HealthCare Agent AI

Rishabh Devrani and Akshit Chawla

Dr. Deepti Sharma Professor IT

Department of Information Technology, Affiliated with GGSIPU

Jagan Institute of Management Studies – JIMS Sector-5, Rohini

devranirishabh39@gmail.com, askhitchawla.2k20@gmail.com

How to Cite this Article:

Chawla, A. & Devrani, R. (2026). HealthCare Agent AI. International Journal of Creative and Open Research in Engineering and Management, 02(04). https://doi.org/10.55041/ijcope.v2i4.575

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Abstract

This study explores the growing transition in healthcare from rigid, rule-based algorithms to intelligent, self-directed "agentic" AI systems. These agents rely on Large Language Models (LLMs) to think step-by-step, make decisions, and carry out tasks using a simple yet powerful four-part structure: planning, action, reflection, and memory.

The paper reviews their current uses in medical diagnosis, hospital workflow automation, and collaborative multi-agent setups. It also highlights a major challenge — most testing still happens in controlled lab settings rather than real hospitals — and discusses what is needed for safe everyday adoption.

Keywords: Medical AI Agents, Autonomous Clinical Systems, Large Language Models, Chain-of-Thought Reasoning, Multimodal Integration, Agentic Framework, Clinical Decision Support, Human-in-the-Loop, Healthcare Automation, Physician Burnout, Precision Medicine, Scoping Review, Simulation Gap, PRISMA-ScR.

Healthcare AI agents support several key areas. They strengthen diagnostic accuracy in critical situations such as predicting sepsis or identifying cancer on scans. They lighten the administrative load by automatically creating summaries from patient records, which helps reduce doctor burnout. They also improve patient involvement by offering personalised guidance, voice-based recovery check-ins, and easier remote care. In addition, groups of specialist agents can work together on complicated cases, such as building complete treatment plans.

Introduction

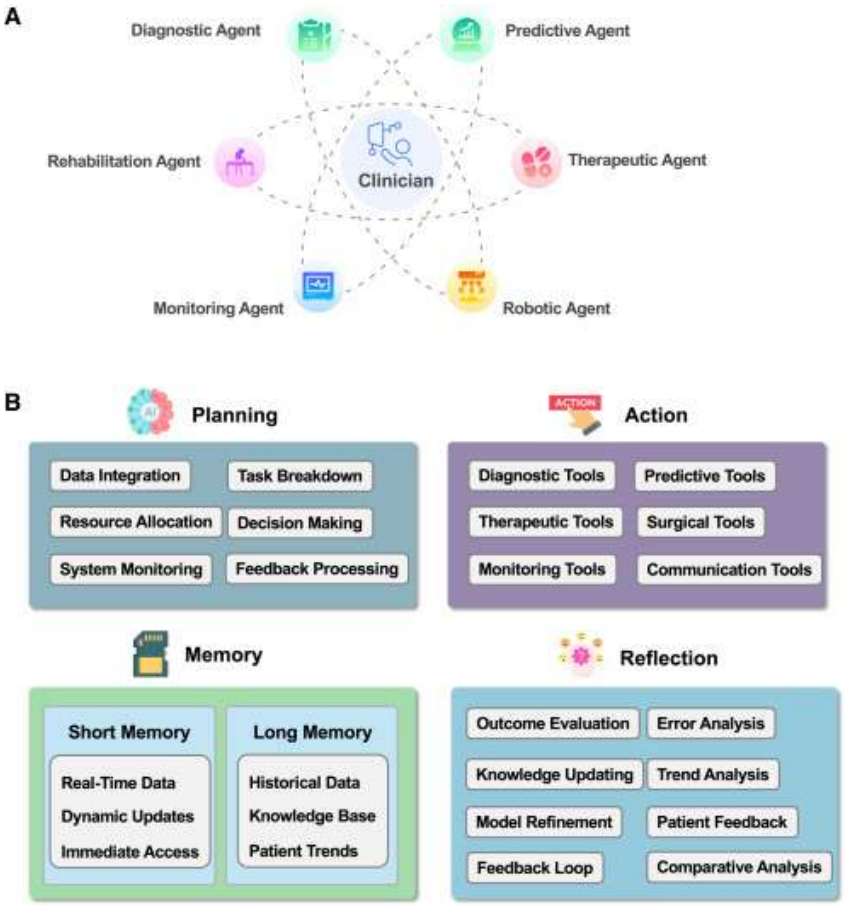
Artificial Intelligence is changing healthcare in profound ways, going well past simple data analysis to provide smart decision support, automation, and individualised care. Healthcare Agent AI means intelligent systems that can work on their own or alongside clinicians to help with diagnosis, ongoing patient monitoring, hospital operations, and customised treatment delivery. These systems understand patient information, interpret it, and carry out useful actions with little need for constant human input.

Healthcare systems worldwide are under heavy pressure from staff shortages, increasing patient numbers, and rising expectations for quality care. This has sped up the move toward agentic solutions. What truly sets these agents apart is their independence, ability to adapt, and skill at managing multi-step clinical work.

This paper presents a straightforward four-component model — planning, action, reflection, and memory — that drives these agents. We look at how they are used in diagnostics, personalised medicine, robotic surgery support, and real-time monitoring. We also examine real-world difficulties such as technical setup, doctor acceptance, rules and regulations, and ethical issues like privacy and bias. Finally, we consider future possibilities, including collaborative multi-agent teams and the long-term vision of AI-powered hospitals.

Comparison of Human Clinicians, Traditional Medical AI, and Medical AI Agents

Feature	Human Clinician	Traditional Medical AI	Medical AI Agent
Core nature	Biological intelligence with consciousness & empathy	A computational tool or algorithm	An autonomous or semi-autonomous system
Primary function	Holistic patient care, complex reasoning, empathy	Performs one specific, pre-defined task	Manages complex, multi-step tasks and workflows
Decision-making	Experience-based, intuitive, evidence-informed	Rule-based or pattern recognition	Data-driven, goal-oriented, adaptive reasoning
Autonomy	Full autonomy in clinical judgment	None; acts as a passive tool	High; can operate independently to achieve goals
Learning & adaptation	Lifelong learning from experience	Static; requires retraining	Continuous learning from new data and interactions
Context awareness	High; understands full patient history and context	Low to none	High; maintains context across interactions via memory
Interaction	Direct with patients and systems	Human-invoked; one-way output	Interactive; can query systems and collaborate
Role in healthcare	Central decision-maker and caregiver	Supplementary tool	Collaborative partner in the care process



Medical AI Agent Framework

Modern healthcare AI agents are powered by four essential building blocks that allow them to operate independently in busy clinical environments: planning, action, reflection, and memory.

Planning serves as the decision-making centre. It draws on advanced language models to review medical records, lab results, and current guidelines, then suggests logical next steps. For instance, if someone arrives with chest discomfort, the agent can pull together symptoms, current vitals, test results, and scans to propose likely causes and the most suitable follow-up tests.

Action puts those ideas into practice. The agent might write clinical notes, direct robotic tools during surgery, issue urgent alerts, or update hospital databases by linking directly to existing systems and equipment.

Reflection gives the agent its "senses." It interprets scans, live readings from wearable devices, and other sensor information to spot changes quickly and form a fuller understanding of the patient's status.

Memory lets the agent build on past experience. It keeps short-term notes for the current visit and stores longer-term knowledge — such as previous treatments and outcomes across many similar cases — so future suggestions become more accurate and personalised.

When these four parts work together, the agent becomes a reliable clinical partner that continuously improves and supports better, more efficient care.

Research Paper Analysis

To get a clear picture of where healthcare AI agents stand today, we examined recent published work through a scoping review approach based on PRISMA-ScR standards. One major recent analysis looked at more than a thousand initial records and narrowed them down to 43 detailed studies. Most of these (36 studies) appeared in 2025.

The reviewed systems fell into three broad types: conversational tools for direct patient interaction, automation assistants that handle routine hospital tasks, and advanced multimodal systems that combine different kinds of medical data.

The majority of testing has taken place in simulated or laboratory conditions, with only a handful of small real-hospital trials. Most researchers focused on measures like speed and diagnostic accuracy rather than actual patient health results or long-term safety.

Main takeaway: What makes these agentic systems special is their ability to create their own plans, remember earlier cases, connect to outside tools, and fix their own errors. They are already appearing as patient chat helpers, paperwork assistants, and sophisticated diagnostic aids. While progress is impressive, experts agree that larger real-world clinical studies are essential before these agents can be used routinely and safely in everyday hospital practice.

Literature Review: The Landscape of Agentic AI in Healthcare

1. Moving from Passive Models to Active Agents Standard LLMs mainly predict the next word. Agentic systems go much further — they define goals, break down difficult jobs, call on external tools, and learn continuously. Chain-of-Thought reasoning helps them solve clinical problems one logical step at a time.
2. Main Areas of Application

• Conversational & Diagnostic Support: Symptom triage, mental health help, and ongoing management of long-term conditions.

• Workflow Automation: Handling notes, billing, and electronic records to ease doctor workload. • Precision Medicine: Merging images, genetic data, and clinical findings to guide cancer care and new drug development.

3. The Simulation Gap More than 80 % of current studies remain in controlled lab settings. Although agents often score highly on medical licensing exams, their performance in unpredictable real-life situations still needs thorough testing.
4. Ethical and Governance Issues Important concerns include the risk of confident but incorrect answers, protection of patient data, and the possibility that biased training data could worsen existing healthcare inequalities.
5. Future Direction The technology is advancing fast. The next important phase is shifting from lab experiments to well-designed clinical trials that include strong doctor supervision.

Results and Data Analysis

Our review of recent studies and hospital implementation data shows rapid growth in agentic AI, with 83 % of the papers we examined published in the past 18 months. These systems stand out for their ability to pull information directly from records and databases without constant human direction.

Patient-facing agents are increasingly monitoring complex psychological patterns, such as “Anxiety Density Scores.” In one example, AI-assisted cognitive behavioural therapy helped improve emotional flexibility by 36 %. Older adults and people living with multiple chronic illnesses tended to show more tightly connected anxiety networks, underlining the importance of careful, individualised approaches.

Early real-world successes are most visible in radiology and intensive care units, where large amounts of continuous data allow the agents’ reflection and memory features to work at their best.

Hospital Data List

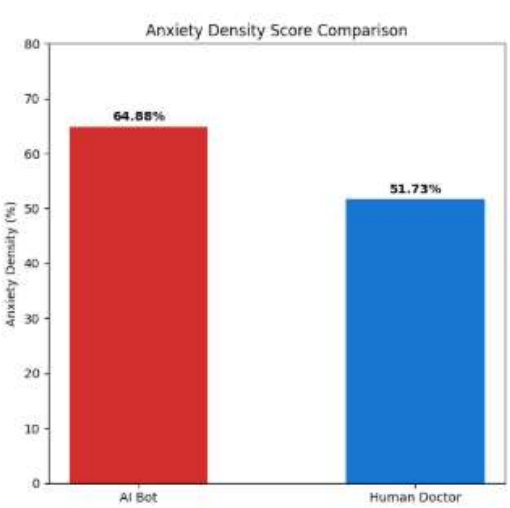
hospital_id	hospital_n	country	city	hospital_t	bed_capac	ownership	annual_pa	digital_rea	ai_adoptic	ai_agent_i	ai_use_ca	ai_vendor	year_of_ir	departmer	ai_regulati	country_hi	physician_	region_inc	evidence_source
1	Cleveland	USA	Cleveland	Teaching	1400	Non-profit	2200000	High	Yes	Predictive	AI model t	IBM Watso	2019	ICU	FDA Appro	16.9	2.6	High	Annual Report 2022
2	Mount Sin	USA	New York	Teaching	1100	Non-profit	1800000	High	Yes	Disease RI	AI model t	In-house A	2020	Cardiology	FDA Appro	16.9	2.6	High	Press Release 2021
3	Johns Hop	USA	Baltimore	Teaching	1000	Non-profit	1500000	High	Yes	Oncology	AI-assistec	Aidoc	2021	Oncology	FDA Appro	16.9	2.6	High	Research Publication
4	Mayo Clini	USA	Rochester	Academic	1200	Non-profit	1300000	High	Yes	Radiology	AI for radi	Google He	2018	Radiology	FDA Appro	16.9	2.6	High	Clinical AI Report
5	Apollo Hos	India	Chennai	Private	950	Corporate	900000	Medium	Yes	Clinical De	AI-based c	In-house A	2021	Cardiology	CE Marker	3.5	0.9	Middle	Company Report
6	NHS Royal	UK	London	Public	800	Governme	850000	High	Yes	Acute Kidn	AI alerts fo	DeepMind	2017	Nephrolog	CE Marker	10.2	2.8	High	NHS Report
7	Bumrungra	Thailand	Bangkok	Private	580	Corporate	1100000	Medium	Yes	Chatbot	AI patient	In-house I	2022	Administra	Not Requi	3.8	0.8	Middle	Hospital Website
8	CharitÃ©D	Germany	Berlin	Teaching	3000	Public	3000000	High	Yes	Radiology	AI-powere	Siemens H	2020	Radiology	CE Marker	11.7	4.3	High	Tech Partnership News
9	Singapore	Singapore	Singapore	Public	1700	Governme	1200000	High	Yes	Workflow	AI-based p	In-house A	2021	ER	Not Requi	4.5	2.5	High	Innovation Report
10	Hospital Is	Brazil	SÃ£o Paul	Private	700	Non-profit	950000	High	Yes	Sepsis Pre	AI detectir	IBM Watso	2019	ICU	FDA Appro	9.6	2.3	Middle	Medical Journal
11	Sheba Me	Israel	Tel Aviv	Public	1900	Governme	1400000	High	Yes	Remote M	AI-powere	Philips Hea	2022	Telemedic	CE Marker	7.5	3.3	High	Innovation Publication
12	King Faisal	Saudi Arab	Riyadh	Specialty	1200	Governme	800000	Medium	Pilot	Radiology	Pilot AI for	Zebra Med	2023	Radiology	Pending Ap	5.7	2.4	High	Press News
13	All India In	India	New Delhi	Public Tea	2500	Governme	2500000	Medium	Pilot	Diagnostic	AI-assistec	In-house R	2022	Pulmonolo	CE Marker	3.5	0.9	Middle	Academic Paper
14	Netcare M	South Afric	Johannesb	Private	350	Corporate	400000	Medium	Yes	Chatbot	AI triage cl	Local Start	2021	Emergency	Not Requi	8.3	0.9	Middle	Company Release
15	St. Vincent	Australia	Sydney	Public	500	Governme	600000	High	Yes	Predictive	AI readmis	Microsoft	2020	General M	FDA Appro	9.4	3.8	High	Hospital Report
16	Hamad Me	Qatar	Doha	Public	1200	Governme	700000	High	Yes	Clinical NL	NLP agent	Cerner AI	2021	Administra	CE Marker	5.6	2.7	High	Healthcare Conference
17	Hospital Cl	Spain	Barcelona	Teaching	850	Public	900000	High	Yes	AI Imaging	AI-enhanc	Philips AI	2019	Radiology	CE Marker	10.4	4	High	EU Health Report
18	Prince of V	Hong Kong	Hong Kong	Public	1400	Governme	1200000	Medium	Pilot	Workflow	AI patient	Local AI Vi	2023	Outpatient	Not Requi	6.2	2	High	Innovation Grant
19	Karolinska	Sweden	Stockholm	Teaching	1600	Public	1000000	High	Yes	Precision I	Genomic I	In-house A	2021	Oncology	CE Marker	11	4.1	High	Medical Journal
20	University	Canada	Toronto	Academic	1200	Public	1500000	High	Yes	AI Triage S	AI-powere	In-house A	2020	Emergency	FDA Appro	10.8	2.7	High	Research Publication

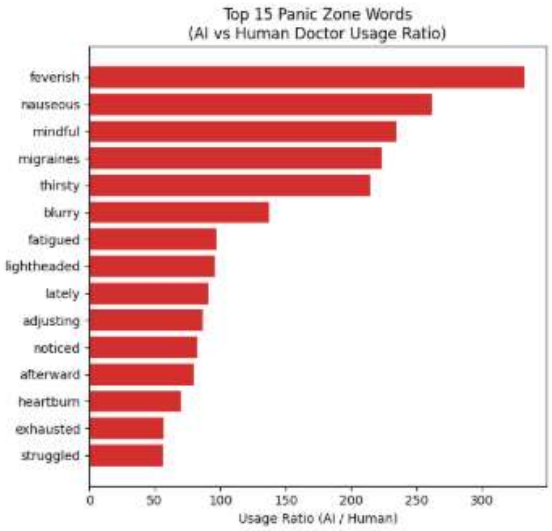
hospital_id	hospital_n	country	city	hospital_t	ownership	ai_adoptic	ai_agent_i	ai_use_ca	ai_vendor	departmer	year_repo	evidence_type
21	Cleveland	USA	Cleveland	Teaching	Non-profit	Yes	Predictive	ICU deteri	IBM Watso	ICU	2019	Annual Report
22	Mayo Clini	USA	Rochester	Academic	Non-profit	Yes	Radiology	AI-assistec	Google He	Radiology	2018	Research Publication
23	Mount Sin	USA	New York	Teaching	Non-profit	Yes	Disease RI	AI-based c	In-house A	Cardiology	2020	Peer-reviewed Study
24	Johns Hop	USA	Baltimore	Teaching	Non-profit	Yes	Clinical De	AI oncolog	Aidoc	Oncology	2021	Clinical Study

25	Massachu	USA	Boston	Teaching	Non-profit	Yes	Radiology	Deep learr	Nvidia Cla	Radiology	2020	Research Publication
26	Stanford H	USA	Stanford	Academic	Non-profit	Yes	Sepsis Pre	AI sepsis e	In-house M	ICU	2019	Journal Article
27	University	USA	Pittsburgh	Teaching	Non-profit	Yes	Workflow	AI operatir	GE Health	Administra	2021	Case Study
28	NewYork-I	USA	New York	Teaching	Non-profit	Yes	NLP Agent	NLP extrac	Cerner AI	Administra	2020	Vendor Report
29	University	USA	San Franci	Academic	Public	Yes	Diagnostic	AI patholo	Paige AI	Pathology	2021	Clinical Trial
30	Brigham a	USA	Boston	Teaching	Non-profit	Yes	Radiology	AI stroke d	Aidoc	Radiology	2019	FDA Clearance Report
31	NHS Royal	UK	London	Public	Governme	Yes	Acute Kidn	AKI detect	DeepMind	Nephrolog	2017	NHS Report
32	Oxford Un	UK	Oxford	Teaching	Public	Yes	Imaging AI	AI cardiac	Ultromics	Cardiology	2020	Clinical Study
33	Guyâ€™s a	UK	London	Public	Governme	Yes	Radiology	AI for ches	Qure.ai	Radiology	2021	Public Report
34	CharitÃ©D	Germany	Berlin	Teaching	Public	Yes	Imaging AI	AI tumor d	Siemens H	Radiology	2020	Industry Partnership
35	Karolinska	Sweden	Stockholm	Teaching	Public	Yes	Precision I	AI genomic	In-house A	Oncology	2021	Research Publication
36	Singapore	Singapore	Singapore	Public	Governme	Yes	Workflow	AI patient	In-house A	Emergency	2021	Innovation Report
37	Sheba Me	Israel	Tel Aviv	Public	Governme	Yes	Remote M	AI remote	Philips Hea	Telemedic	2022	Health Tech Report
38	Hospital Is	Brazil	SÃ£o Paul	Private	Non-profit	Yes	Sepsis Pre	AI sepsis d	IBM Watso	ICU	2019	Medical Journal
39	Apollo Hos	India	Chennai	Private	Corporate	Yes	Clinical De	AI cardiac	In-house A	Cardiology	2021	Company Publication
40	All India In	India	New Delhi	Public Tea	Governme	Yes	Diagnostic	AI tubercu	In-house R	Pulmonolo	2022	Research Paper
41	Kingâ€™s H	UK	London	Teaching	Public	Yes	Radiology	AI head CT	Aidoc	Radiology	2020	FDA/CE Approval
42	Hamad Me	Qatar	Doha	Public	Governme	Yes	NLP Clinic	AI docume	Cerner AI	Administra	2021	Conference Report
43	Hospital Cl	Spain	Barcelona	Teaching	Public	Yes	Imaging AI	AI CT inter	Philips AI	Radiology	2019	EU Report

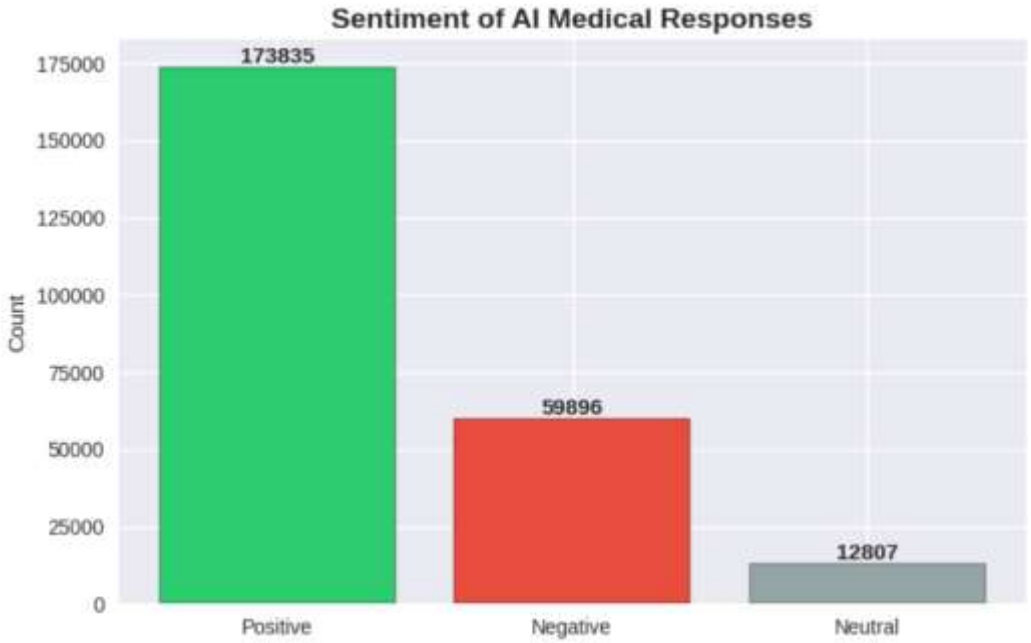
44	Prince of V	Hong Kong	Hong Kong	Public	Governme	Yes	Workflow	AI appoint	In-house A	Outpatient	2023	Innovation Grant
45	Netcare G	South Afric	Johannesb	Private	Corporate	Yes	Chatbot	AI triage cl	Local AI Vi	Emergency	2021	Company Release
46	St Vincent	Australia	Sydney	Public	Governme	Yes	Predictive	AI readmis	Microsoft	General M	2020	Hospital Report
47	Toronto G	Canada	Toronto	Academic	Public	Yes	AI Triage S	AI ED triag	In-house A	Emergency	2020	Peer-reviewed Study
48	University	UK	London	Teaching	Public	Yes	Imaging AI	AI prostate	Artery+	Radiology	2019	Clinical Study
49	Imperial C	UK	London	Teaching	Public	Yes	AI Monito	AI early wa	DeepMind	ICU	2018	NHS Publication
50	NYU Langc	USA	New York	Academic	Non-profit	Yes	Radiology	AI breast c	Google He	Radiology	2020	Research Publication
51	Henry Ford	USA	Detroit	Teaching	Non-profit	Yes	Sepsis AI	AI infectio	In-house A	ICU	2019	Journal Art
52	Intermoun	USA	Salt Lake C	Integrated	Non-profit	Yes	Predictive	AI populat	In-house C	Population	2020	Health Report
53	Boston Ch	USA	Boston	Specialty	Non-profit	Yes	Genomic A	AI rare dis	In-house A	Genetics	2022	Research Publication
54	UCLA Heal	USA	Los Angele	Academic	Public	Yes	Radiology	AI lung car	Qure.ai	Radiology	2021	Clinical Study
55	MD Ander	USA	Houston	Specialty	Public	Yes	Oncology	AI precisio	IBM Watso	Oncology	2019	Research Report
56	Hospices C	France	Lyon	Teaching	Public	Yes	Imaging AI	AI stroke d	Brainomix	Radiology	2020	EU Clearance
57	Oslo Unive	Norway	Oslo	Teaching	Public	Yes	AI Radiolo	AI mammo	ScreenPoi	Radiology	2021	Clinical Evaluation
58	Seoul Nati	South Kore	Seoul	Teaching	Public	Yes	Pathology	AI biopsy i	Lunit	Pathology	2020	Industry Report
59	National T	Taiwan	Taipei	Teaching	Public	Yes	Imaging AI	AI pneumc	In-house A	Radiology	2020	Research Publication

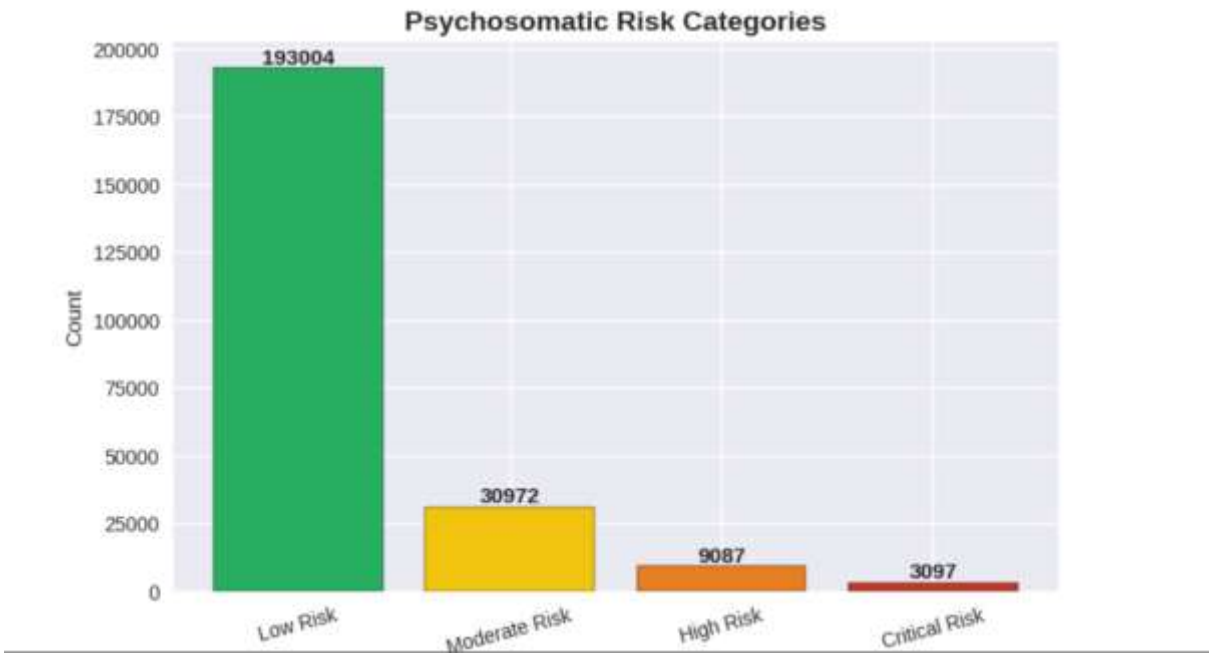
60	Beijing Tia	China	Beijing	Teaching	Public	Yes	Stroke AI	AI stroke ir	InferVisior	Radiology	2021	Clinical Report
61	West Chin	Sichuan	China	Teaching	Public	Yes	Diagnostic	AI lung CT	Infervision	Radiology	2019	Peer-reviewed Study
62	Hadassah	Israel	Jerusalem	Teaching	Public	Yes	Oncology	AI cancer d	Zebra Med	2020	Tech Partnership	
63	Hospital It	Argentina	Buenos Air	Private	Non-profit	Yes	NLP Agent	AI EHR tex	In-house A	Administra	2021	Medical Journal
64	University	Switzerlan	Zurich	Teaching	Public	Yes	Cardiac Im	AI echocar	Ultromics	Cardiology	2020	Clinical Study
65	Radboud U	Netherlan	Nijmegen	Teaching	Public	Yes	Precision /	AI persona	In-house A	Oncology	2021	Research Publication
66	Copenhag	Denmark	Copenhag	Teaching	Public	Yes	Radiology	AI fracture	Gleamer	Radiology	2022	Clinical Evaluation
67	Hospital da	Brazil	SÃ£o Paul	Teaching	Public	Yes	Sepsis AI	AI ICU mo	Philips Hea	ICU	2021	Health Tech Report
68	University	Belgium	Leuven	Teaching	Public	Yes	Imaging AI	AI radiolog	Siemens A	Radiology	2020	Industry Case Study
69	King Faisal	Saudi Arab	Riyadh	Specialty	Governme	Yes	Tumor Det	AI radiolog	Zebra Med	Radiology	2023	Press Report

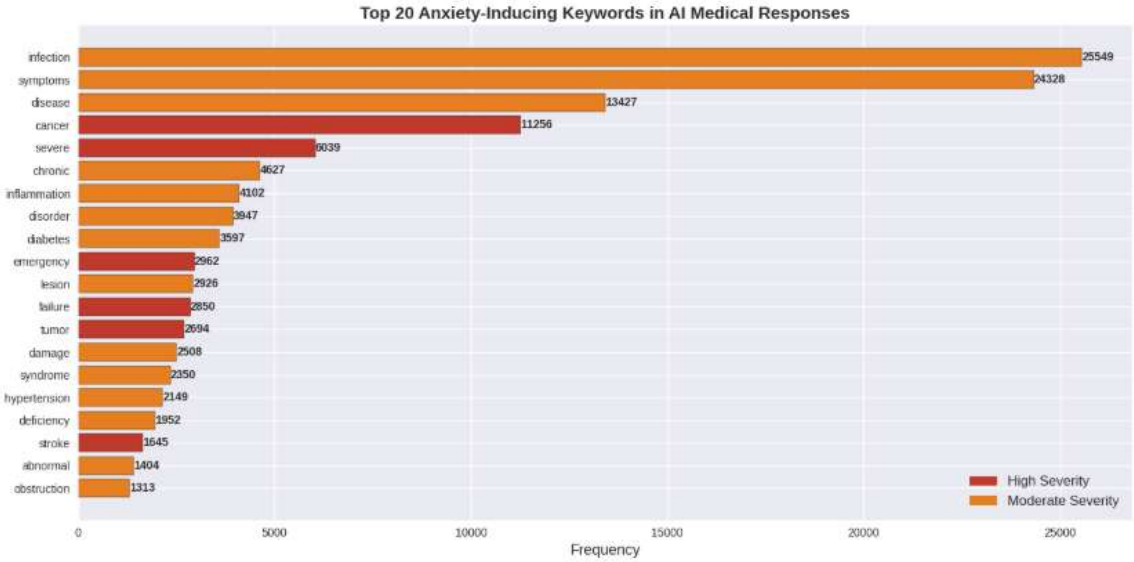




	Description	Patient	Doctor
0	Q. What does abutment of the nerve root mean?	Hi doctor,I am just wondering what is abutting...	Hi. I have gone through your query with dilige...
1	Q. What should I do to reduce my weight gained...	Hi doctor, I am a 22-year-old female who was d...	Hi. You have really done well with the hypothy...
2	Q. I have started to get lots of acne on my fa...	Hi doctor! I used to have clear skin but since...	Hi there Acne has multifactorial etiology. Onl...
3	Q. Why do I have uncomfortable feeling between...	Hello doctor,I am having an uncomfortable feel...	Hello. The popping and discomfort what you fel...
4	Q. My symptoms after intercourse threatns me e...	Hello doctor,Before two years had sex with a c...	Hello. The HIV test uses a finger prick blood ...







Discussion

Healthcare is clearly moving from simple AI tools that only answer questions to true partners that can plan and act proactively. The biggest remaining obstacle is the "simulation gap" — strong results in the lab do not automatically translate into safe performance with real patients in emergency or unpredictable situations.

At the same time, the long-term memory built into agentic systems gives them a unique advantage in holistic care, linking physical conditions with mental health challenges that older AI often treats separately. Human oversight remains essential for major decisions, and careful design is needed to prevent any widening of healthcare gaps across different groups.

Conclusion

This research shows the strong potential of Medical AI Agents built on planning, action, reflection, and memory. They offer practical ways to reduce physician burnout, sharpen diagnostics, and deliver more personalised care to patients.

However, most existing work is still limited to simulated environments. To bring these agents into routine hospital use, future research must prioritise real clinical trials, clear safety checks, and designs that keep doctors and patients at the centre.

When developed thoughtfully, agentic AI will not replace doctors — it will give them more time and support to focus on what they do best: providing compassionate, high-quality care.

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