AI IN RADIOLOGY(& PATHOLOGY)

A CLINICAL PERSPECTIVE

Dr. Michal Guindy

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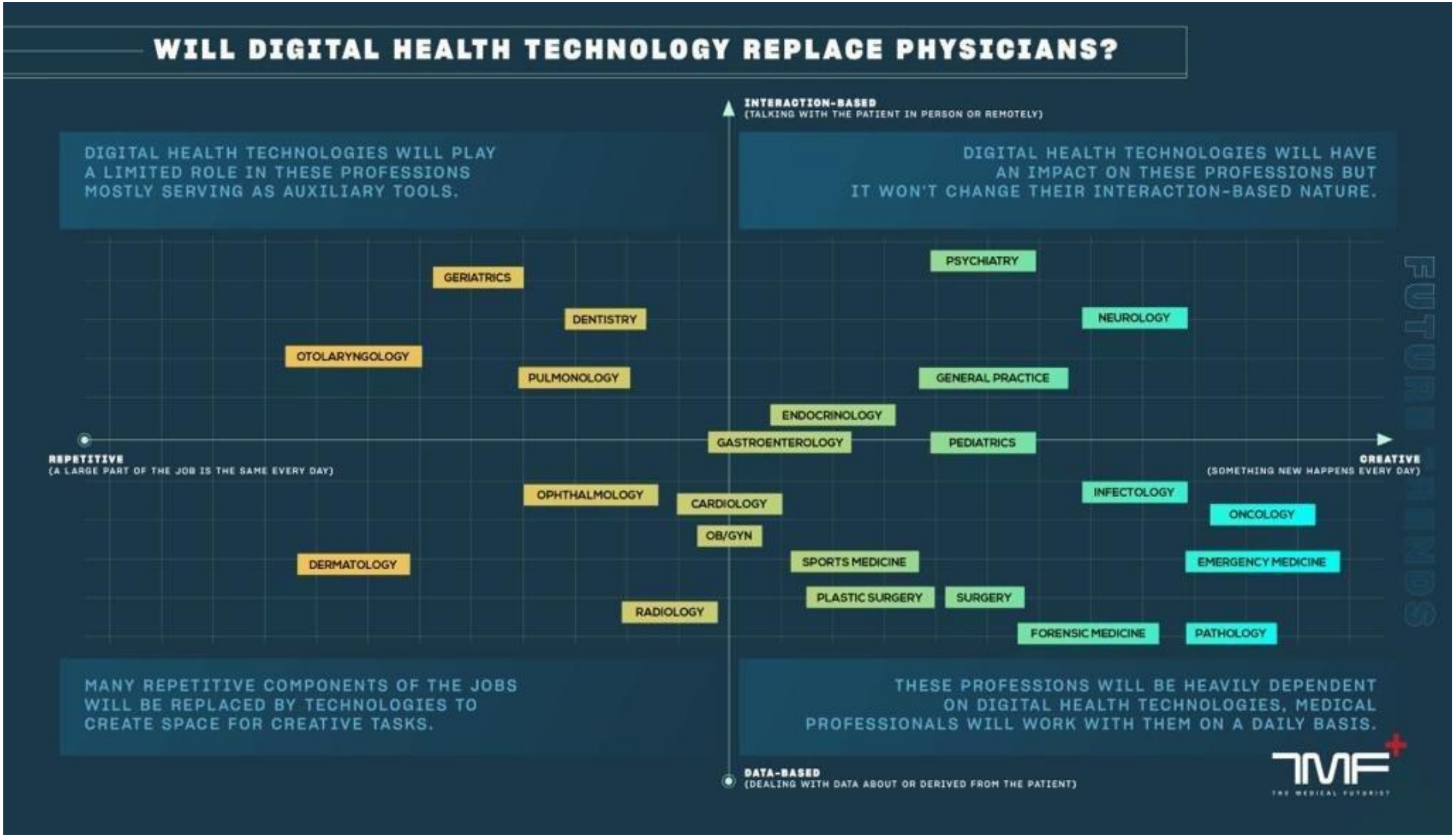
WILL DIGITAL HEALTH TECHNOLOGY REPLACE PHYSICIANS?
INTERACTION-BASED
(TALKING WITH THE PATIENT IN PERSON OR REMOTELY)
DIGITAL HEALTH TECHNOLOGIES WILL PLAY A LIMITED ROLE IN THESE PROFESSIONS MOSTLY SERVING AS AUXILIARY TOOLS.
DIGITAL HEALTH TECHNOLOGIES WILL HAVE AN IMPACT ON THESE PROFESSIONS BUT IT WON'T CHANGE THEIR INTERACTION-BASED NATURE.
GERIATRICS
DENTISTRY
OTOLARYNGOLOGY
PULMONOLOGY
PSYCHIATRY
NEUROLOGY
GENERAL PRACTICE
ENDOCRINOLOGY
GASTROENTEROLOGY
PEDIATRICS
REPETITIVE
(A LARGE PART OF THE JOB IS THE SAME EVERY DAY)
CREATIVE
(SOMETHING NEW HAPPENS EVERY DAY)
OPHTHALMOLOGY
CARDIOLOGY
OB/GYN
DERMATOLOGY
SPORTS MEDICINE
RADIOLOGY
PLASTIC SURGERY
SURGERY
INFECTOLOGY
ONCOLOGY
EMERGENCY MEDICINE
FORENSIC MEDICINE
PATHOLOGY
FUTURE TRENDS
MANY REPETITIVE COMPONENTS OF THE JOBS WILL BE REPLACED BY TECHNOLOGIES TO CREATE SPACE FOR CREATIVE TASKS.
THESE PROFESSIONS WILL BE HEAVILY DEPENDENT ON DIGITAL HEALTH TECHNOLOGIES, MEDICAL PROFESSIONALS WILL WORK WITH THEM ON A DAILY BASIS.
DATA-BASED
(DEALING WITH DATA ABOUT OR DERIVED FROM THE PATIENT)
TMF
THE MEDICAL FUTURIST

Radiology – early adopters

- A highly computerised profession
- AI part of image processing and post processing
- History of CAD
- No Patient Care - less issues with doctor-patient relations
- Standard – DICOM (Digital Imaging and Communications in Medicine)
- Open source imaging
- Large data available without language barrier

From hype to hope to hard work: developing responsible AI for radiology

Change is inevitable and can be exciting, even if potentially daunting. There are always challenges to be faced and problems to be overcome. In my own generation of radiologists, we have faced many changes, from slide decks to PowerPoint, barium enemas to computed tomography (CT) colonography, floppy disks to cloud storage, hard-copy film to picture archiving and

available data-sets. We can look to our colleagues managing tissue banks for strategies that ensure strong data access policies.

As clinical radiologists, we also need to grapple with many new research methodologies, a whole new lexicon, unfamiliar research protocols, new fluid ways to publish results prior to peer-review and a whole world of open-

Radiology

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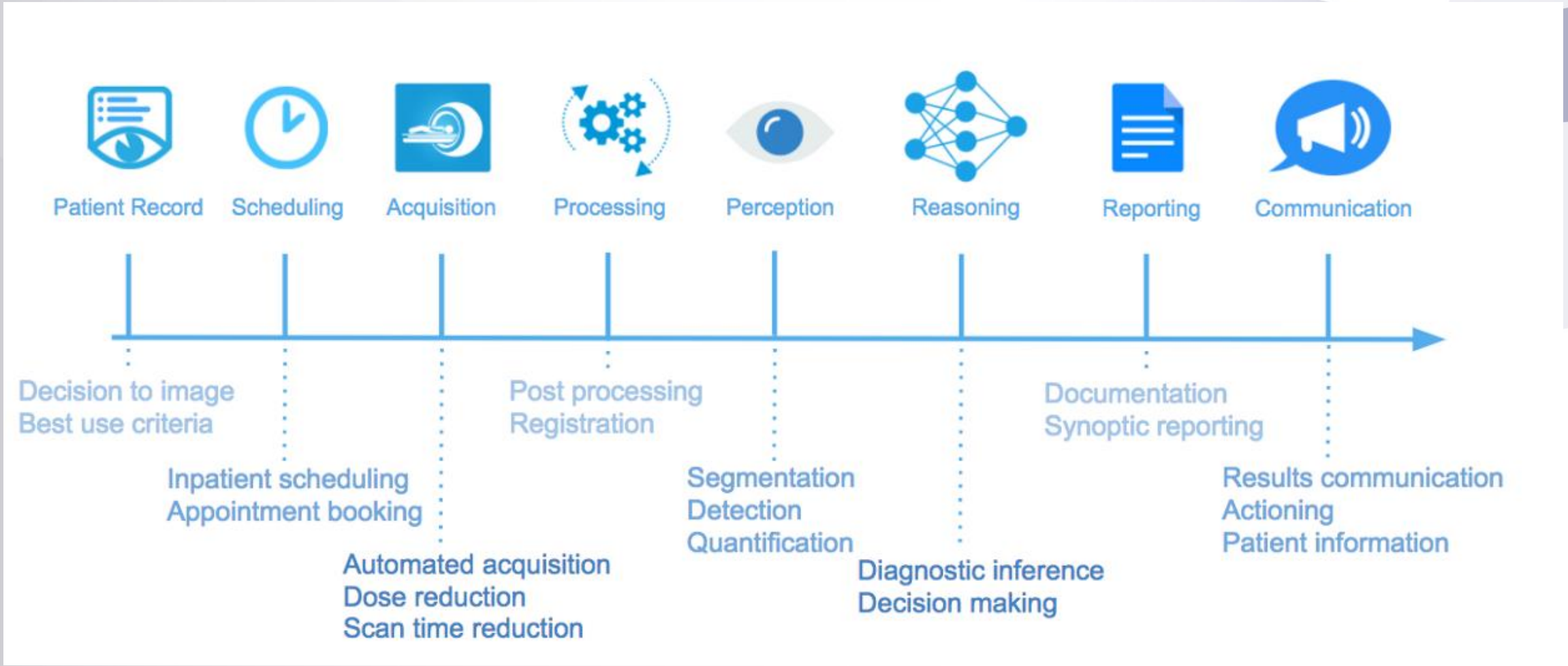
AI in radiology

- **Productivity**: By automating and prioritizing routine tasks, AI is streamlining radiology workflows. This means less wasted time moving between discordant tasks as AI generates a more "**connect the dots**" task queue.
- **Quantity**: AI tools and applications can **extract and quantify** information either automatically or semi-automatically.
- **Precision**: Ensuring that the correct information is accessible, separated from non-useful information, and by ensuring that quantification processes are repeatable, AI improves accuracy.


Patient Record
Scheduling
Acquisition
Processing
Perception
Reasoning
Reporting
Communication
Decision to image
Best use criteria
Inpatient scheduling
Appointment booking
Automated acquisition
Dose reduction
Scan time reduction
Post processing
Registration
Segmentation
Detection
Quantification
Diagnostic inference
Decision making
Documentation
Synoptic reporting
Results communication
Actioning
Patient information

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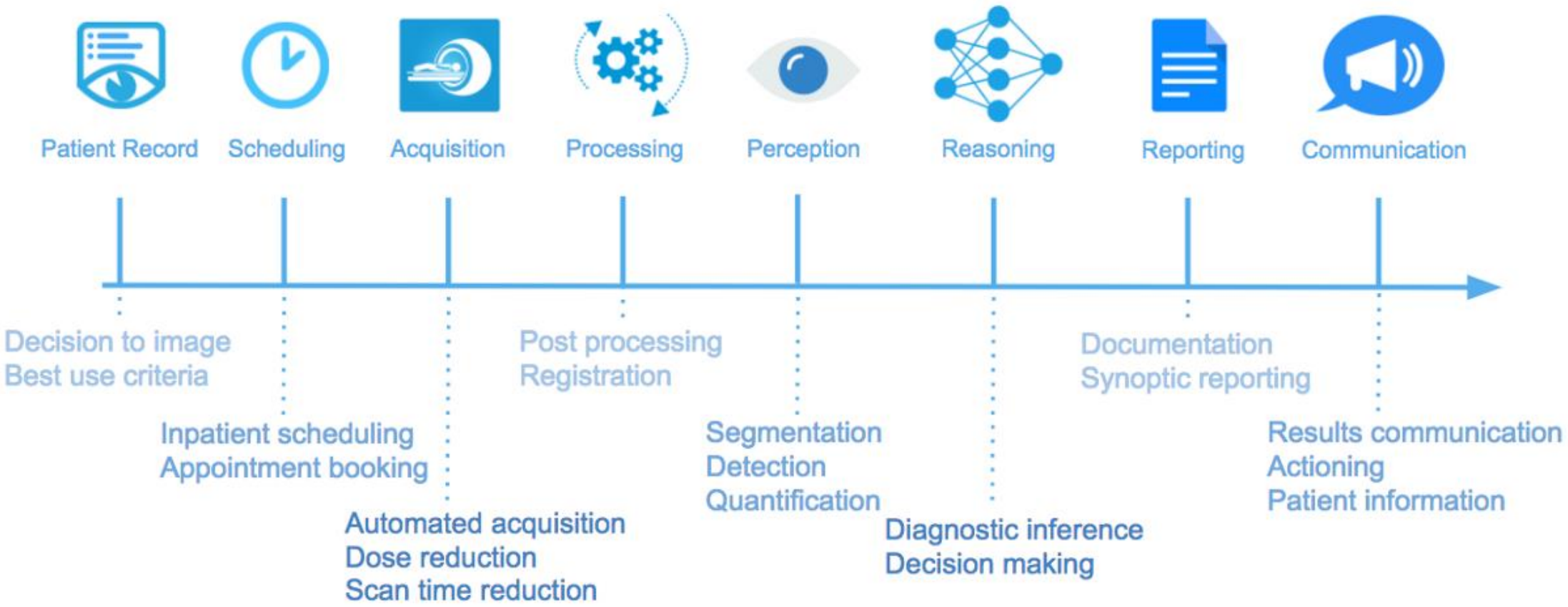

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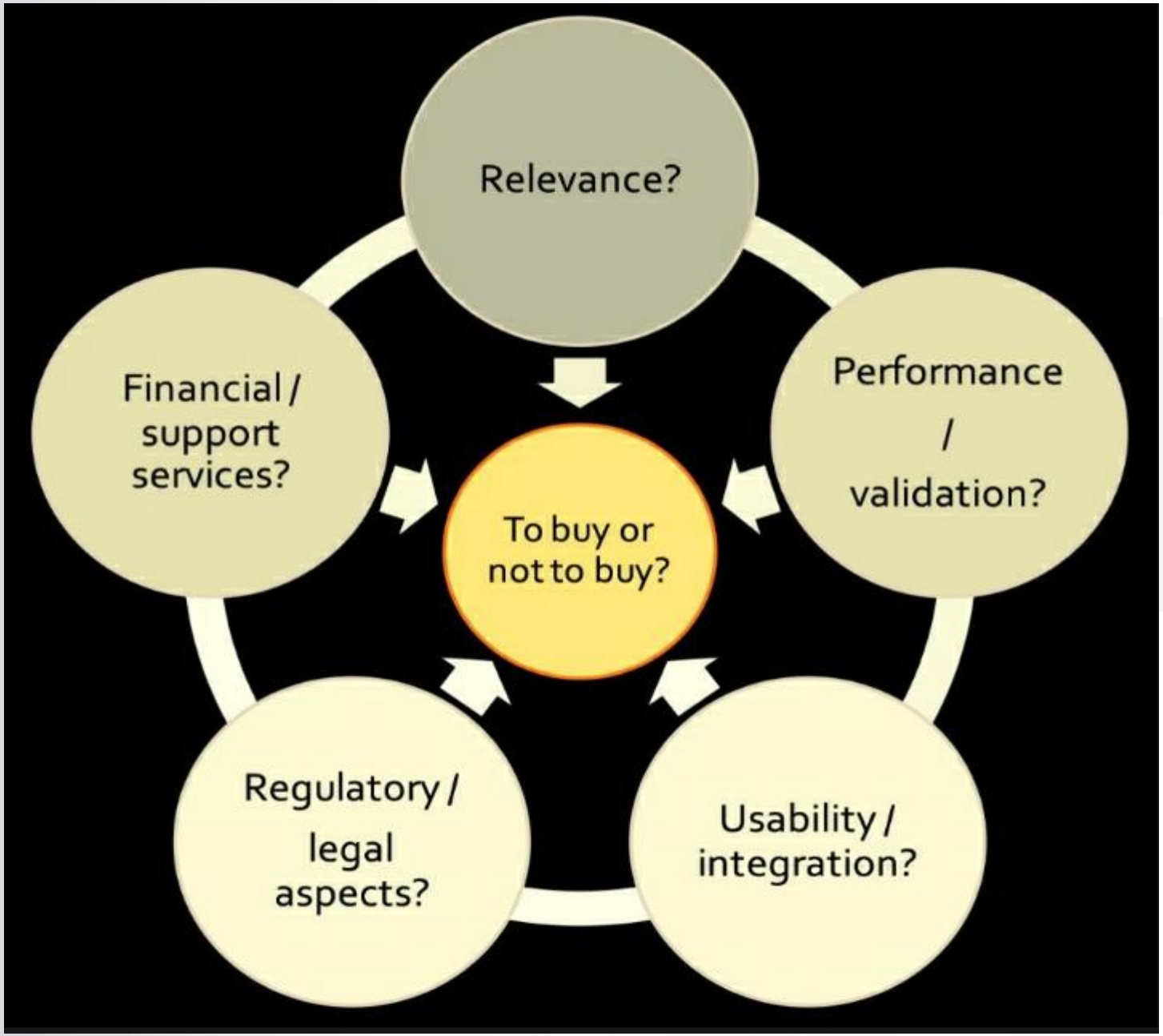

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STORIES

rise

Scaling HealthTech at Assuta

It's not just the innovation

OO+NT=COO

Old Organization + New Technology

= Costly Old Organization

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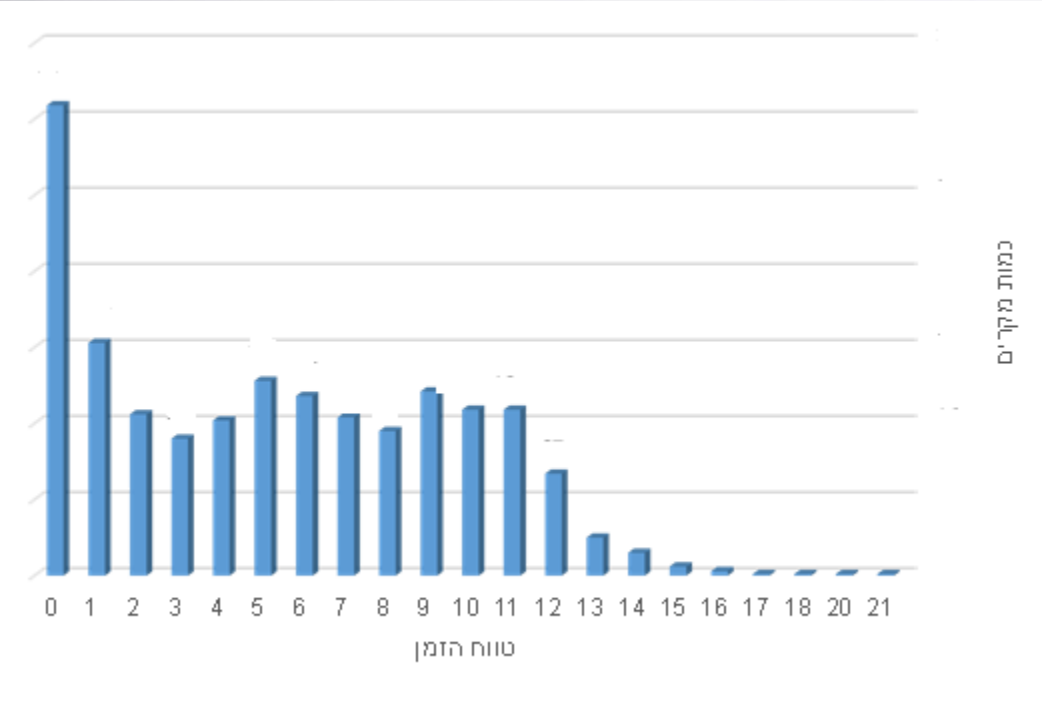
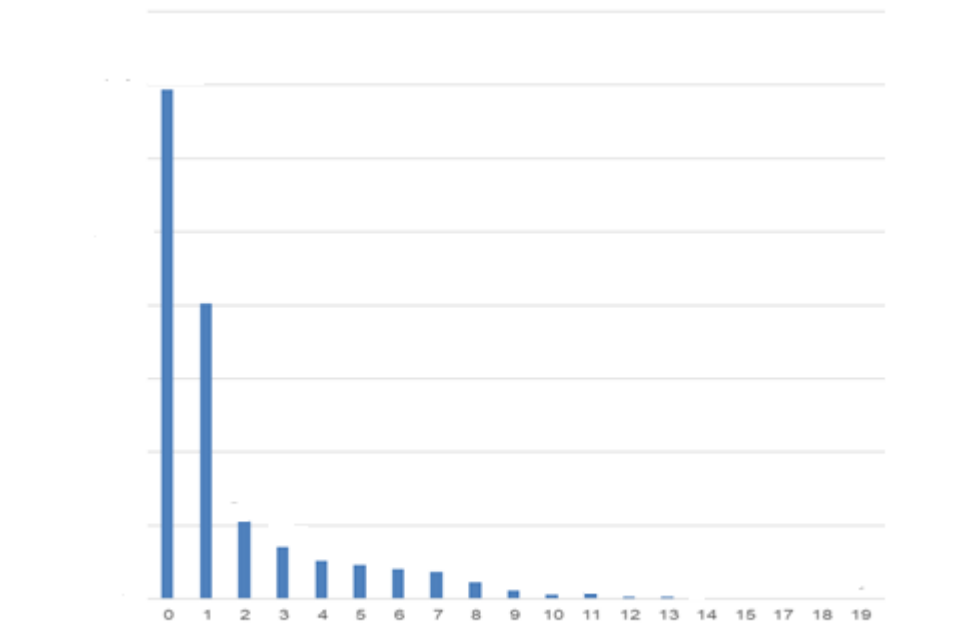
Urgent cases - time to reading

2018



2019



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BREAST

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Current functionality

- Triage
- CAD
- Second reading
- First reading- exclude normal
- Risk analysis
- Density assessment

Predicting Breast Cancer by Applying Deep Learning to Linked Health Records and Mammograms

Ayelet Akselrod-Ballin*, Michal Chorev*, Yoel Shoshan, Adam Spiro, Alon Hazan, Roie Melamed, Ella Barkan, Esma Herzel, Shaked Naor, Ehud Karavani, Gideon Koren, Yaara Goldschmidt, Varda Shalev, Michal Rosen-Zvi, Michal Guindy

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original reports abstract

Multi-Institutional Validation of a Mammography-Based Breast Cancer Risk Model

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PURPOSE Accurate risk assessment is essential for the success of population screening programs in breast cancer. Models with high sensitivity and specificity would enable programs to target more elaborate screening efforts to high-risk populations, while minimizing overtreatment for the rest. Artificial intelligence (AI)-based risk models have demonstrated a significant advance over risk models used today in clinical practice. However, the responsible deployment of novel AI requires careful validation across diverse populations. To this end, we validate our AI-based model, Mirai, across globally diverse screening populations.

METHODS We collected screening mammograms and pathology-confirmed breast cancer outcomes from Massachusetts General Hospital, USA; Novant, USA; Emory, USA; Maccabi-Assuta, Israel; Karolinska, Sweden; Chang Gung Memorial Hospital, Taiwan; and Barretos, Brazil. We evaluated Uno's concordance-index for Mirai in predicting risk of breast cancer at one to five years from the mammogram.

RESULTS A total of 128,793 mammograms from 62,185 patients were collected across the seven sites, of which 3,815 were followed by a cancer diagnosis within 5 years. Mirai obtained concordance indices of 0.75 (95% CI, 0.72 to 0.78), 0.75 (95% CI, 0.70 to 0.80), 0.77 (95% CI, 0.75 to 0.79), 0.77 (95% CI, 0.73 to 0.81), 0.81 (95% CI, 0.79 to 0.82), 0.79 (95% CI, 0.76 to 0.83), and 0.84 (95% CI, 0.81 to 0.88) at Massachusetts General Hospital, Novant, Emory, Maccabi-Assuta, Karolinska, Chang Gung Memorial Hospital, and Barretos, respectively.

CONCLUSION Mirai, a mammography-based risk model, maintained its accuracy across globally diverse test sets from seven hospitals across five countries. This is the broadest validation to date of an AI-based breast cancer model and suggests that the technology can offer broad and equitable improvements in care.

J Clin Oncol 00.

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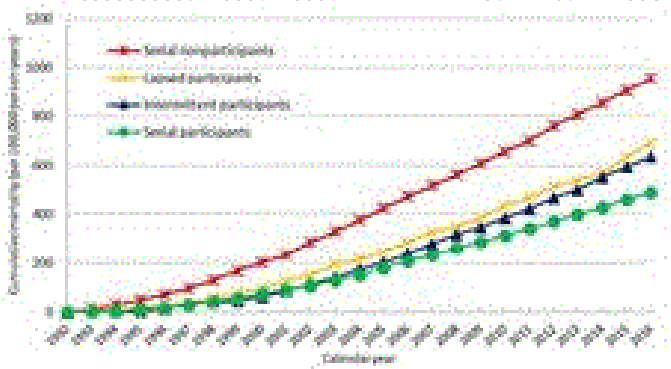
Performance in retrospective analysis of Dutch screening mammography cohort

	Reader 1	AI alone	Double reading after consensus	Reader 1 + AI before consensus
Sensitivity	52.4%	56.1%	59.1%	66.5%
Recall rate	3%	3%	3.1%	5.2%
Screening-detected cancers	138	127	159	154
Interval cancers detected	2	14	0	15
Cancers detected on next screening round	1	10	0	10

Most apps are not able to compare studies

Beneficial Effect of Consecutive Screening Mammography Examinations on Mortality from Breast Cancer: A Prospective Study



- Participation in the two most recent screening mammography appointments before a breast cancer diagnosis confers a higher protection against breast cancer death than participation in neither or only one examination.

Cumulative mortality from breast cancer per 100 000 person-years in nine Swedish counties from 1992 to 2016 according to participation status: serial participants, who participated in both of the last two screenings; intermittent participants, who participated in only the most recent screening; lapsed participants, who participated in only the next-to-last screening; and nonparticipants. Serial participants experienced the lowest cumulative mortality from breast cancer as follow-up increased.

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Radiology

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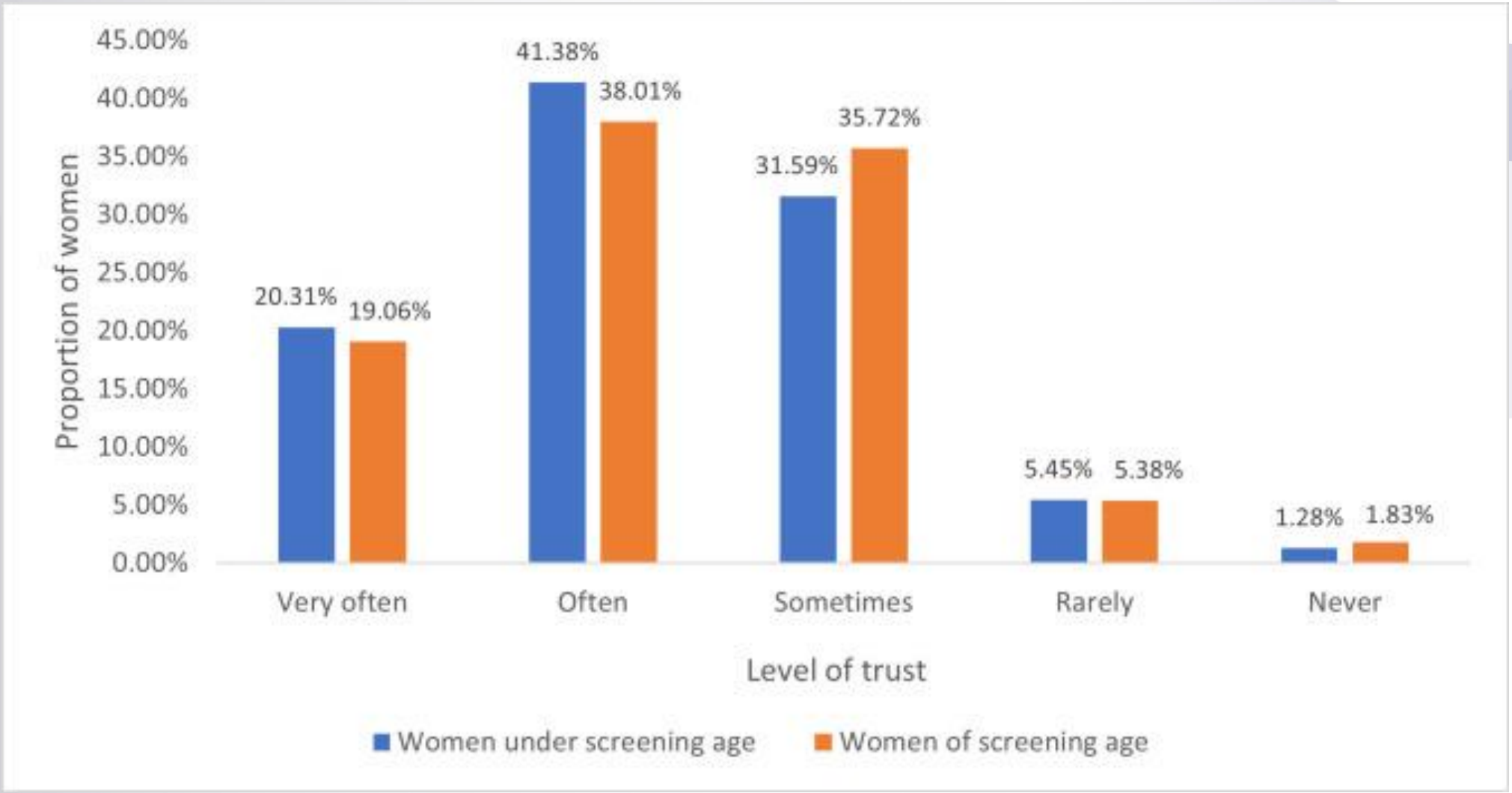
Public Attitude



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Pathology

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AI solution in pathology

- referring question
- workflow
- CAD
- (triage: first & second read)
- Coding
- Quantification
- Substituted to add on studies
- personalized medicine

Difference from radiology

- Digital pathology not yet widely used
- Some pathologists do not work on computers
- AI is introduced coupled with digital pathology
- Quantitative discipline computer has clear advantage
- Changing the workflow – additional stains etc.
- Gold standard - low awareness of missed diagnoses amongst patients and doctors

Co-opetition

- We are living in excieting time
- We will do much better togeter