AI in healthcare

* Challenges in healthcare systems -
1] Rising costs (affects patients, insurance comp, drug manuf
The costs have been rising due to advances in medical tech, aging pop & other expenses. This impacts all stakeholders in the long chain. Rising costs of HC prevents patients for taking routine health checkups & hence diff to prevent, control & monitor health related issues.

Integrating new tech like EHR, telemedi etc req planning & research

2] Quality of care
Ensuring consistent & high quality care across all HC providers is a chall. Equip, resources & medical expertise shouldn't be faulty.

People in villages do not have acc to all medi servi

3] HC data management (requires AI)
Managing & protecting HC data is really essential. Ensuring privacy & sec of patient data. Sensitive data can be misused by hackers.

4] Medical errors & patient safety.
Medication mistakes, treatment mistakes etc.

5] HC workforce shortage - more pressure on existing staff. longer wait times

* Stakeholders in HC sys. → inc hospi, nursing homes, clinics, health centres, health prog in schools

Patients, Pharmacists, HC profs, suppliers

SH is a person / grp / org or sys who affects or is affected by an org action. Types -
i) External SH. (doesn't need one another to survive)
3 categ - i) Those that prov IP to org ii) those that compete with it iii) those that have interest in how the org works.

org depends on them for survival → i - patients, suppliers & financial communities.
ii - other hospitals (comp for patients), competing for skilled personel
iii - gov regulatory agencies, media, political action groups.

2) Interface SH
These func on the interf btw the org & its envi
Includes medi staff & hospital board of trustie
org may prov special services & benefits to
them so that they continue to be with the org.
3) Internal SH
Exist within the org ie managem, prof &
non prof staff. Continue to be associated.

* Issues faced to entrance HC delivery -
1] Resistance to change
HC prof & SH might resist from adapting
to new tch, pract or proc due to being
comf with existing methods.
2) Lack of standardization
Variety in treatm & practices can lead to
inconsistent care quality & hampe efforts to
improve outcomes.
3] Interoperability chall
Integrating diff Health info sys can be diff
causing diff in exchanging patient data smoothly
4] Data privacy
5] Resource constraints
Limited funding, personnel & facilities can
impede the implementation of new tch.
6] Policy chall
HC poli & regulatories can intro chall on aligning
improvement initiatives with legal reg.
7] Might not reach pop in secluded areas.
New tech in HC
8] complexity: HI sys inv various providers, facilitie
& specialities. ↑ chall in comm & coordination

Types of tech contri to clinical data -
IOT devices, Mobile health apps that track health metrics, EHR, lab tests & results, medi img tech → remote monitoring & telemedicine

* Clinical data is detailed info abt patients & their medi condi during any medi interactions. This data helps in diag, treatm & managing patients & conducting research to imp HC sys. Categ- Patient history, medical hist (surgeries), lab tests & results, medication history, symptoms info, EHR, clinical notes
Clinical data management ⇒ handling clinical data
→ Current state: EHR, BDA, remote monitoring ie wearable devices, telemedicine ie remote consultations
→ Future trends - NLP - to analy clinical notes.
1) Predictive & preventive care 2) Adv AI for diag, analy, pred, treatm. 3) Blockchain - ensure data security & solve interoperability iss.
4) Data priv - strict rules to protect data.
5) Sharing & analy data on a global scale to improve global health initiatives.

lacks medi prof invlvt, unavail of medical equip, infra in villages

Explainable AI to dev models that are transparent & interpretable

* Source of data should be known, acc, readable, complete, unbiased

* HC deli sys
It is a collection of components that work tog to prov medi care & services. Includes-
1) HC providers - help diag, treat, prev serv to pati
2) HC professionals - apart from docs, radiologists, dieticians, psychologists help provide support.
3) Patients - receive services to improve health
4) HC facilities - phy loc where help prov.
5) Pharma comp - helps develop, distri medicines.
6) Health insurance comp - cover medical expenses
7) HC services - various serv, surgery, pri care etc.
8) Medi equip - surgical tools, monitoring dev, diag machines.

Benefits ⇒

Pharma help drug discovery & dev, research to develop innovative treatm, manufac medi by following rules, collaborate with docs to provide info of medi & its usage.

* Interoperability refers to ability of diff HC sys & SW app to comm, exchange & use data across various platforms & org. Helps red HC costs, helps in remote care, patient info to flow safely, better medical deci & treatm, adopt new tech.

* Roles of HC providers - diag & treatm, patient care, preventive care, edu ie guidance on diet, exercise, emergency care

* Telemedicine means using telecomm services to provide HC services remotely. 24/7 avail, remote moni, faster diag & treatm, reduced HC costs like travelling & administrative (HC prov) tasks, convenience & flexibility ie from home, patients in rural areas benefited.

* Electronic Health Record (EHR) is a digital version of a patient's med hist - treatm, surg, test results & other health related info. Prov comprehensive view of patient's health, help make informed deci & improve patient care.

Pros - 8) Prov alot of data for research & analytics.
4) For analy & imp HC outcomes of population.

1) Accuracy: reduce errors due to illegible handwtg or lost paper records.
2) Data sharing: ensures secure data sharing.
3) Minimized paper works, admin costs & prevent medical errors. Red admin tasks ∴ more time for pat care
4) Provide real time updates of pat records
5) Data is easily accessible from anywhere & support remote monitoring.
6) Enable quick access to patient info.
7) Provide alerts, reminders to HC prof to help decimaking

Cons -
1) H/W, SW, training costs. 2) Staff might not adapt to this change. 3) Tech issues like downtime
4) Protecting data from breaches.
5) Learning to effectively use EHR can take time.
6) Transition from paper based to EHR will disrupt proc & workflows

→ Components of EHR:
1) Clinical doc 2) Orders & prescriptions.
3) Lab results 4) Patient hist & demographics.

* Medical img processing refers to use of comp algo & techniques to manipulate, analyze & enhance medi imgs for clinical & research purposes. Extract valuable info from img, improving quality & help in diag and treatment.
⇒ Importance - diag, treatm planning, monitoring treatm, early detection, educating students/pat.
⇒ Application - in radiology - X-rays, MRI etc to detect tumors in brain.
⇒ Medical img modalities -
1] X-rays - imgs of bones & tissues. Frac, dental
2] MRI - magnetic fields and radio waves to generate detailed imgs of soft tissues. Brain, joint, organ
3] CT - inv, taking X-rays from multi angles to take cross sectional img
4] Ultrasound - high freq soundwaves for org/tissues
5] Mammography - breast tissues.
6] PET - inject a small amt of radioactive substance to visualize metabolic acti. cancer det, brain disorders.
* Img acquisition is the proc of capturing visual info of the human body using diff devices.
1) This is in analog and is conv to digital format for further processing using Analog-to-Dig-Converter.
2) sampling ie capturing discrete pts from img & quantization

assigns digital val to them.
3] Resol^n ie size of img & bit depth is no of possible intensity levels per pixel.

→ To improve quality -
1] Img representation - rep as arr of dig val each pixel's intensity rep a property.
2] Histogram equalization - enhances contrast by distri pixel intensities across full range.
3] Spatial filtering - tech like convolution used to filter img and remove noise.
4] Freq domain proc - imgs conv to freq components
5] Img Restoration - remove noise & distortion.

* Types of medical data
1) Clinical 2) Imging
3) Genomic - genetic info of person DNA, RNA.
4) Sensor 5) EHR
6) Patient gen health data - data collected dir from patients symp, lifestyle choices.
7) Population health data - to study public health.

* Data quality issues - missing val, outliers, inaccuracies (outdate info), inconsis, duplicate.
↑ conflicting info in diff parts of the dataset

* Steps in data cleaning
1) Identify data quality issues
How they will affect your analysis.
2) Handling missing val (1 or 1) - delete, fill
3) Outlier detection - use stat methods. Decide whether to remove, transform or adjust outliers.