2018;116:1-5. <https://doi.org/10.1016/j.ypmed.2018.08.036>
5. Substance Abuse and Mental Health Services Administration. 2018 National Survey on Drug Use and Health (NSDUH). <https://www.samhsa.gov/data/release/2018-national-survey-drug-use-and-health-nsduh-releases>. Published 2020. Accessed March 30, 2020.
6. Kasman AM, Zhang CA, Li S, Stevenson DK, Shaw GM, Eisenberg ML. Association of preconception paternal health on perinatal outcomes: analysis of U.S. claims data. *Fertility and Sterility*. 2020. <https://doi.org/10.1016/j.fertnstert.2019.12.026>
7. Ornellas F, Carapeto PV, Mandarim-de-Lacerda CA, Aguila MB. Obese fathers lead to an altered metabolism and obesity in their children in adulthood: review of experimental and human studies. *Jornal de Pediatria*. 2017;93(6):551-9. <https://doi.org/10.1016/j.jped.2017.02.004>
8. Berke J. Marijuana legalization is sweeping the US. See every state where cannabis is legal. Business Insider. <https://www.businessinsider.com/legal-marijuana-states-2018-1>. Published January 1/February 23, 2020. Accessed March 15, 2022.
9. Crume TL, Juhl AL, Brooks-Russell A, Hall KE, Wymore E, Borgelt LM. Cannabis use during the perinatal period in a state with legalized recreational and medical marijuana: the association between maternal characteristics, breastfeeding patterns, and neonatal outcomes. *J Pediatr*. 2018;197:90-96. <https://doi.org/10.1016/j.jpeds.2018.02.005>
10. Grant KS, Petroff R, Isoherranen N, Stella N, Burbacher TM. Cannabis use during pregnancy: Pharmacokinetics and effects on child development. *Pharmacol Ther*. 2018;182:133-151. <https://doi.org/10.1016/j.pharmthera.2017.08.014>
11. Adapted from the following *Environmental Epigenetics* article: Schrott R, Murphy, SK. Cannabis use and the sperm epigenome: a budding concern? *Environmental Epigenetics*. 2020;6(1):1-10. <https://academic.oup.com/eep/article/6/1/dvaa002/5810192>. Image made with graphics from BioRender.
12. Murphy SK, et al. Cannabinoid exposure and altered DNA methylation in rat and human sperm. *Epigenetics*. 2018;13(12):1208-21. <https://doi.org/10.1080/15592294.2018.1554521>
13. Avery S. Gene Linked to Autism Undergoes Changes in Men's Sperm After Marijuana Use. <https://physicians.dukehealth.org/articles/gene-linked-autism-undergoes-changes-mens-sperm-after-marijuana-use>. Duke Health. Published November 19, 2019.
14. Holloway ZR, Hawkey AB, Pippin E, White H, Wells C, Kenou B, Rezvani AH, Murphy SK, Levin ED. Paternal factors in neurodevelopmental toxicology: THC exposure of male rats causes long-lasting neurobehavioral effects in their offspring. *NeuroToxicology*. 2020; 78:57-63. <https://doi.org/10.1016/j.neuro.2020.01.009>
15. Schrott R, SK Murphy, JL Modliszewski, DE King, Hill B, N Itchon-Ramos, D Raburn, T Price, ED Levin, R Vandrey, DL Corcoran, SH Collins & JT Mitchell. (2021). Refraining from use diminishes cannabis-associated epigenetic changes in human sperm. *Environmental Epigenetics*, 7(1). <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC8455898/>

