

Medical Data Privacy and Ethics in the Age of Artificial Intelligence

Lecture 4: Medical Ethics + Data Ethics

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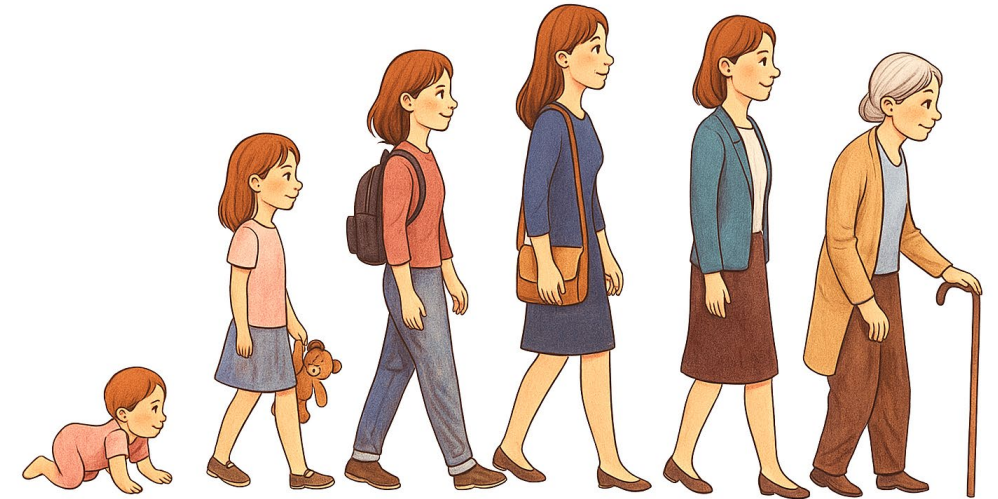
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Learning Objective of This Lecture

- Know four principles of medical ethics
- Know five stages of data life cycle



Credit: ChatGPT-5 prompt: "The lifetime of a woman, white background, each stage separated."

https://www.reddit.com/r/notinteresting/comments/ixa4p7/your_age_depends_entirely_on_what_year_it_is/

Medical Ethics

The purpose of the WMA is to serve humanity by endeavoring to achieve the highest international standards in Medical Education, Medical Science, Medical Art and **Medical Ethics**, and Health Care for all people in the world.

- Hippocratic Oath
- Declaration of Geneva (1948)
- Declaration of Helsinki (1964) -- Ethical Principles for Medical Research Involving Human Participants (18th WMA General Assembly, Helsinki, Finland, June 1964)
- Latest version: the 75th WMA General Assembly, Helsinki, Finland, October 2024
- AMA Code of Medical Ethics (Adopted 1957; revised 2001)



<https://www.wma.net/policies-post/wma-declaration-of-helsinki/>

Top High Impact Factor Journals

- A list of top 20 high impact factor journals across various subject areas for 2024
 - A good impact factor can vary by field, but in many scientific disciplines, an IF above 5 or 10 is often considered high.
 - In many fields, a journal with an impact factor between 1 and 5 might be considered average.

<https://www.enago.com/academy/top-high-impact-factor-journals/>

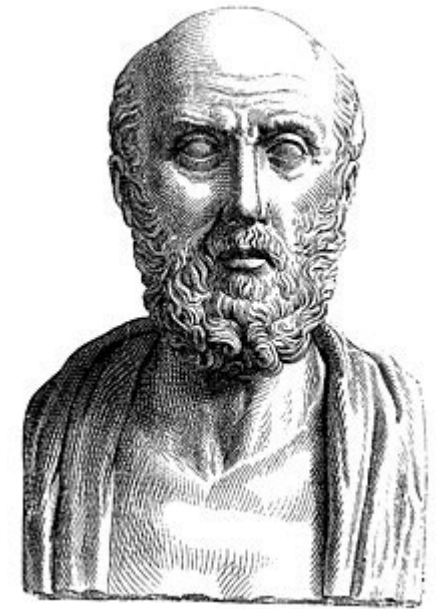
Sr. No.	Journal	Impact Factor
1.	CA-A Cancer Journal for Clinicians	254.7
2.	Lancet	168.9
3.	New England Journal of Medicine	158.5
4.	JAMA-Journal of the American Medical Association	120.7
5.	Nature Reviews Drug Discovery	120.1
6.	Nature Reviews Molecular Cell Biology	112.7
7.	BMJ-British Medical Journal	105.7
8.	Nature Reviews Immunology	100.3
9.	World Psychiatry	73.3
10.	Lancet Psychiatry	64.3

Four Principles (Pillars) of Medical Ethics

- **Beneficence** (doing good)
- **Non-maleficence** (to do no harm)
- **Autonomy** (giving the patient the freedom to choose freely, where they are able)
- **Justice** (ensuring fairness)
- **Further Concepts:**
 - Consequentialism (E.g., Is lying OK or not? OK.)
 - Deontology (Duty-based Idealism. E.g., Lying is not OK.)
 - Utilitarianism (Maximize the overall utility of the society. E.g., Trolley problem.)

Hippocratic Oath

- The Hippocratic Oath is an oath of ethics historically taken by physicians.
- The earliest expression of medical ethics in the Western world.
- The oldest partial fragments of the oath date to circa AD 275 (when evidence was found).
- “Practice two things in your dealings with disease: either help or do not harm the patient.”
 - *Epidemics*, Hippocrates
- Still in use today by many US medical schools.



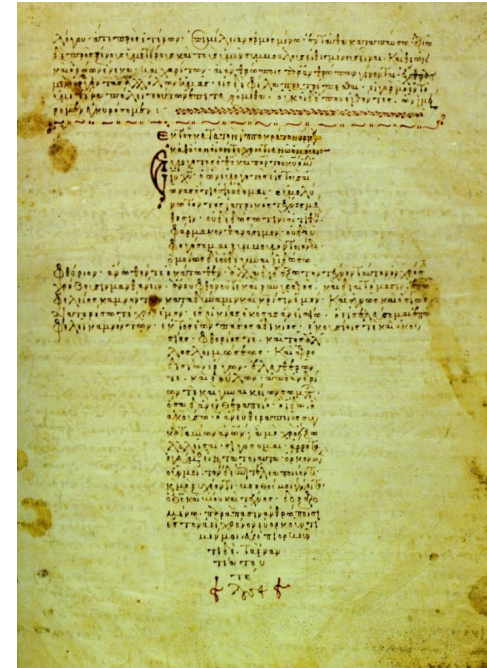
The Greek physician Hippocrates (460–370 BC), to whom the oath is traditionally attributed.

Hippocratic Oath (1964, by Louis Lasagna)

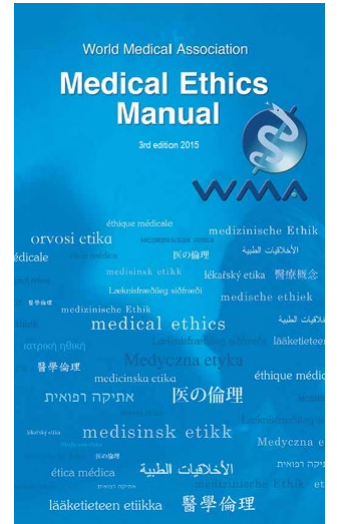
- I swear to fulfill, to the best of my ability and judgment, this covenant:
- I will respect the hard-won scientific gains of those physicians in whose steps I walk, and gladly share such knowledge as is mine with those who are to follow.
- I will apply, for the benefit of the sick, all measures [that] are required, avoiding those twin traps of overtreatment and therapeutic nihilism.
- I will remember that there is art to medicine as well as science, and that warmth, sympathy, and understanding may outweigh the surgeon's knife or the chemist's drug.
- I will not be ashamed to say "I know not", nor will I fail to call in my colleagues when the skills of another are needed for a patient's recovery.
- I will respect the privacy of my patients, for their problems are not disclosed to me that the world may know. Most especially must I tread with care in matters of life and death. If it is given me to save a life, all thanks. But it may also be within my power to take a life; this awesome responsibility must be faced with great humbleness and awareness of my own frailty. Above all, I must not play at God.

Hippocratic Oath (1964, by Louis Lasagna)

- I will remember that I do not treat a fever chart, a cancerous growth, but a sick human being, whose illness may affect the person's family and economic stability. My responsibility includes these related problems, if I am to care adequately for the sick.
- I will prevent disease whenever I can, for prevention is preferable to cure.
- I will remember that I remain a member of society, with special obligations to all my fellow human beings, those sound of mind and body as well as the infirm.
- If I do not violate this oath, may I enjoy life and art, respected while I live and remembered with affection thereafter. May I always act so as to preserve the finest traditions of my calling and may I long experience the joy of healing those who seek my help.



A 12th-century Byzantine manuscript of the Oath in the form of a cross



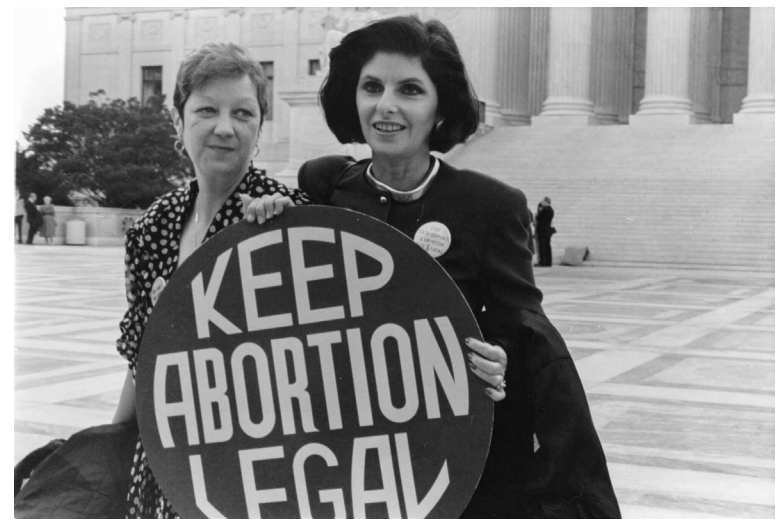
Patient's right to confidentiality

■ The WMA Declaration on the Rights of the Patient

- All identifiable information about a patient's health status, medical condition, diagnosis, prognosis and treatment and all other information of a personal kind, must be kept **confidential**, even after death. Exceptionally, the descendants may have a right of access to information that would inform them of their health risks.
- Confidential information can only be disclosed if the patient gives **explicit consent** or if expressly provided for in the law. Information can be disclosed to other healthcare providers only on a strictly "need to know" basis unless the patient has given explicit consent.
- All **identifiable patient data** must be protected. The protection of the data must be appropriate to the manner of its storage. Human substances from which identifiable data can be derived must be likewise protected.

Beginning-of-Life Issues

Right to Abortion



- Roe v. Wade, 410 U.S. 113 (1973)
- “Jane Roe” (Norma McCorvey) vs Henry Wade, Texas’s abortion laws
- A landmark decision of the U.S. Supreme Court in which the Court ruled that the Constitution of the United States protected the right to have an abortion prior to the point of fetal viability.
- On January 22, 1973, Supreme Court issued a 7–2 decision in McCorvey's favor holding that the Due Process Clause of the Fourteenth Amendment to the United States Constitution provides a fundamental “right to privacy”, which protects a pregnant woman's right to an abortion.

Overruling Right to Abortion

- Dobbs v. Jackson Women's Health Organization, 597 U.S. 215 (2022).
- The case concerned the constitutionality of a 2018 Mississippi state law that banned most abortion operations after the first 15 weeks of pregnancy. Jackson Women's Health Organization—Mississippi's only abortion clinic at the time—had sued Thomas E. Dobbs, state health officer with the Mississippi State Department of Health, in March 2018.
- A landmark decision of the U.S. Supreme Court in which the court held that the Constitution of the United States does not confer a right to abortion. The Court's decision overruled Roe v. Wade (1973).
- On June 24, 2022, by a vote of 6–3, the Supreme Court struck down the right to abortion previously guaranteed by the United States Constitution, holding that regulation of abortion is a matter for states to decide.

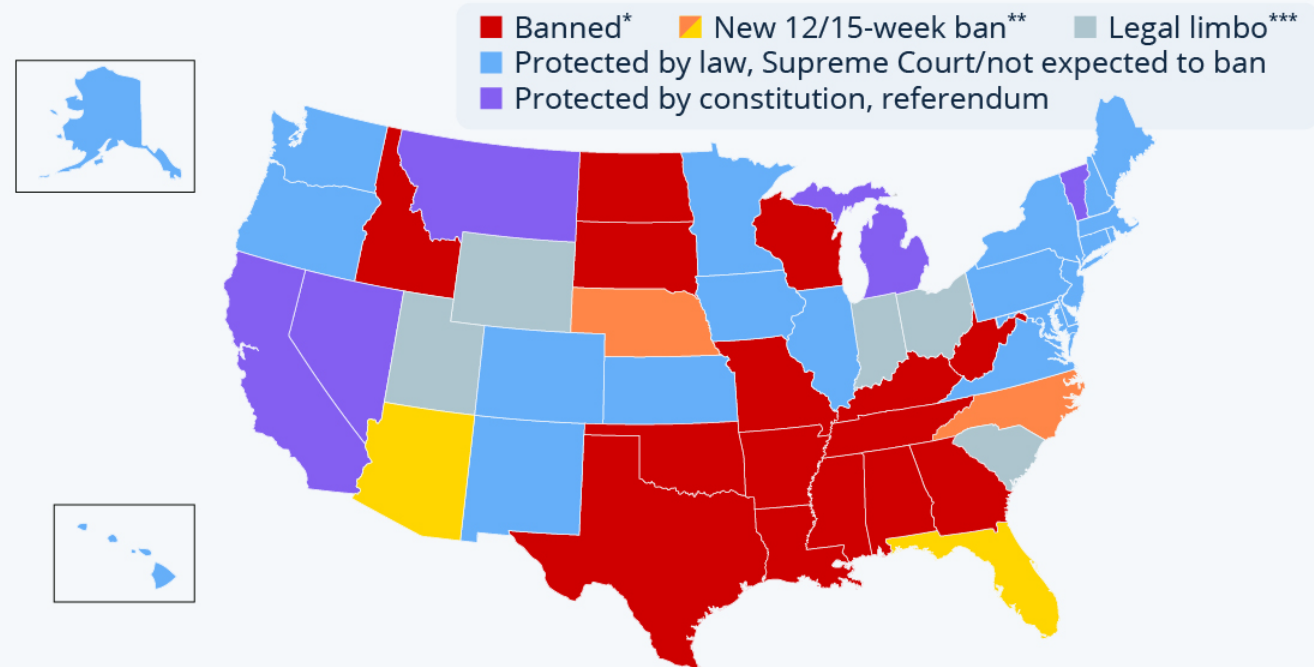
Clayton EW, Embí PJ, Malin BA. Dobbs and the future of health data privacy for patients and healthcare organizations. *Journal of the American Medical Informatics Association*. 2023 Jan 1;30(1):155-60.

Post-Roe v. Wade

- The WMA **Statement on Therapeutic Abortion** acknowledges this diversity of opinion and belief and concludes that “This is a matter of individual conviction and conscience that must be respected.”

Post-Roe v. Wade: The State of U.S. Abortion Laws

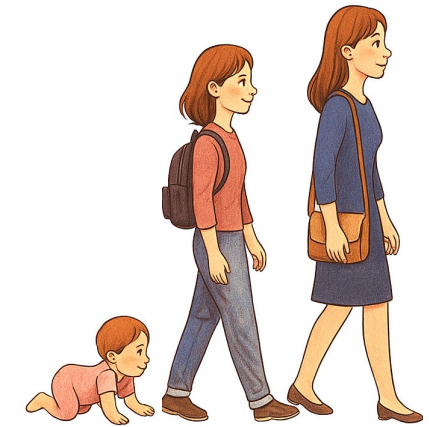
Legal status of abortion post-Roe v. Wade
in the United States (as of June 23, 2022)



Some bans have exceptions in case of rape, danger to life/health of mother
* Incl. 6-week bans ** Fla: May be reduced to 6 weeks, N.C.: Takes effect July 1
*** Utah: restricted to 18 weeks

Sources: Washington Post, Statista research

Beginning-of-Life Issues



■ Contraception (Birth control)

- Although there is increasing international recognition of a woman's right to control her fertility, including the prevention of unwanted pregnancies, physicians still have to deal with difficult issues such as requests for contraceptives from minors and explaining the risks of different methods of contraception.

■ Assisted Reproduction

- The 2006 WMA **Statement on Assisted Reproductive Technologies** notes that “whilst consensus can be reached on some issues, there remain fundamental differences of opinion that cannot be resolved.” The statement identifies areas of agreement and also highlights those matters on which agreement cannot be reached.”

Beginning-of-Life Issues

■ Prenatal Genetic Screening

- Genetic tests are now available for determining whether an embryo or foetus is affected by certain genetic abnormalities and whether it is male or female. Depending on the findings, a decision can be made whether or not to proceed with pregnancy. Physicians need to determine when to offer such tests and how to explain the results to patients.

■ Severely Compromised Neonates

- Because of extreme prematurity or congenital abnormalities, some neonates have a very poor prognosis for survival. Difficult decisions often have to be made whether to attempt to prolong their lives or allow them to die.

End-of-Life Issues

- Euthanasia
 - knowingly and intentionally performing an act that is clearly intended to end another person's life and that includes the following elements: the subject is a competent, informed person with an incurable illness who has voluntarily asked for his or her life to be ended; the agent knows about the person's condition and desire to die, and commits the act with the primary intention of ending the life of that person; and the act is undertaken with compassion and without personal gain.
- Assistance in Suicide
 - knowingly and intentionally providing a person with the knowledge or means or both required to commit suicide, including counselling about lethal doses of drugs, prescribing such lethal doses or supplying the drugs.

End-of-Life Issues

- Physicians are understandably reluctant to implement requests for euthanasia or assistance in suicide because these acts are illegal in most countries and are prohibited in most medical codes of ethics. This prohibition was part of the **Hippocratic Oath** and has been emphatically restated by the WMA in its 2005 **Statement on Physician-Assisted Suicide** and its 2005 **Declaration on Euthanasia**.
- Euthanasia, that is the act of deliberately ending the life of a patient, even at the patient's own request or at the request of close relatives, is unethical. This does not prevent the physician from respecting the desire of a patient to allow the natural process of death to follow its course in the terminal phase of sickness.

Dual Loyalty - WMA International Code of Medical Ethics (2022 Revision)

- **Patient Welfare:** Physicians must prioritize patients' health, well-being, autonomy, and best interests while minimizing potential harm. (Article 14)
- **Professional Independence:** Physicians must report conditions that compromise ethical medical practice and maintain independent professional judgment. (Articles 6, 32)
- **Conflicts of Interest:** Physicians must recognize, avoid, disclose, and appropriately manage conflicts of interest. (Articles 5, 25)
- **Social Responsibility:** Physicians have responsibilities not only to individual patients but also to public health, health equity, and future generations. (Articles 1, 34–38)
- **Key Message:** Medical ethics requires balancing individual patient welfare, professional integrity, and broader responsibilities to society.

Public Health

- Refers both to the **health of the public** and also to the **medical specialty that deals with health from a population perspective** rather than on an individual basis.
- **Epidemiology** is the study of the distribution and determinants of health and disease in populations
- Sometimes, though, the interests of public health may conflict with those of individual patients
 - when a **vaccination that carries a risk of an adverse reaction** will prevent an individual from transmitting a disease but not from contracting it
 - **when notification is required for certain contagious diseases**, for cases of child or elder abuse, or for conditions that may render certain activities, such as driving a car or piloting an aircraft, dangerous to the individual and to others.

Public Health

- In general, physicians should attempt to find ways to minimize any harm that individual patients might suffer as a result of meeting public health requirements.
 - When reporting is required, the **patient's confidentiality should be protected to the greatest extent possible** while fulfilling the legal requirements. (E.g., case reporting for **COVID-19**)
- A different type of conflict between the interests of individual patients and those of society arises when physicians are asked to assist patients to receive benefits to which they are not entitled.
 - **Insurance payments or sick-leave.** Although some physicians are unwilling to deny requests from patients for certificates that do not apply in their circumstances, they should rather help their patients find other means of support that do not require unethical behavior.

Medical Ethics Concerning Special Populations

- This require special considerations due to their unique legal, cognitive, and emotional statuses.
 - Ethical principles like **autonomy, beneficence, non-maleficence, and justice** must be carefully adapted to address the specific needs and vulnerabilities of these populations.
- **Infants and Neonates**
 - **Lack of Autonomy:** Infants cannot make medical decisions, so parents or legal guardians make choices on their behalf.
 - **Best Interest Standard:** Decisions should be made in the best interest of the child, balancing survival, quality of life, and long-term outcomes.
 - **Ethical Dilemmas in Neonatal Intensive Care (NICU):** With premature infants or those with severe congenital conditions, decisions about life-sustaining treatments (e.g., ventilation) must consider both survival chances and potential suffering.



(Assisted by ChatGPT)

Medical Ethics Concerning Special Populations

■ Children and Adolescents

- **Evolving Autonomy:** While minors typically require parental consent for medical decisions, their growing cognitive abilities raise ethical questions about assent and decision-making capacity.
- **Mature Minor Doctrine:** Some jurisdictions allow mature minors (typically 14-18 years old) to consent to certain treatments, especially in reproductive health, mental health, and substance abuse.
- **Confidentiality vs. Parental Involvement:** In cases like sexual health or mental health care, adolescents may have confidentiality rights that conflict with parental oversight.
- **Ethical Issues in Pediatric Research:** Special protections (e.g., minimal risk, necessity of parental consent, child assent) are required to prevent exploitation.



(Assisted by ChatGPT)

Medical Ethics Concerning Special Populations

■ Psychiatric Patients

- **Autonomy and Competence:** Many psychiatric patients can make informed decisions, but those with severe mental illnesses (e.g., psychosis, schizophrenia) may have impaired decision-making capacity.
- **Involuntary Treatment:** Ethical concerns arise when patients are treated against their will due to risks to themselves or others. Legal frameworks (e.g., involuntary hospitalization, guardianship) must balance individual rights and public safety.
- **Stigmatization and Discrimination:** Psychiatric patients often face bias in healthcare, which can lead to ethical violations such as inadequate treatment or coercion.
- **Use of Restraints and Seclusion:** These interventions should only be used as a last resort to prevent harm, following strict ethical and legal guidelines.

(Assisted by ChatGPT)

American Academy of Child and Adolescent Psychiatry (AACAP) Code of Ethical Principles

- **Developmental Perspective**

- Promoting the Welfare of Children and Adolescents (Beneficence)
- Minimizing Harmful Effects (Non-maleficence)

- **Assent and Consent (Autonomy)**

- Assent is an agreement by someone who is not legally able to give consent

- **Confidentiality (Autonomy/ Fidelity)**

- Third Party Influence (Fidelity)
- Research Activities
- **Advocacy and Equity (Justice)**
- Professional Rewards
- Legal Considerations

American Association of
Child & Adolescent
Psychiatry

Medical Ethics Concerning Special Populations (Cont.)

▪ Geriatric and Cognitively Impaired Patients (e.g., Dementia, Alzheimer's)

- **Decision-Making and Advance Directives:** Patients with progressive cognitive decline require ethical considerations in honoring previously expressed wishes (e.g., advance directives, living wills).
- **Surrogate Decision-Making:** Family members or legally appointed guardians may have to make medical choices when the patient lacks capacity.
- **End-of-Life Care:** Ethical dilemmas include withholding or withdrawing life-sustaining treatment, palliative care, and assisted dying (where legal).



(Assisted by ChatGPT)

Medical Ethics Concerning Special Populations (Cont.)

■ Patients with Disabilities

- **Equal Access to Healthcare:** People with physical, intellectual, or developmental disabilities must receive equitable and non-discriminatory care.
- **Informed Consent Challenges:** Individuals with intellectual disabilities may need special communication strategies or supported decision-making processes.
- **Reproductive Rights and Ethical Concerns:** Sterilization, contraception, and reproductive decisions for disabled individuals pose ethical and legal challenges.

(Assisted by ChatGPT)

Medical Ethics Concerning Special Populations (Cont.)

■ Prisoners and Institutionalized Populations

- **Ethical and Legal Protections:** Prisoners have the right to medical care, but access to adequate treatment is often compromised by institutional constraints.
- **Consent and Coercion:** Prisoners may feel pressured to participate in medical research or procedures, requiring extra safeguards against coercion.
- **Mental Health Treatment:** High rates of mental illness in incarcerated populations raise ethical concerns about involuntary treatment and solitary confinement.



<https://www.istockphoto.com/illustrations/cartoon-of-a-prisoners>

(Assisted by ChatGPT)

Data Lifecycle Management

- The systematic approach to managing data from its creation to its eventual disposal. The lifecycle typically follows these stages:
- **Stages of Data Lifecycle Management:**
 1. **Data Creation & Acquisition:** Data is generated from various sources such as medical records, IoT devices, surveys, or AI models.
 2. **Data Storage & Processing:** Data is stored in databases, cloud environments, or data lakes, where it is cleaned, transformed, and analyzed.
 3. **Data Usage & **Sharing**:** Data is used for research, analytics, AI training, decision-making, or shared across institutions under governance policies.
 4. **Data Archiving & Retention:** Inactive or old data is moved to long-term storage while ensuring accessibility and compliance with legal retention periods.
 5. **Data Disposal & Deletion:** Data is securely deleted or anonymized when no longer needed, following policies to prevent unauthorized access.

(Assisted by ChatGPT)

Data Governance

- The framework that ensures the proper management, security, quality, and compliance of data within an organization. It involves policies, procedures, and technologies that oversee data collection, storage, usage, and sharing.
- **Key Components of Data Governance:**
 - **Data Policies & Standards:** Defines guidelines on data handling, storage, access, and security.
 - **Data Quality Management:** Ensures accuracy, completeness, consistency, and reliability of data.
 - **Data Security & Privacy:** Implements access controls, encryption, anonymization, and compliance with regulations like GDPR, HIPAA, and China's PIPL.
 - **Data Stewardship:** Assigns responsibilities to individuals (data stewards) who oversee data integrity and compliance.
 - **Compliance & Legal Regulations:** Ensures data use aligns with national and international laws.
 - **Data Architecture & Metadata Management:** Organizes and catalogs data for better discoverability and usability. (E.g., International Classification of Diseases (ICD) codes, Observational Medical Outcomes Partnership (OMOP) Common Data Model)

(Assisted by ChatGPT)

Standardized Data: The OMOP Common Data Model

- OMOP can be considered a type of data that can be used to build a **knowledge graph** within the healthcare domain.
- A "knowledge graph" is a broad concept representing a network of entities and their relationships, used to **organize complex information** and **enable semantic querying**.

DATA STANDARDS

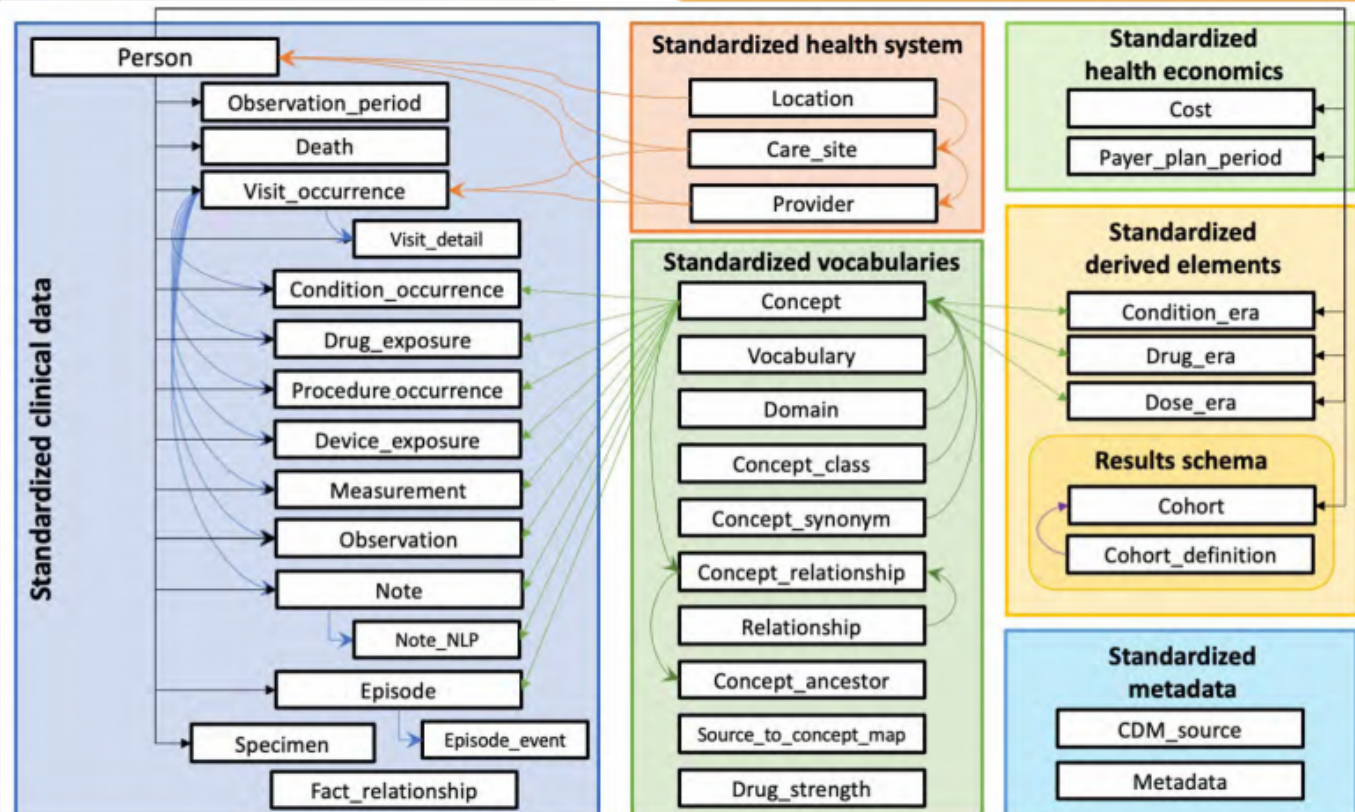
OMOP Common Data Model

The Observational Medical Outcomes Partnership (OMOP) Common Data Model (CDM) is an open community data standard, designed to standardize the structure and content of observational data and to enable efficient analyses that can produce reliable evidence.



"The OMOP Common Data Model serves as the foundation of all our work in the OHDSI community, and I'm proud that our open community data standard has been so widely adopted and so extensively used to generate reliable evidence."

- Clair Blacketer
2020 Titan Award for Data Standards recipient



OMOP CDM By The Numbers

37 tables

- 17 to standardize clinical data
- 10 to standardize vocabularies

394 fields

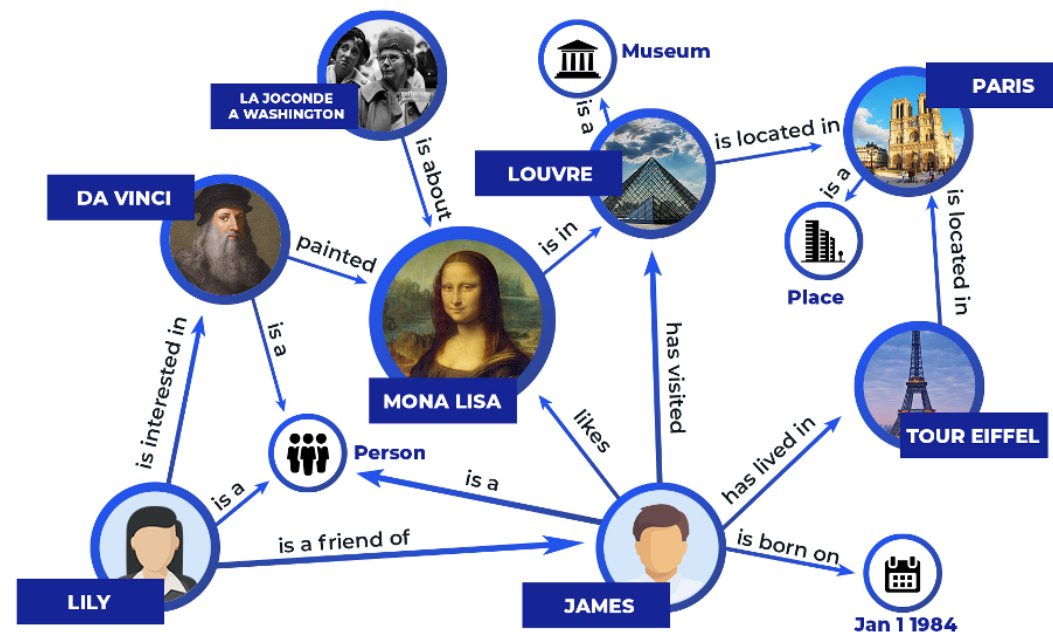
- 193 with _id to standardize identification
- 101 with _concept_id to standardize content
- 43 with _source_value to preserve original data

1 Open Community Data Standard

LLMs VS KGs

- Large language models (LLMs) and knowledge graphs (KGs) are both technologies that help machines understand and process information. LLMs are good at **generating human-like text**, while KGs are good at **organizing and structuring data**.

An example of knowledge graph



(Assisted by Gemini)

What OHDSI is:

- ✓ **Open Source**
- ✓ **Community**
- ✓ **Data**



Why Choose OHDSI/OMOP:

- ✓ **Fast, reliable** studies across a series of datasets and data types
- ✓ **Reduced cost of ownership** including understanding coding schemes, writing statistical programs across databases or developing software
- ✓ **Expanded data access** via the OHDSI network and remote multi-center database studies



OHDSI Collaborators:

- 3,758 collaborators
- >1,100 organizations
- 83 countries from 6 continents

OHDSI Network:

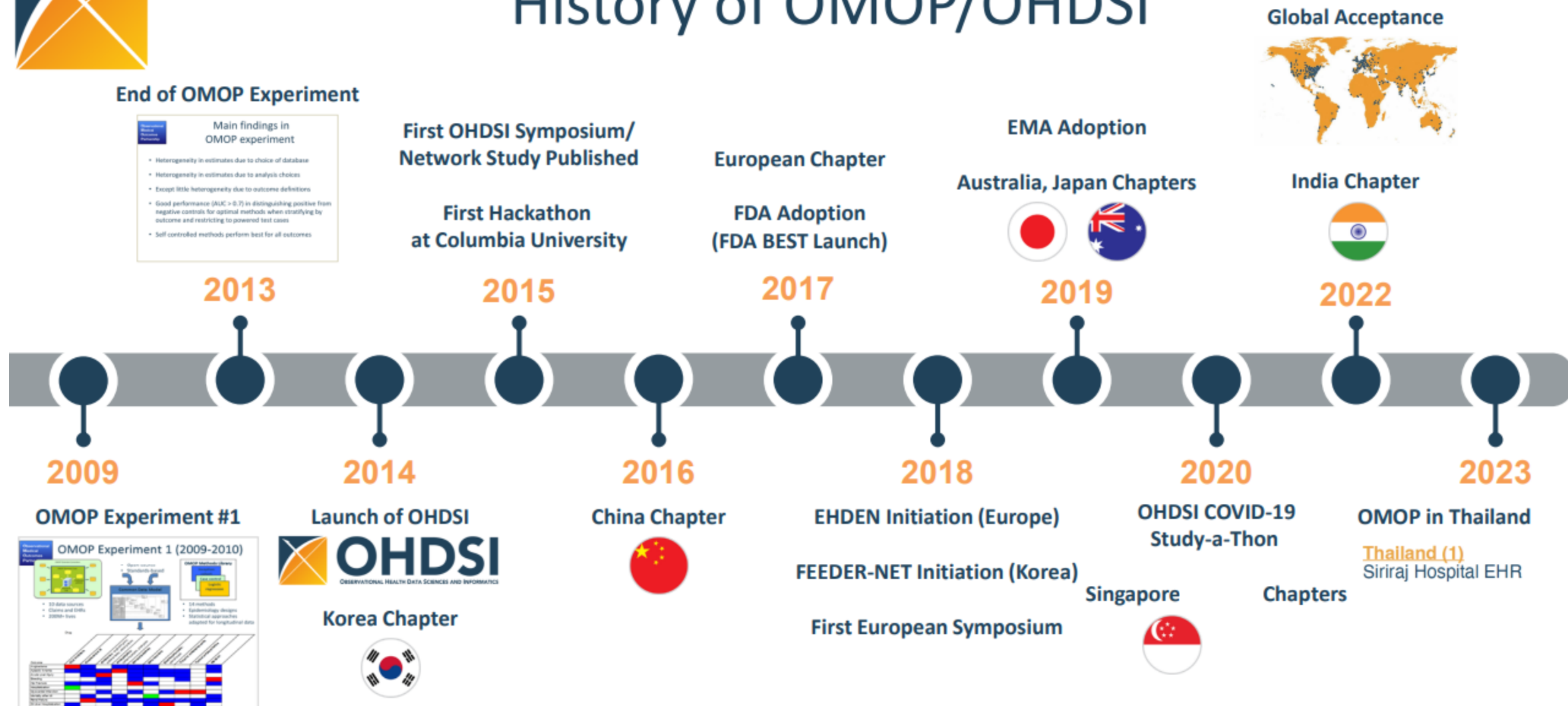
- 534 data sources
- 49 countries
- 956M unique patient records

<https://ohdsi.org/>

History of OMOP/OHDSI (Observational Health Data Sciences and Informatics)

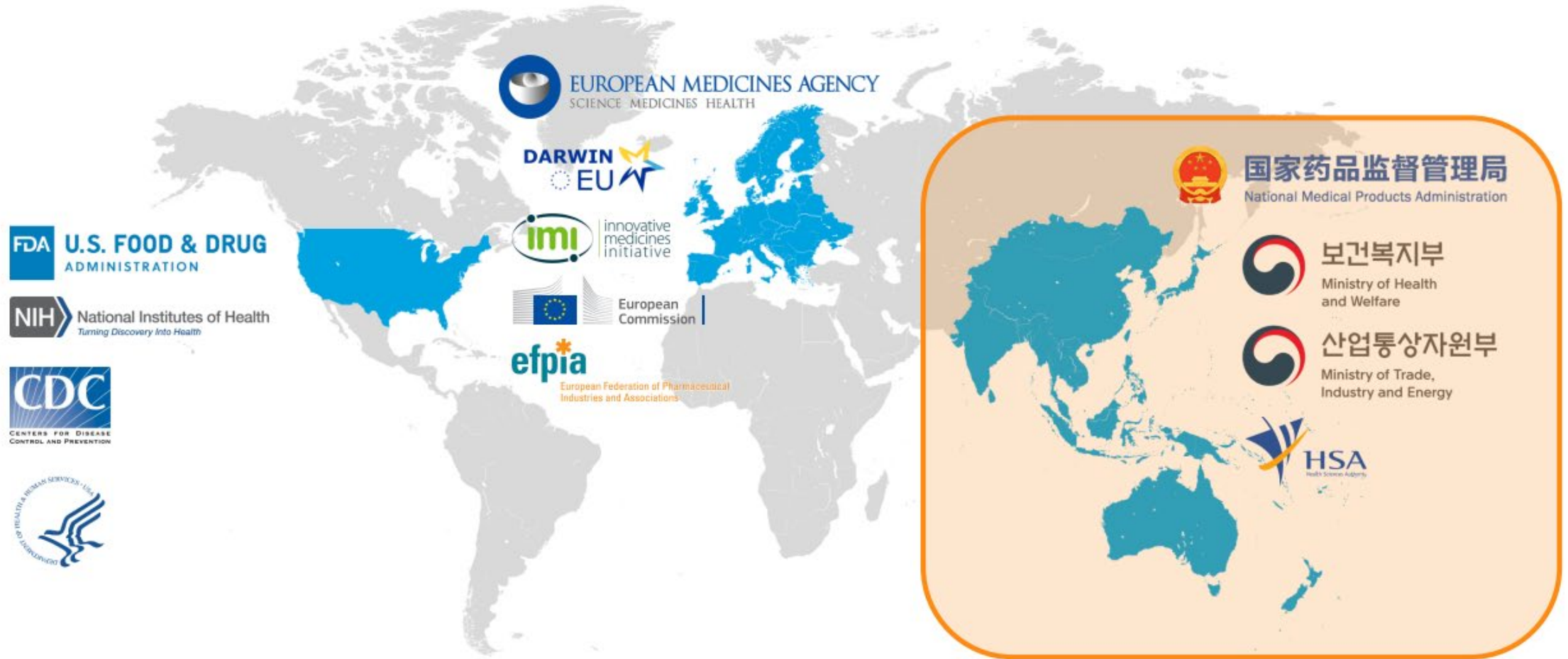


History of OMOP/OHDSI





Global OHDSI Adoptions





China Government's Guides on RWE & RWD

From Center for Drug Evaluation (CDE), National Medical Products Administration (NMPA)

- **1st guide** was released in Jan 2020, introducing the definition, data source requirement, design, and evaluation of using RWE for drug effectiveness study and safety monitoring.
- **2nd guide** was released in Aug 2020, focusing on the details and importance of the source, safety, curation, quality assurance and maintenance of RWD, so that reliable RWE could be produced

国家药品监督管理局药品审评中心
CENTER FOR DRUG EVALUATION, NMPA
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关于公开征求《用于产生真实世界证据的真实世界数据指导原则（征求意见稿）》意见的通知

发布日期: 20200803

为进一步指导和规范申办者利用真实世界数据生成真实世界证据支持药物研发,我中心组织起草了《用于产生真实世界证据的真实世界数据指导原则（征求意见稿）》，现在中心网站予以公示，以广泛听取各界意见和建议，欢迎各界提出宝贵意见和建议，并及时反馈给我们。

征求意见时限为自发布之日起2个月。

您的反馈意见请发到以下联系人的邮箱：

联系人：高丽丽、赵骏

联系方式：gaoli@cde.org.cn, zhaojun@cde.org.cn

感谢您的参与和大力支持。

国家药品监督管理局药品审评中心
2020年8月3日

附件 1:	《用于产生真实世界证据的真实世界数据指导原则（征求意见稿）》.docx
附件 2:	《用于产生真实世界证据的真实世界数据指导原则（征求意见稿）》起草说明.doc

Importance of Biomedical Data Sharing

■ Accelerating **Medical Research**

- Shared biomedical data enable researchers to **develop new treatments**, conduct large-scale studies, and **validate findings** across different populations.
- It fosters **collaboration** among researchers, leading to breakthroughs in disease understanding and drug discovery.

■ Enhancing **AI and Machine Learning Models**

- High-quality, diverse datasets improve the **performance** and **generalizability** of AI-driven diagnostic tools and predictive models.
- Training AI on larger datasets helps **reduce bias** and ensures better accuracy in clinical decision-making.

(Assisted by ChatGPT)

Importance of Biomedical Data Sharing (Cont.)

- Improving **Public Health** Outcomes
 - Data sharing facilitates **early detection** of disease outbreaks and trends, enabling public health interventions.
 - It supports epidemiological studies and global health **monitoring** efforts.
- Facilitating **Personalized Medicine**
 - Integrating biomedical data **across institutions** helps tailor treatments to individual patients, improving therapeutic outcomes.
 - **Genomic data sharing** plays a crucial role in precision medicine by identifying patient-specific disease risks.
- Optimizing **Healthcare Systems**
 - Shared clinical data (to analyzers) can **enhance hospital efficiency**, improve patient care coordination, and reduce medical errors.
 - It helps policymakers design **evidence-based** healthcare policies and resource allocation strategies.

(Assisted by ChatGPT)

Privacy Challenges in Biomedical Data Sharing

■ Patient Confidentiality and Data Protection

- Medical records contain highly sensitive personal information, and unauthorized access or breaches can lead to **identity theft** or **discrimination**.
- **Compliance with privacy regulations** (e.g., GDPR, HIPAA) is necessary to protect patient rights.

More about privacy regulations on Oct 28 in Week 7

■ Re-identification Risks

- Even **de-identified** datasets can be **re-identified** when combined with other publicly available data.
- Advanced **machine learning** techniques can **infer** patient identities, raising privacy concerns.

More about re-identification on Nov 4 in Week 8

(Assisted by ChatGPT)

Privacy Challenges in Biomedical Data Sharing (Cont.)

■ Balancing Data Utility and Privacy

More about protection techniques in Weeks 10, 13, 14

- Privacy-preserving techniques like **differential privacy, federated learning, and synthetic data generation** are needed to enable data sharing while minimizing risks.

More about game-theoretic models on Dec 2 in Week 12

- Researchers must find the **right balance** between data utility and privacy protection to ensure both scientific progress and ethical responsibility.

■ Data Security Threats

- Cybersecurity risks, including data breaches and **hacking**, threaten the **integrity** of biomedical databases.
- Institutions must implement robust **encryption, access controls**, and secure storage solutions.

More about encryption technologies on Dec 9 in Week 13

(Assisted by ChatGPT)

Take-away messages

- Four Principles of Medical Ethics
 - **Beneficence** (doing good)
 - **Non-maleficence** (to do no harm)
 - **Autonomy** (giving the patient the freedom to choose freely, where they are able)
 - **Justice** (ensuring fairness)

In-class Quiz 1 - Core Evaluation Areas

(Lectures 1 – 4) Closed-book Exam (20-25 mins)

- Applications of AI in medicine
- Principles of ethical AI
- Definition and examples of sensitive personal information
- Definition of privacy from the Civil Code of China 2020
- Right to privacy
- Informed consent
- Institutional Review Boards (IRBs)
- Differences in public governance values between China and the West
- Four principles of medical ethics
- ~~• Five stages of the data life cycle~~
- ~~• Importance of biomedical data sharing~~
- ...

Readings Due on Oct 14

■ Optional

- ❑ Dunkelau J, Leuschel M. Fairness-aware machine learning: An extensive overview. 2019.
 - <https://stups.hhu-hosting.de/downloads/pdf/fairness-survey.pdf>
- ❑ Xu J, Xiao Y, Wang WH, Ning Y, Shenkman EA, Bian J, Wang F. Algorithmic fairness in computational medicine. EBioMedicine. 2022 Oct 1;84.
 - [https://www.thelancet.com/pdfs/journals/ebiom/PIIS2352-3964\(22\)00432-7.pdf](https://www.thelancet.com/pdfs/journals/ebiom/PIIS2352-3964(22)00432-7.pdf)