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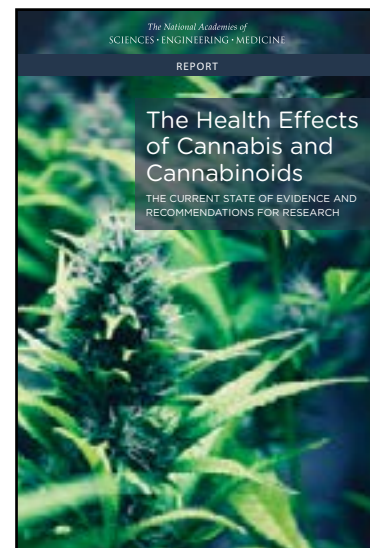
The Health Effects of Cannabis and Cannabinoids

The Current State of Evidence and Recommendations for Research

Recent years have seen a rapid rise in the medical and recreational use of cannabis: a broad term that can be used to describe the various products and chemical compounds (e.g., marijuana, cannabinoids) derived from different species of the cannabis plant. Despite increased cannabis use and a changing state-level policy landscape, conclusive evidence regarding the short- and long-term health effects—both harms and benefits—of cannabis use remains elusive.

A lack of definitive evidence has resulted in insufficient information on the health implications of cannabis use, causing a significant public health concern for vulnerable populations such as adolescents, pregnant women, and others. Unlike with substances such as alcohol or tobacco, no accepted standards exist to help guide individuals as they make choices regarding if, when, where, and how to use cannabis safely and, in regard to therapeutic uses, effectively.

With support from a host of federal, state, philanthropic and nongovernmental organizations, the National Academies of Sciences, Engineering, and Medicine convened an ad hoc, expert committee to develop a comprehensive, in-depth review of the most recent evidence regarding health effects of using cannabis and cannabis-derived products. In the resulting report, *The Health Effects of Cannabis and Cannabinoids: The Current State of Evidence and Recommendations for Research*, the committee presents nearly 100 research conclusions. The committee also formulated recommendations to expand and improve the quality of cannabis research efforts, enhance data collection efforts to support the advancement of research, and address the current barriers to cannabis research.



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THE STUDY PROCESS

The committee conducted an extensive search of literature databases to identify relevant articles published since the 1999 release of the National Academies report *Marijuana and Medicine: Assessing the Science Base*. As a result of their search efforts, the committee considered more than 10,000 scientific abstracts for their relevance to the report. Given the large scientific literature on cannabis, the breadth of the statement of task, and other constraints of the study, the committee gave primacy to recently published systematic reviews and high-quality primary research for 11 groups of health topics and concerns, including therapeutic effects for a variety of diseases and conditions; cancer incidence; respiratory disease; prenatal, perinatal, and neonatal outcomes; psychosocial and mental health concerns, and others.

The committee was charged to conduct a comprehensive, in-depth review of health topics with the greatest public health impact rather than to conduct multiple systematic reviews, which would have required a lengthy and robust series of processes. The committee did, however, adopt key features of that process: a comprehensive literature search, assessments by more than one person of the quality of the literature and the conclusions, pre-specification of the questions of interest before conclusions were formulated, standard language to allow for comparisons between conclusions, and declarations of conflict of interest via the National Academies conflict-of-interest policies.

Because of the practical steps taken to narrow a very large literature to one that was manageable within the timeframe available to the committee, there is a possibility that some literature was missed. Furthermore, some research may not be reflected in this report if it did not directly address the health endpoint research questions that were prioritized by the committee.

THE COMMITTEE'S CONCLUSIONS

The committee arrived at nearly 100 different research conclusions related to cannabis or cannabinoid use and health, organizing these into 5 categories: conclusive, substantial, moderate, limited, and no/insufficient evidence.

For a definition of these levels of evidence and a full listing of the conclusions, please see the "Committee's Conclusions" document by visiting the report's website at [nationalacademies.org/CannabisHealthEffects](https://www.nationalacademies.org/CannabisHealthEffects).

THE COMMITTEE'S RECOMMENDATIONS

Based on their research conclusions, the committee members formulated four recommendations that outline priorities to inform a research agenda. The recommendations prioritize research approaches and objectives to:

- address current research gaps, highlighting the need for a national cannabis research agenda that includes clinical and observational research, health policy and health economics research, and public health and public safety research;
- identify actionable strategies to improve research quality and promote the development of research standards and benchmarks;
- highlight the potential for improvements in data collection efforts and the enhancement of surveillance capacity; and
- propose strategies for addressing the current barriers to the advancement of the cannabis research agenda.

The full text of the committee's recommendations appears on the pages that follow.

CONCLUSION

This is a pivotal time in the world of cannabis policy and research. Shifting public sentiment, conflicting and impeded scientific research, and legislative battles have fueled the debate about what, if any, harms or benefits can be attributed to the use of cannabis or its derivatives. This report provides a broad set of evidence-based research conclusions on the health effects of cannabis and cannabinoids and puts forth recommendations to help advance the research field and better inform public health decisions.

To read the full report, please visit [nationalacademies.org/CannabisHealthEffects](https://www.nationalacademies.org/CannabisHealthEffects).

RECOMMENDATIONS

Recommendation 1: To develop a comprehensive evidence base on the short- and long-term health effects of cannabis use (both beneficial and harmful effects), public agencies, philanthropic and professional organizations, private companies, and clinical and public health research groups should provide funding and support for a national cannabis research agenda that addresses key gaps in the evidence base.

Prioritized research streams and objectives should include, but need not be limited to:

Clinical and Observational Research

- Examine the health effects of cannabis use in at-risk or under-researched populations, such as children and youth (often described as less than 18 years of age) and older populations (generally over 50 years of age), pregnant and breastfeeding women, and heavy cannabis users.
- Investigate the pharmacokinetic and pharmacodynamic properties of cannabis, modes of delivery, different concentrations, in various populations, including the dose–response relationships of cannabis and THC or other cannabinoids.
- Determine the benefits and harms associated with understudied cannabis products, such as edibles, concentrates, and topicals.
- Conduct well-controlled trials on the potential beneficial and harmful health effects of using different forms of cannabis, such as inhaled (smoked or vaporized) whole cannabis plant and oral cannabis.
- Characterize the health effects of cannabis on unstudied and understudied health endpoints, such as epilepsy in pediatric populations; symptoms of posttraumatic stress disorder; childhood and adult cancers; cannabis-related overdoses and poisonings; and other high-priority health endpoints.

Health Policy and Health Economics Research

- Identify models, including existing state cannabis policy models, for sustainable funding of national, state, and local public health surveillance systems.
- Investigate the economic impact of recreational and medical cannabis use on national and state public health and health care systems, health insurance providers, and patients.

Public Health and Public Safety Research

- Identify gaps in the cannabis-related knowledge and skills of health care and public health professionals, and assess the need for, and performance of, continuing education programs that address these gaps.
- Characterize public safety concerns related to recreational cannabis use and evaluate existing quality assurance, safety, and packaging standards for recreational cannabis products.

Recommendation 2: To promote the development of conclusive evidence on the short- and long-term health effects of cannabis use (both beneficial and harmful effects), agencies of the United States Department of Health and Human Services, including the National Institutes of Health and the Centers for Disease Control and Prevention should jointly fund a workshop to develop a set of research standards and benchmarks to guide and ensure the production of high-quality cannabis research. Workshop objectives should include, but need not be limited to:

- The development of a minimum dataset for observational and clinical studies, standards for research methods and design, and guidelines for data collection methods.
- Adaptation of existing research-reporting standards to the needs of cannabis research.
- The development of uniform terminology for clinical and epidemiological cannabis research.
- The development of standardized and evidence-based question banks for clinical research and public health surveillance tools.

Recommendation 3: To ensure that sufficient data are available to inform research on the short- and long-term health effects of cannabis use, (both beneficial and harmful effects), the Centers for Disease Control and Prevention, the Substance Abuse and Mental Health Services Administration, the Association of State and Territorial Health Officials, National Association of County and City Health Officials, the Association of Public Health Laboratories, and state and local public health departments should fund and support improvements to federal public health surveillance systems and state-based public health surveillance efforts. Potential efforts should include, but need not be limited to:

- The development of question banks on the beneficial and harmful health effects of therapeutic and recreational cannabis use and their incorporation into major public health surveys, including: the National Health and

Committee on the Health Effects of Marijuana

Marie McCormick (Chair),

Harvard T.H. Chan School of Public Health

Donald I. Abrams

Zuckerberg San Francisco General Hospital

Margarita Alegría

Massachusetts General Hospital

William Checkley

Johns Hopkins University

R. Lorraine Collins

State University of New York at Buffalo

Ziva Cooper

Columbia University Medical Center

Adre J. Du Plessis

Children's National Health System

Sarah Feldstein Ewing

Oregon Health & Science University

Sean Hennessy

University of Pennsylvania

Kent Hutchison

University of Colorado Boulder

Norbert E. Kaminski

Michigan State University

Sachin Patel

Vanderbilt University Medical Center

Daniele Piomelli

University of California, Irvine

Stephen Sidney

Kaiser Permanente Northern California

Robert B. Wallace

University of Iowa College of Public Health

John Williams

Duke University Medical Center

Study Sponsors

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Oregon Health Authority

Robert W. Woodruff Foundation

The Colorado Health Foundation

Truth Initiative

Washington State Department of Health

Study Staff

Leigh Miles Jackson

Study Director

Jennifer Cohen

Program Officer

Kelsey Geiser

Research Associate
(from July 2016)

R. Brian Woodbury

Research Associate

Sara Tharakan

Research Associate
(until July 2016)

Hope Hare

Administrative Assistant

Matthew Masiello

Research Assistant
(from June 2016)

Marjorie Pichon

Senior Program Assistant
(from August 2016)

Kathleen Stratton

Scholar

Brownsyne

Tucker-Edmonds

Norman F. Grant/American Board of Obstetrics and Gynecology Fellow

Rose Marie Martinez

Senior Board Director, Board on Population Health and Public Health Practice

Nutrition Examination Survey, National Health Interview Survey, Behavioral Risk Factor Surveillance System, National Survey on Drug Use and Health, Youth Risk Behavior Surveillance System, National Vital Statistics System, Medical Expenditure Panel Survey, and the National Survey of Family Growth.

- Determining the capacity to collect and reliably interpret data from diagnostic classification codes in administrative data (e.g., International Classification of Diseases-10)
- The establishment and utilization of state-based testing facilities to analyze the chemical composition of cannabis and products containing cannabis, cannabinoids, or THC.
- The development of novel diagnostic technologies that allow for rapid, accurate, and noninvasive assessment of cannabis exposure and impairment.
- Strategies for surveillance of harmful effects of cannabis for therapeutic use.

Recommendation 4: The Centers for Disease Control and Prevention, National Institutes of Health, Food and Drug Administration, industry groups, and nongovernmental organizations should fund the convening of a committee of experts tasked to produce an objective and evidence-based report that fully characterizes the impacts of regulatory barriers to cannabis research and that proposes strategies for supporting development of the resources and infrastructure necessary to conduct a comprehensive cannabis research agenda. Committee objectives should include, but need not be limited to:

- Proposing strategies for expanding access to research-grade marijuana, through the creation and approval of new facilities for growing and storing cannabis.
- Identifying nontraditional funding sources and mechanisms to support a comprehensive national cannabis research agenda.
- Investigating strategies for improving the quality, diversity, and external validity of research-grade cannabis products.

Health and Medicine Division

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