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Artificial Intelligence in Clinical Diagnosis: Promise and Privacy

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Artificial Intelligence in Clinical Diagnosis: Promise and Privacy

Practice MCQs

At a glance

AI tools now read scans, slides and eye photos for doctors. Health data is very personal, so privacy rules matter as much as accuracy.

01 **The first**IDx-DR (DR means diabetic retinopathy, an eye disease), cleared by the US Food and Drug Administration (FDA) on 11 April 2018.
02 **The skill**Deep learning finds patterns in labelled scans.
03 **The law**India's Digital Personal Data Protection (DPDP) Act, 2023 sets consent rules.
04 **The risk**Data without names can still identify people.

- A lung CT (computed tomography) scan model beat six radiologists when no earlier scan was available.
- The DPDP Act has no separate class for health data.
- UPSC Mains 2023 asked about AI in diagnosis and privacy.

Source: US FDA, IDx-DR press release

Deep learningA way for software to learn from many labelled examples.
SensitivityHow often a test catches people who are sick.
SpecificityHow often a test clears people who are healthy.
Federated learning Training a model without moving patient data out of the hospital.

Artificial intelligence now helps doctors read scans, slides and eye photos. The same tools also test how well we protect private health data. This lesson covers how the tools learn, where they work, and what the law says about privacy. It follows the UPSC Mains 2023 question on this topic.

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What is AI, and how does it learn to read

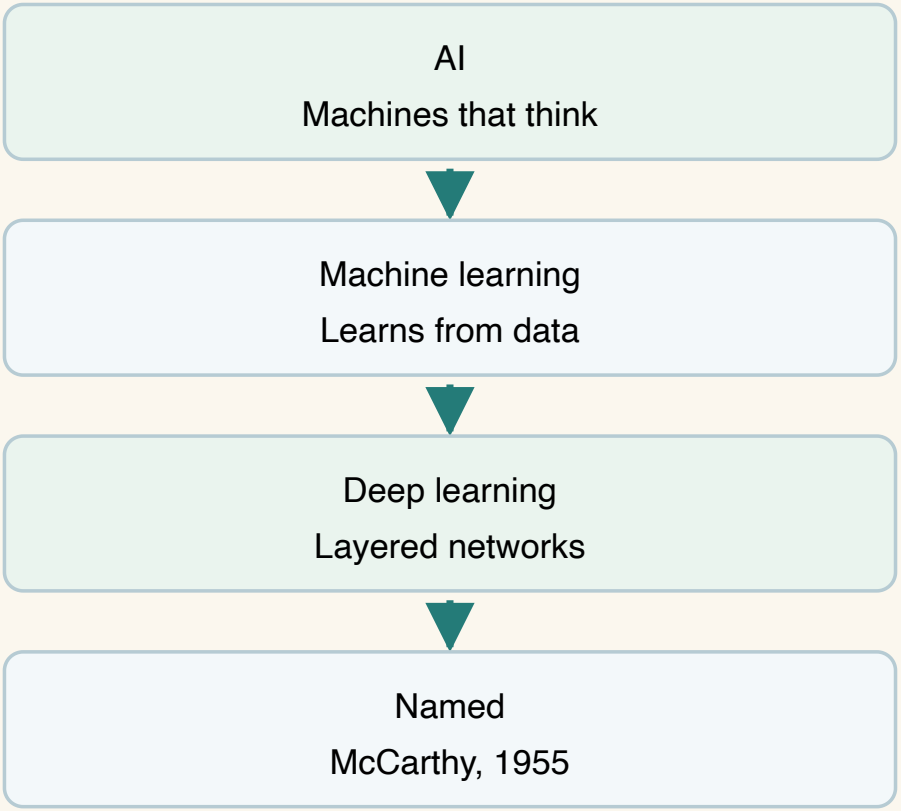
medical images?

AI in medicine is not magic. It is a model trained on many labelled examples.

1. What is AI, and who named it?

Artificial intelligence, or AI, means machines that do tasks which need human intelligence. John McCarthy wrote the 1955 proposal for a summer research conference on “artificial intelligence”. That was the first use of the phrase in print. He then organised the 1956 Dartmouth summer project.

Machine learning is a part of AI. A machine learning model learns patterns from data. Deep learning is a part of machine learning. It uses layered neural networks.



Deep learning sits inside machine learning, which sits inside AI.



A radiologist interprets MRI scans, the very task artificial intelligence now assists. Photo: The Medical Futurist editors, CC BY 4.0, via Wikimedia Commons.

True or False: Deep learning is a part of machine learning.
Source: Stanford Engineering, John McCarthy obituary, item 1

Source: Dartmouth, AI coined at Dartmouth, item 1

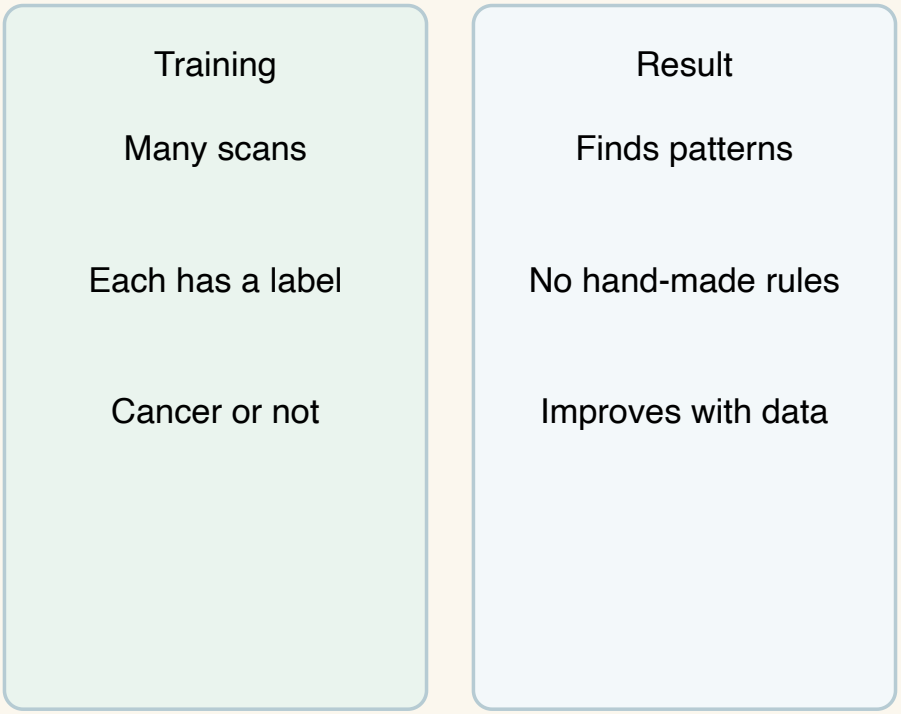
Source: IBM (technology company), deep learning, item 1

2. How does a deep learning model learn to spot disease?

Developers feed the model many scans. Each scan has a label, such as “cancer” or “no cancer”. The model finds patterns that match the labels. No doctor writes the rules inside it.

A lung study shows the idea. Researchers trained a model on low-dose chest computed tomography (CT) scans, which are detailed X-ray images.

It reached 94.4% area under the curve on 6,716 cases from the National Lung Cancer Screening Trial. It did about as well on an independent set of 1,139 cases.



Doctors supply labels. The model finds the rules.

Source: Nature Medicine, lung cancer screening with deep learning, item 2

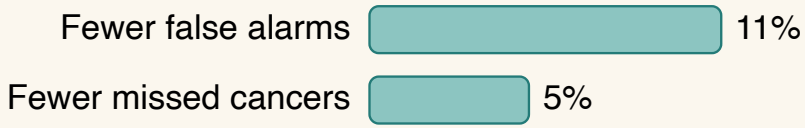
Source: IBM (technology company), deep learning, item 2

3. Can AI match a radiologist on a scan?

On narrow tasks it can. In 2019 the same lung model was tested against six radiologists. When no earlier scan was available, the model did better than all six. It cut false positives by 11% and false negatives by

5%.

When an earlier scan was available, the model did about as well as the radiologists. So AI works best as a helper, not a replacement.



No earlier scan was available in this test.

No prior scan	Prior scan
Model did better	About equal
Than all six	to the six

AI helps. It does not replace the doctor.

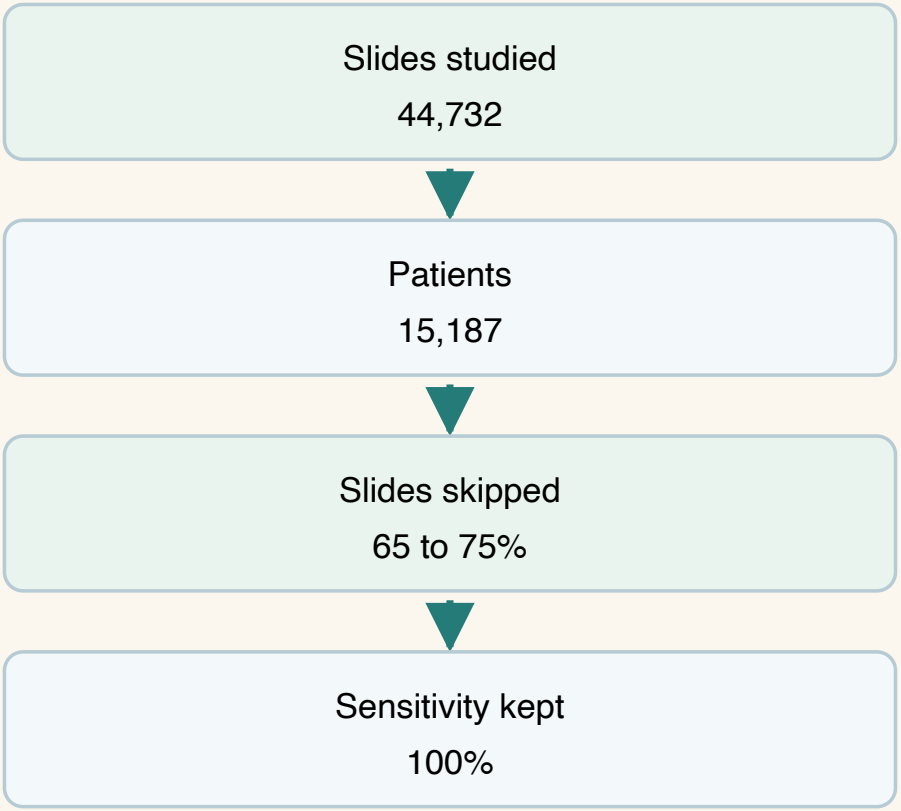
True or False: The lung model beat six radiologists even when an earlier scan was available.

Source: Nature Medicine, lung cancer screening with deep learning, item 3

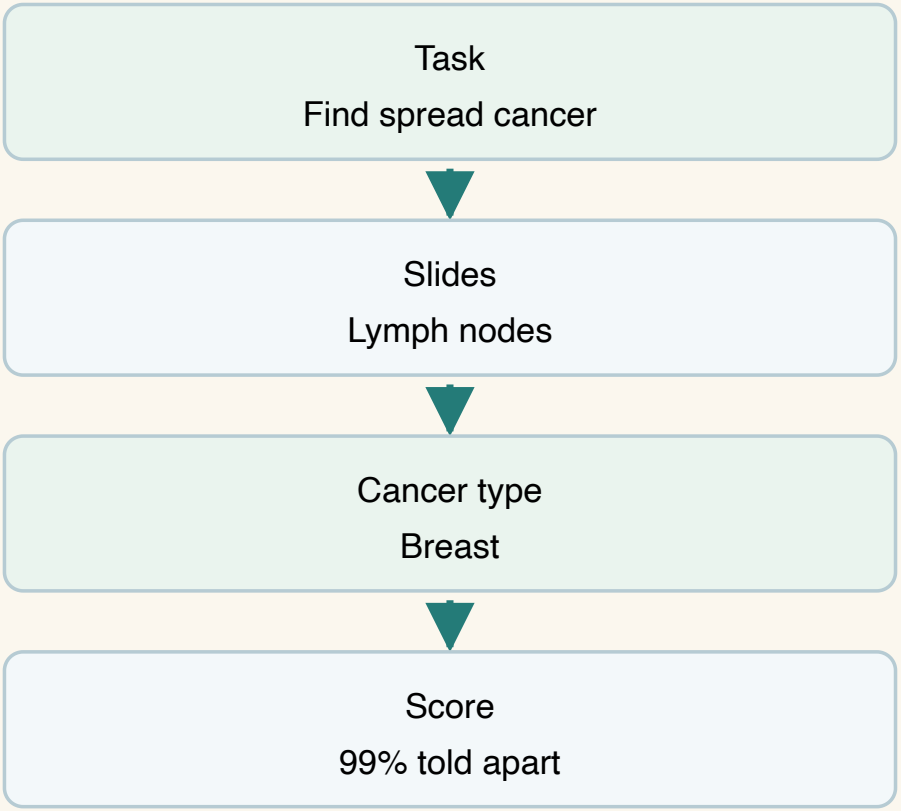
4. How does AI help with slides and eye photos?

A pathology study used 44,732 slides from 15,187 patients. The system let pathologists skip 65% to 75% of slides while keeping 100% sensitivity. That saves expert time for the hard cases.

In 2018 Google described a tool called LYNA, short for Lymph Node Assistant. It checks lymph node slides for breast cancer that has spread. It told slides with cancer from slides without cancer 99% of the time.



Pathologists can skip many slides and miss no cancer.



LYNA told slides with cancer from slides without it.

Source: Nature Medicine, computational pathology, item 4

Source: Google Research blog, LYNA, item 4

Which AI diagnosis tools have won approval?

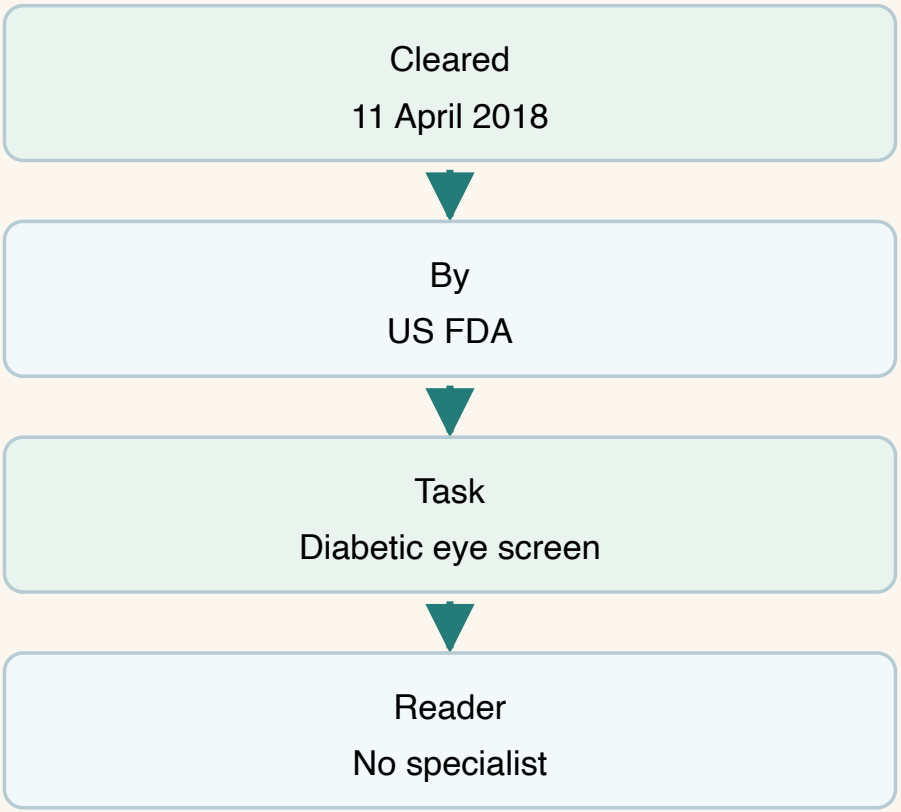
Tools must prove themselves before doctors may use them. The first approval for an autonomous AI screen came in 2018.

5. What was IDx-DR, and why did it matter?

On 11 April 2018 the US Food and Drug Administration (FDA) permitted the marketing of IDx-DR (DR stands for diabetic retinopathy).

It was the first medical device to use AI to detect more than mild diabetic retinopathy in adults with diabetes. Diabetic retinopathy is damage to blood vessels in the retina.

The software reads eye images taken with a Topcon camera. It gives a result without a specialist reading the image. That lets a primary care office run the screening.



It was the first device of its kind.

True or False: IDx-DR needs a specialist to read the image before it gives a result.
Source: US FDA, IDx-DR press release, item 5

Source: npj Digital Medicine, IDx-DR pivotal trial, item 5

6. How accurate was IDx-DR in its trial?

The FDA studied images from 900 patients at 10 primary care sites. IDx-DR found more than mild disease 87.4% of the time. It found no such disease in 89.5% of patients who did not have it.

The company's own trial paper gives close numbers. Sensitivity was 87.2% and specificity was 90.7%. Sensitivity means catching the sick. Specificity means clearing the healthy.



900 patients at 10 primary care sites.

Source: US FDA, IDx-DR press release, item 6

Source: npj Digital Medicine, IDx-DR pivotal trial, item 6

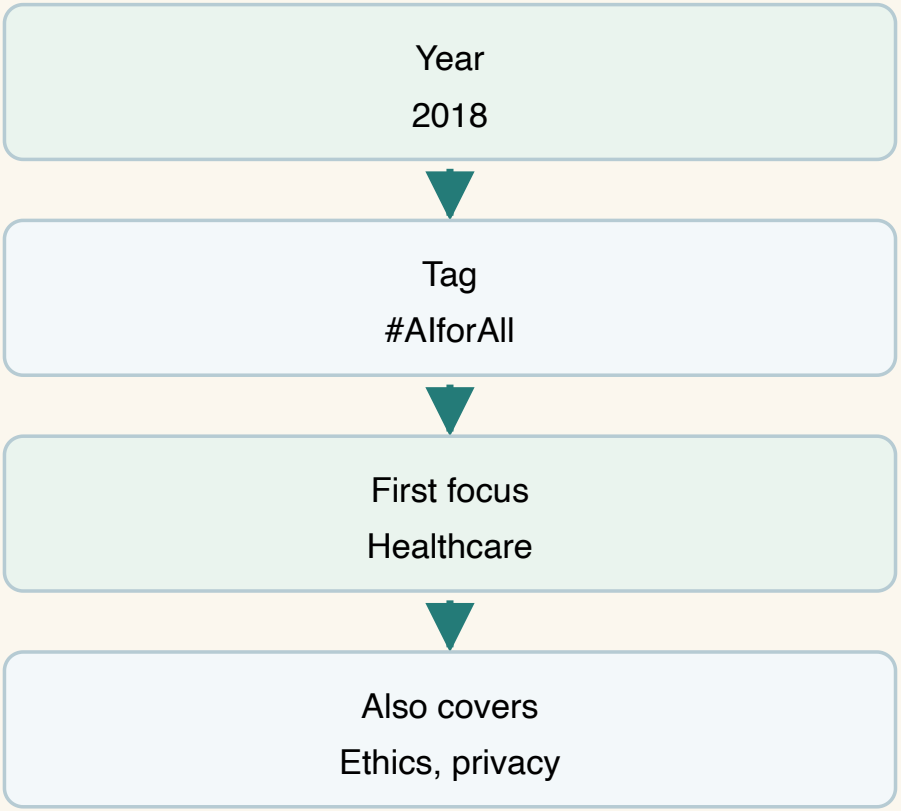
What is India doing about AI in health?

India has set a national plan, funded a national mission, and issued health-specific ethics rules.

7. What did NITI Aayog say in its AI strategy?

NITI Aayog (National Institution for Transforming India), the government's policy think tank, published the National Strategy for Artificial Intelligence in 2018. It uses the tag #AIforAll. The strategy names healthcare as its first focus area, ahead of agriculture and education.

It also has a chapter on ethics, privacy and security. The Union Budget speech for 2018-19 had asked NITI Aayog to set up a national programme on AI.



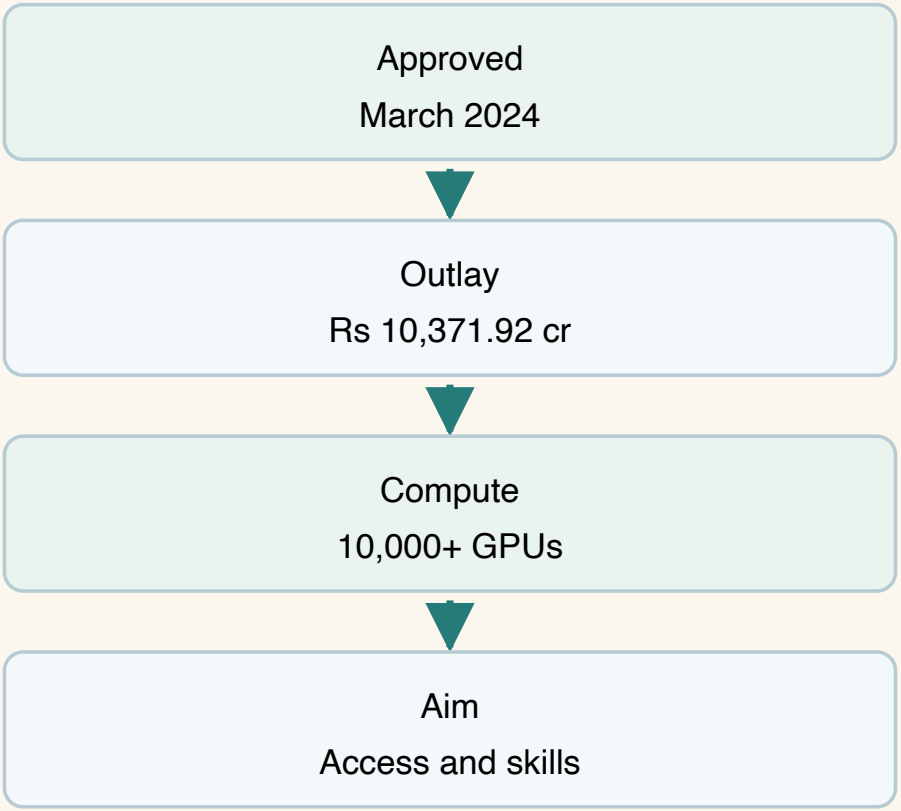
Healthcare comes first in the list of focus areas.

True or False: NITI Aayog's AI strategy names healthcare as its first focus area.
Source: NITI Aayog, National Strategy for AI, item 7

8. What is the IndiaAI Mission?

The Union Cabinet approved the IndiaAI Mission in March 2024. The budget outlay is Rs 10,371.92 crore. It plans public AI compute with 10,000 or more GPUs.

The mission aims to make computing easier to access and to improve data quality. It also backs home-grown AI tools and AI skills.



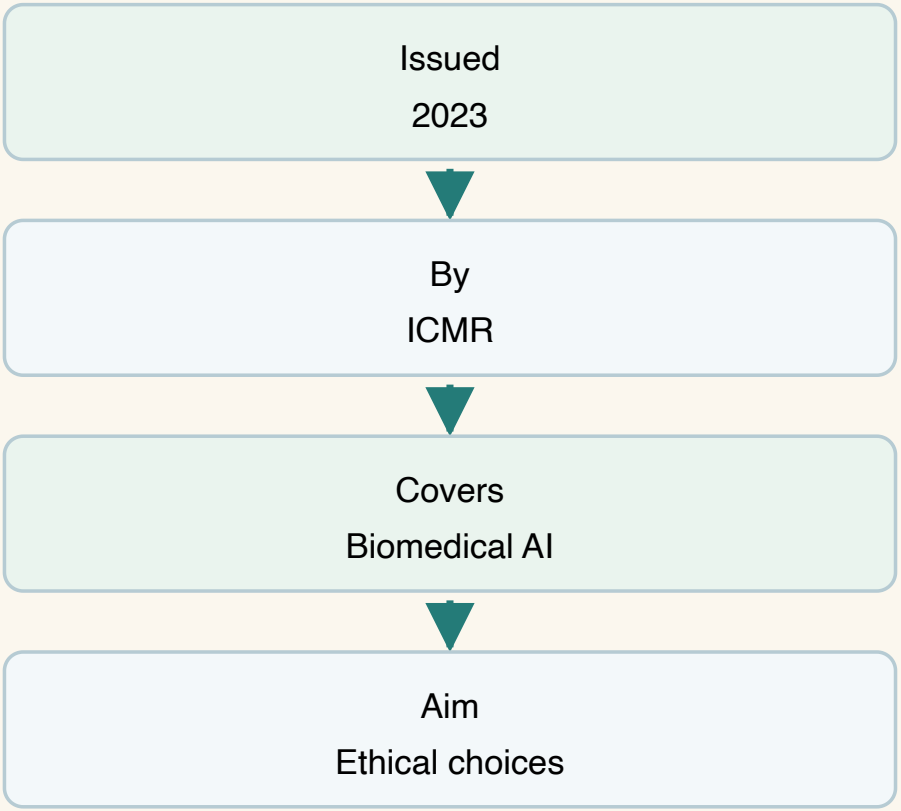
The mission funds computing power and AI skills.

Source: PIB, IndiaAI Mission, item 8

9. What do the ICMR guidelines add?

The Indian Council of Medical Research (ICMR) issued ethical guidelines for AI in biomedical research and healthcare in 2023. They aim to guide ethical decisions while AI tools are built, deployed and adopted.

They are written for doctors, researchers and developers. They sit beside the Digital Personal Data Protection (DPDP) Act, which covers all personal data.



They guide how AI tools are built and used.

Source: ICMR, ethical guidelines for AI in healthcare, item 9

Why is health data special, and what protects it?

Health records show illness, habits and family history. Misuse can cost a person a job or insurance.

10. What does India's DPDP Act, 2023 say?

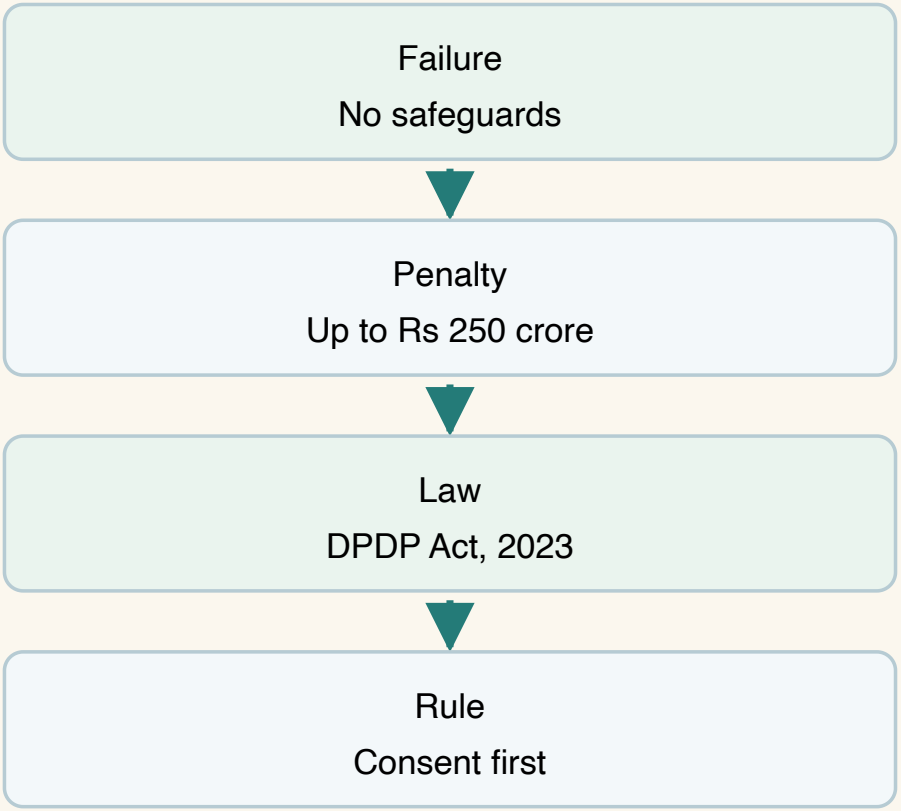
The Digital Personal Data Protection Act, 2023 covers digital personal data. Consent must be free, specific, informed, unconditional and unambiguous. It needs a clear affirmative action.

The Act has no separate “sensitive data” class. Health data gets the same rules as other personal data. The Act does allow processing without consent in a medical emergency. It also allows it for treatment during an epidemic or other threat to public health.

A failure to keep reasonable security safeguards can bring a penalty of up to Rs 250 crore.

India DPDP	EU GDPR
One data class	Health is special
Clear consent	Banned by default
Emergency exception	Explicit consent OK

Only the EU law has a special health class.



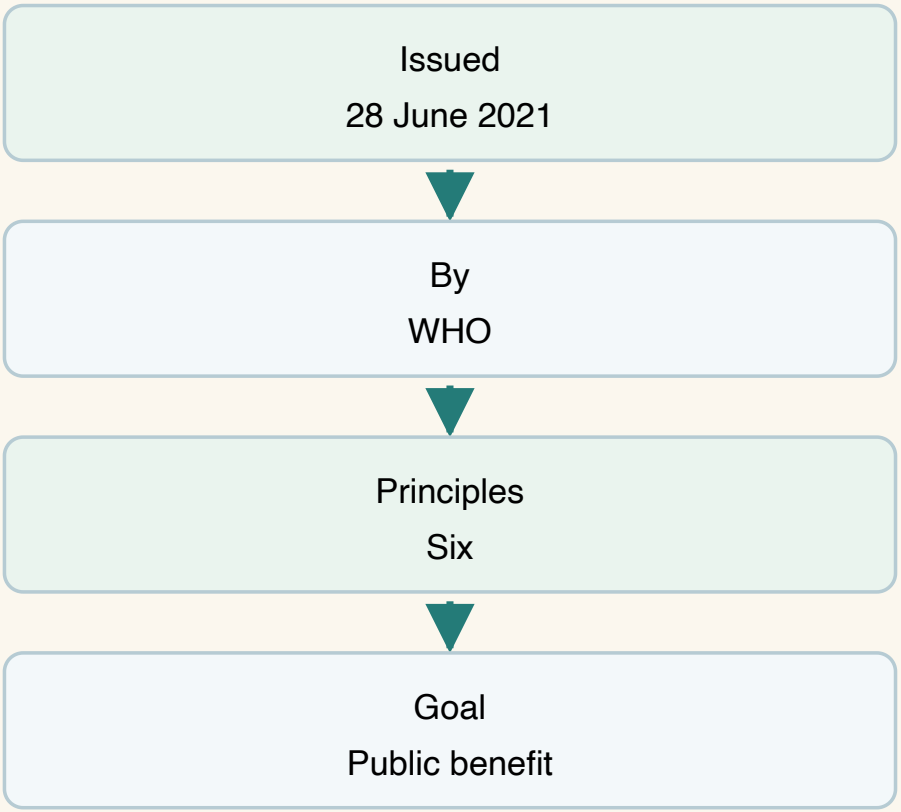
Weak security can bring a heavy fine.

True or False: The DPDP Act, 2023 creates a separate class called sensitive personal data.
Source: MeitY, DPDP Act 2023, item 10

11. How do the EU and WHO treat health data?

The EU's General Data Protection Regulation (GDPR) puts data about health in a special category. Article 9 bans processing it, unless an exception applies. One exception is the person's explicit consent.

The World Health Organization (WHO) issued guidance on the ethics of AI for health on 28 June 2021. It sets out six consensus principles so that AI serves the public good.



The six principles aim at public benefit.

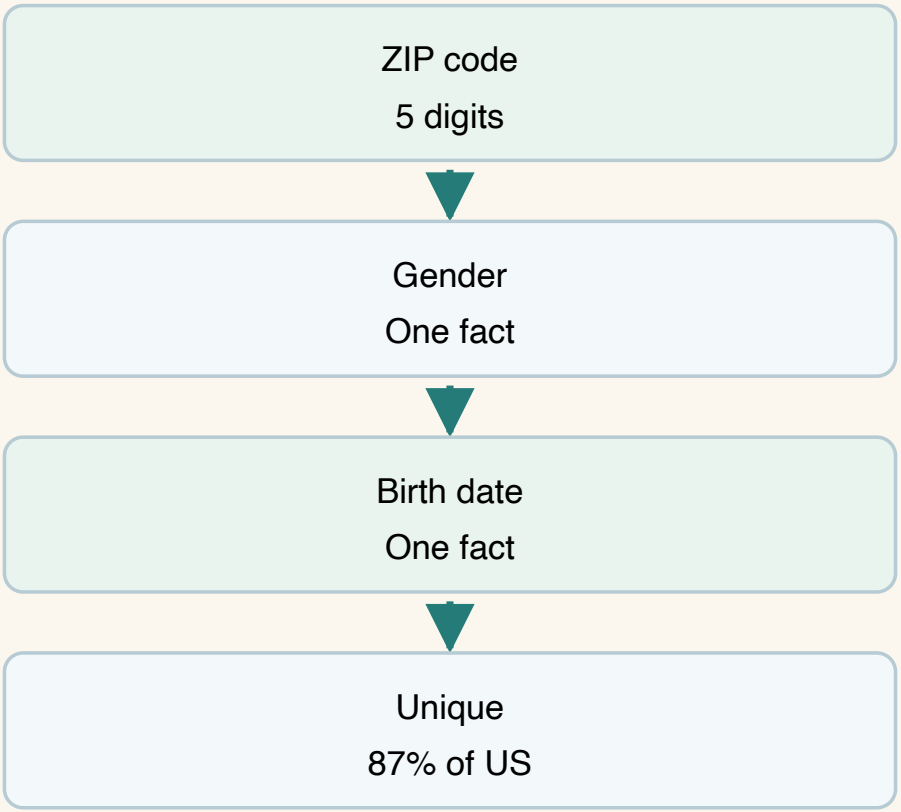
Source: GDPR Article 9, item 11

Source: WHO, Ethics and governance of AI for health, item 11

12. Is removing the name enough to protect a patient?

No. Latanya Sweeney showed this in 2000. She found that 87% of the US population could be picked out by only three facts. These were a 5-digit ZIP (postal) code, gender and date of birth.

So data without names can still point to one person. Joining two datasets can rebuild an identity.



Three plain facts picked out most Americans.

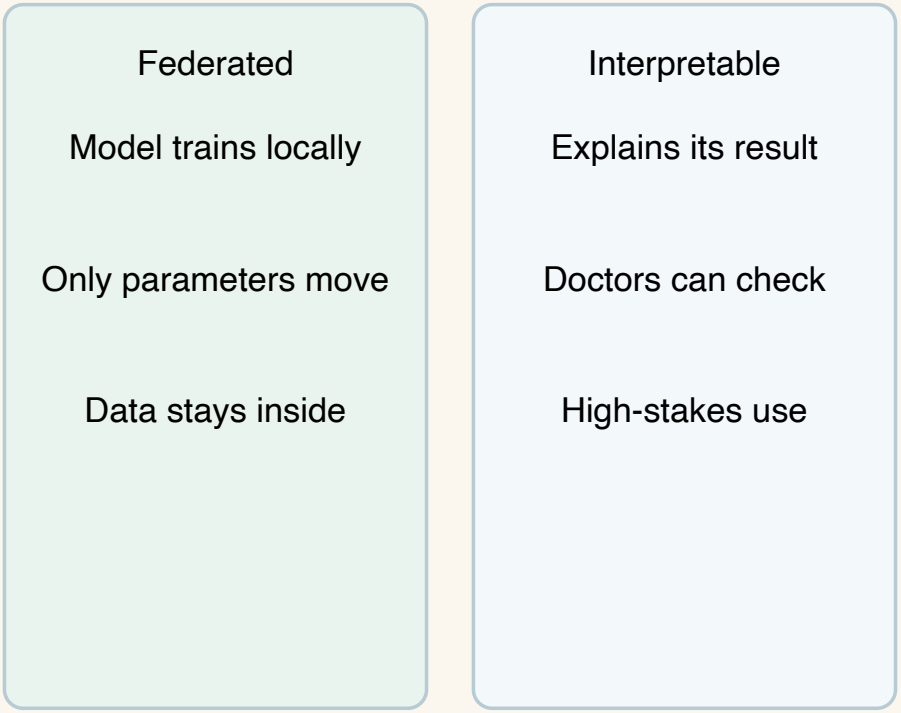
True or False: Removing a patient's name makes health data impossible to trace.

Source: Sweeney, Simple demographics often identify people uniquely, item 12

13. How can hospitals protect patients and still use AI?

Federated learning is one answer. The model trains inside each hospital. Only model details, such as parameters, are shared. Patient data stays behind the hospital's firewall.

Another problem is the black box. Many models cannot explain their results. A Nature Machine Intelligence paper argues that for high-stakes decisions we should use models that are interpretable.



One protects data. The other builds trust.

True or False: Federated learning moves all patient data to one central server.
Source: npj Digital Medicine, federated learning, item 13

Source: Nature Machine Intelligence, interpretable models, item 13

What is a chemical signature and how does it help diagnose disease?

Current affairs, October 2026. Doctors are testing body chemicals to catch brain diseases early. Here is how that works.

What is a biomarker?

A **biomarker** is a measurable sign of what is happening in the body. It can be a protein, a chemical or a by-product of a disease. Experts call it a *chemical signature*.

Think of it as the body's fingerprint. Machines such as spectrometers and chromatographs read the pattern of molecules in a sample.

Which markers are used for Alzheimer's disease?

WHO says 57 million people lived with dementia in 2021. About 10 million new cases appear each year. Alzheimer's disease causes roughly 60 to 70 per cent of them.

Two proteins matter most: **amyloid-beta** and **tau**. A form called phosphorylated tau, especially **p-tau217**, can be measured in blood. It can also be measured in **cerebrospinal fluid (CSF)**, the fluid around the brain and spinal cord.

Blood is easy to collect. CSF needs a more invasive procedure. Skin samples are still under study.

Are there markers for other brain diseases?

Researchers study alpha-synuclein for Parkinson's disease. In autoimmune encephalitis, antibodies attack brain proteins. This can look like a mental illness.

Neurofilament light shows that nerve cells are damaged. It does not point to one disease. In brain tumours, molecular profiling helps doctors classify the tumour and plan treatment.

Why is a marker not the same as a diagnosis?

A positive marker does not prove disease or dementia. Age, kidney function, medicines, other illness and the stage of disease can all change the levels. The way a sample is taken matters too.

So doctors combine symptoms, history, a physical exam and brain scans. Sometimes they need several markers.

What stops India from using these tests widely?

Cost is high. The tests are mostly available only at large centres. Labs also use different methods, so results are hard to compare.

Exam point: a biomarker supports a diagnosis. It never replaces the doctor's overall judgement.

Source: The Hindu, Athira Elssa Johnson, 18 October 2026, chemical signatures and early disease detection

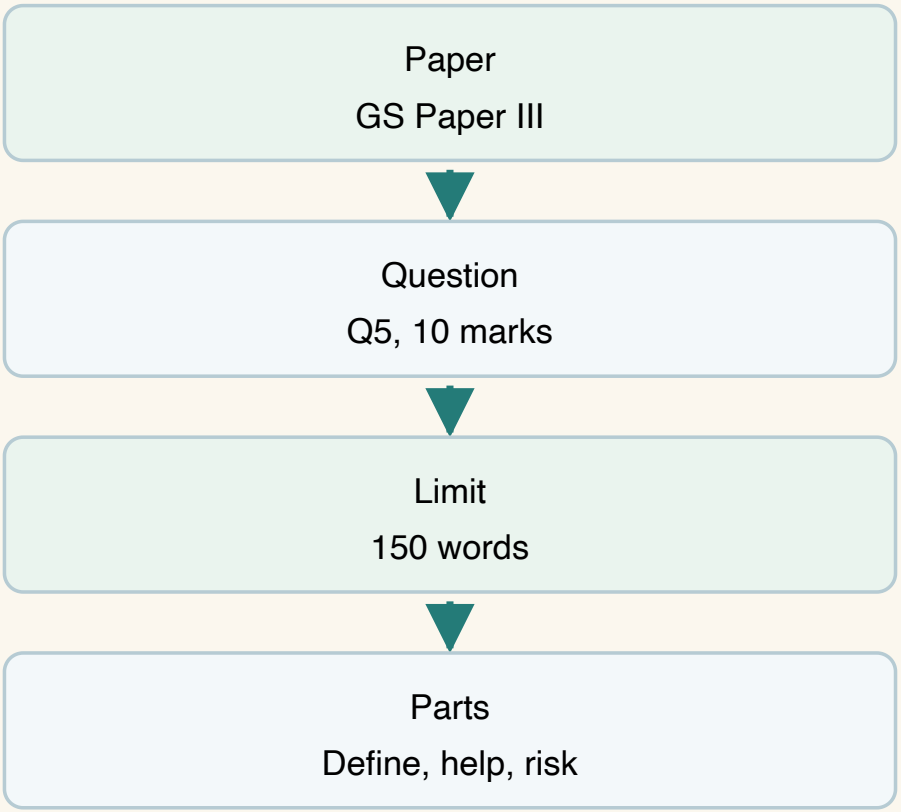
How did UPSC test AI in healthcare?

The 2023 Mains asked for both sides. It wanted the benefits and the privacy threat.

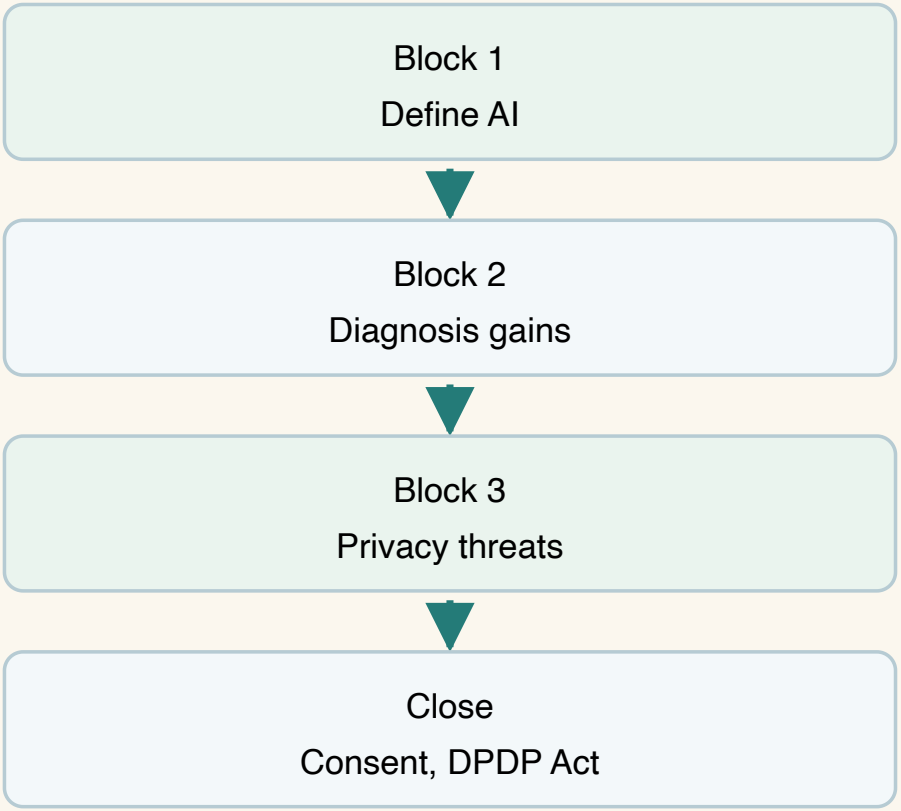
14. What did UPSC Mains 2023 ask, and how do you answer it?

The question came in UPSC Civil Services Mains 2023, General Studies Paper III (the third General Studies paper), as Q5. It carried 10 marks and a 150-word limit.

Answer in three blocks. First define AI. Then give the diagnosis gains, such as scans, slides and eye screening. Last, weigh the privacy threat with consent, the DPDP Act and ethics guidance.



The question asked for gains and the privacy threat.



Give each part of the question its own block.

Source: UPSC Mains 2023 GS III paper page, item 14

Source: MeitY, DPDP Act 2023, item 14

Source: WHO, Ethics and governance of AI for health, item 14

Four questions to think through

Why is AI called a helper, not a replacement?

The lung model beat radiologists only when no earlier scan was available. With an earlier scan it was about equal. Doctors still weigh the whole case.

Why does the DPDP Act allow processing without consent in an emergency?

A medical emergency can threaten life. Waiting for consent could cost the patient. The Act lists this as a narrow exception.

Why can data without names still identify a person?

A few facts together can be unique. ZIP code, gender and birth date were enough for 87% of Americans. Joining two datasets can rebuild identity.

How should you build a 150-word answer to the Mains question?

Open with a one-line definition of AI. Give two or three diagnosis gains with examples. Close with privacy threats and safeguards such as consent.

Check your understanding

Your 7 quick checks Answered 0 of · Correct
This score resets when the page reloads.

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✅ Test Yourself

Try practice questions on AI in diagnosis, health data and privacy.

Practice MCQs

1. Who coined the term "artificial intelligence"?

A. John McCarthy

B. Tim Berners-Lee

C. Marvin Minsky

D. Alan Turing

See answer ↓

2. In 2018 the US FDA permitted marketing of which first AI device to detect diabetic retinopathy?

A. LYNA

B. IDx-DR

C. AlphaFold

D. PARAM Siddhi-AI

See answer ↓

3. In the FDA study, IDx-DR found more than mild diabetic retinopathy about how often?

A. About 20% of the time

B. About 99.9% of the time

C. About 87% of the time

D. About 50% of the time

See answer ↓

4. How did the deep learning lung CT model compare with six radiologists when no earlier scan was available?

A. It could not be tested

B. It matched them exactly

C. It outperformed all six radiologists

D. It did worse than all six

See answer ↓

5. Which 2018 Indian strategy document used the tag #AIforAll?

A. The DPDP Act, 2023

B. The IndiaAI Mission outline

C. NITI Aayog's National Strategy for AI

D. The ICMR guidelines of 2023

See answer ↓

6. What is the budget outlay approved for the IndiaAI Mission in March 2024?

A. Rs 50,000 crore

B. Rs 10,371.92 crore

C. Rs 1,000 crore

D. Rs 6,003.65 crore

See answer ↓

7. How does India's DPDP Act, 2023 treat health data?

A. As a special class that is banned by default

B. Like other personal data, with no separate sensitive class

C. As data only the Centre may hold

D. As data outside the Act

See answer ↓

8. What does federated learning do in healthcare?

A. Replaces doctors with software

B. Trains the model inside each hospital and shares only model details

C. Moves all patient records to one central server

D. Removes patient names from records

See answer ↓

Answer Key

1. **A.** John McCarthy is the answer. His 1955 proposal for a summer conference on artificial intelligence was the first use of the phrase in print. He then organised the 1956 Dartmouth project. The meeting was organised by McCarthy, not by the other three names. Memory hook: McCarthy named it at Dartmouth. ↑ Q1
2. **B.** IDx-DR is the answer. The FDA permitted it on 11 April 2018. It detects more than mild diabetic retinopathy from retinal images. It gives a result without a specialist reading the image. LYNA is a Google tool for lymph node slides. PARAM Siddhi-AI is an Indian supercomputer. Memory hook: IDx-DR was the first autonomous eye screen. ↑ Q2
3. **C.** About 87% is the answer. The FDA reported 87.4% for catching the disease. It also cleared 89.5% of patients who did not have it. Catching the sick is called sensitivity. Clearing the healthy is called specificity. A perfect score is not claimed by the FDA. Memory hook: about 87 and about 90. ↑ Q3
4. **C.** It outperformed all six radiologists. It cut false positives by 11% and false negatives by 5%. When an earlier scan was available, it did about as well as the radiologists. So the model helps but does not replace them. Memory hook: better without history, equal with history. ↑ Q4
5. **C.** NITI Aayog's National Strategy for Artificial Intelligence is the answer. It names healthcare as its first focus area. The IndiaAI Mission came later, in March 2024. The DPDP Act is a data law from 2023. The ICMR guidelines cover ethics in biomedical AI. Memory hook: 2018 plan, #AIforAll. ↑ Q5
6. **B.** Rs 10,371.92 crore is the answer. The Union Cabinet approved the mission in March 2024. It plans public AI compute of 10,000 or more GPUs. Rs 6,003.65 crore is the cost of the National Quantum Mission. The other two figures are not the mission outlay. Memory hook: ten thousand GPUs, ten thousand crore. ↑ Q6
7. **B.** Health data is treated like other digital personal data. The Act has no separate sensitive class. Consent must be free, specific, informed, unconditional and unambiguous. The Act allows processing without consent in a medical emergency. The EU's GDPR is different, because it puts health data in a special category. Memory hook: DPDP has one class, GDPR has two. ↑ Q7

8. **B.** Federated learning trains the model inside each hospital. Only model details, such as parameters, are shared. Patient data stays behind the hospital's firewall. Moving all records to one server is the opposite. Removing names is not enough, because other facts can still identify a person. Memory hook: the model travels, the data stays. ↑ Q8

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