HEA3RT Strategic Plan

2022-2025

PREPARED BY
THE STANFORD HEALTHCARE AI APPLIED RESEARCH TEAM

PUBLISHED OCTOBER 2021
Welcome to the 2022-2025 Strategic Plan of the Stanford Healthcare AI Applied Research Team (HEA3RT)! Founded in 2019, we are a team of physicians, researchers, health system leaders, and quality improvement experts who are dedicated to applied research on artificial intelligence and machine learning (AI/ML) in healthcare. Our mission is to bring leading edge AI/ML technologies from "code to bedside" in support of healthcare’s Quintuple Aim. Our vision is to be a national leader in the study and implementation of AI/ML technologies to solve specific, practical problems in healthcare.

Why did we create HEA3RT? AI/ML is poised as a transformational force in medicine; however, there are big rocks standing in the way of widespread adoption. HEA3RT was created to remove these barriers and to bridge the gap between basic science and real-world implementation of AI/ML technologies. We believe we can achieve this through an integrated tripartite strategy.

First, ensuring that AI/ML use cases in healthcare are relevant and always human-centered. We believe that AI/ML solutions should be centered around augmenting human capabilities and supporting human-driven models of care delivery – not replacing human providers or subverting human relationships that lie at the heart of healing.

“Our mission is to bring leading edge AI/ML technologies from code to bedside in support of healthcare’s Quintuple Aim. Our vision is to be a national leader in the study and implementation of AI/ML technologies to solve specific, practical problems in healthcare.”

Our human-centered approach starts with building partnerships. At HEA3RT, we work with technology companies, academic researchers, non-profit organizations, and health systems to co-design and implement promising AI/ML solutions in support of the Quintuple Aim. Breaking beyond the siloed walls of our disciplines so that providers can work alongside technology partners, speaking the same language and moving toward the same objectives, is the best way to ensure that these AI/ML technologies work for providers and patients, not against them.

Second, doubling down on translational research. Across the field of healthcare AI/ML, there is no shortage of innovation and publications on the basic science front.
Models are rapidly becoming more sophisticated, doubling in computing power every 3-4 months. However, only a minuscule fraction of these technologies is being implemented. This is a problem of translation. It is the problem that the pharmaceutical industry faced decades ago when there was an enormous gap between scientists in the lab making breakthrough discoveries and providers on the frontlines treating patients at the bedside. The exact same problem is happening in the field of healthcare AI/ML today; the only difference is that today’s breakthroughs are being made with lines of computer code.

A new focus on translational research requires a fresh approach. Our team coined the phrase "code to bedside" to reflect the aim of translational research in healthcare AI/ML. To do implementations successfully, you need an approach that seeks to understand, rather than control, real-world variations – for which techniques such as quality improvement, design thinking, and human factors engineering are superior. At HEA₃RT, we use a combination of these techniques that we refer to as the "HEA₃RT Method" and leverage our state-of-the-art Simulation Lab to rapidly create any real-world clinical setting, monitored by video and sensor technology, enabling rapid iterative learning before live clinical testing.

**HEA₃RT METHOD: LIFE CYCLE OF A HEALTHCARE AI/ML APPLIED RESEARCH PROJECT**

1. Form research team and explore opportunity with collaborators
2. Assess utility of AI/ML solutions in addressing identified need
3. Determine key features for success
4. Develop and/or validate AI/ML solutions
5. Design clinical integration workflows
6. Implement AI/ML solutions and conduct PDSA¹ cycles
7. Evaluate AI/ML solutions
8. Disseminate learnings

Third, advocating for equitable and accountable AI/ML. Like any data-powered tool, AI/ML is vulnerable to bias and abuse. Automated systems are not inherently neutral – they reflect the priorities, preferences, and prejudices of the humans who created them. At HEA₃RT, we believe that we must advocate for AI/ML technologies that serve all of us, not only the privileged few.

¹. Plan-Do-Study-Act (PDSA)
To achieve this, we must apply a health equity lens to every AI/ML implementation: Who might be left behind with this technology? Whose perspectives have we not considered? Can this technology be co-opted for potentially harmful purposes? At HEA$_3$RT, we believe that algorithm training data needs to represent the patient populations likely to be impacted by the algorithm. We believe that special care must be taken to directly incorporate the perspectives of all stakeholders to ensure diverse design and deployment. These ethical principles are part of HEA$_3$RT’s core mission, guiding and inspiring our work.

HEA$_3$RT’s 2022-2025 Strategic Plan is both a blueprint for how we intend to achieve our mission and vision, as well as our dream for a better healthcare future with AI/ML.

### FIVE STRATEGIC AREAS

- **Communications**
- **Growth & Business Plan**
- **Equity & Community Engagement**
- **Learner Engagement**
- **Information Technology Integration**

Whether you are a prospective industry collaborator, start-up, academic researcher, student, patient, provider, health system leader, policymaker, investor, or healthcare philanthropist, we invite you to explore our Strategic Plan, visit our website, and connect with us.

Steven Lin, MD  
Founder and Executive Director of HEA$_3$RT
Key Accomplishments (2019-2021)

HEA³RT has experienced tremendous growth since founded in 2019. We have developed a portfolio of collaborations with world-class research partners, launched a state-of-the-art healthcare AI/ML Simulation Lab, and shared our work with the scientific community and the general public. In our first two years, we have taken important strides towards building a translational research center that enables us to study and realize the potential for AI/ML solutions to solve the most pressing challenges in healthcare.

30+
Research collaborators from industry, academia, and non-profits

40+
News articles and interviews about our research in the media

50+
Presentations and papers in top-tier conferences and journals

2M
In seed funding, internal and external grants, and donations
Growth & Business Plan

"The collaboration with [HEA3RT] has been awesome from the start - open dialogue, shared vision, creativity, thoughtfulness, and prioritization. We couldn't have asked for more."

Srini Akkaraju, Co-Founder of Codex Health
Growth & Business Plan

BACKGROUND

Over the coming years, we aim to continue our growth trajectory by expanding our network of collaborators and developing our revenue streams, thereby increasing capacity on our team to support our research, learners, and affiliated faculty.

SUMMARY OF GOALS

- Cultivate collaborative relationships with researchers, faculty, and companies focused on healthcare AI/ML development and translational research
- Expand our revenue streams that simultaneously foster research and advance our mission
- Grow our portfolio of projects in key priority areas for patients, providers, and health systems
- Increase our capacity to conduct sponsored research projects and support the research of affiliate faculty members

GOAL 1

Cultivate a strong network of collaborative relationships with researchers, faculty, and companies focused on healthcare AI/ML development and translational research

1. Build on our existing partnerships with other AI/ML centers and groups at Stanford including but not limited to AIM1, BMIR2, HAI3, and RIT4 with the goal of engaging in one or more collaborations each year whether that be a project, manuscript, or presentation
2. Develop a faculty affiliates program that encourages members to identify problem areas, submit seed grant applications, and connect to HEA3RT’s internal and external network of students, developers, workflow specialists, and data to bring these ideas to life

1. Artificial Intelligence in Medicine and Imaging (AIMI)
2. Center for Biomedical Informatics Research (BMIR)
3. Human-Centered Artificial Intelligence (HAI)
4. Research Information Technology (RIT)
3. Develop an industry affiliates program that facilitates open dialogue and idea sharing between industry stakeholders and clinical faculty and staff, serving as a platform where our faculty affiliates can learn about industry perceptions and priorities, and industry members are introduced to new ideas and research directions for furthering the field of translational AI/ML research.

4. Engage directly with healthcare AI/ML start-up accelerator programs, providing mentorship, clinical partnership, and access to our Simulation Lab as a way to begin testing and generating data.

5. Grow a network of organizations interested in standardizing, sharing, and merging datasets to facilitate more accurate and equitable model development.

**GOAL 2**

**Expand our revenue streams that simultaneously foster research and advance our mission of bringing AI/ML technologies from code to bedside in support of the Quintuple Aim**

1. Build a subscription-based library of organized, annotated datasets to enable model development, facilitate future research projects, and empower other researchers and students at Stanford.

2. Work with applicable Stanford Medicine groups to ensure internally developed intellectual property is identified, protected, and marketed in service of our mission.

3. Develop a membership fee-based industry affiliates program that facilitates open dialogue and idea sharing between industry stakeholders and clinical faculty and staff.

![Current Revenue Sources (FY20 - FY21)](chart1)

- **Internal Funding**: 75%
- **External Funding**: 25%

![Projected Revenue Sources (FY22 - FY25)](chart2)

- **Internal Funding**: 48%
- **External Funding**: 52%
**GOAL 3**

Grow our portfolio of projects in key priority areas for patients, providers, and health systems

1. Build avenues for our network of affiliate faculty, and physician and nursing leadership across Stanford Medicine to guide our project selection and execution to ensure the inclusion of the frontline provider’s experience and perspective
2. Integrate with existing mechanisms for project prioritization and strategic planning within Stanford Medicine such as the Annual Operations Plan and the Improvement Capability Development Planning cycles
3. Assess health equity implications for each project and refine our new project screening process and tools to substantively incorporate the perspectives of patients, providers, and health systems, where applicable

**GOAL 4**

Increase our capacity to conduct sponsored research projects and support the research of affiliate faculty members

1. Hire a program manager (PM) to liaise with our industry partners and internal stakeholders, manage industry-sponsored research projects from contracting to completion, and support our future affiliates programs
2. Hire additional research assistants (RAs) to support manuscript development, grant writing, the expansion of our research project portfolio, and our affiliates programs
3. Leverage tools to improve the efficiency of the administrative processes that underpin the execution of our research projects and portfolio management

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**CURRENT EXPENSE SOURCES**

(FY20 - FY21)

- Physician Leadership: 60%
- PM/RA Support: 26%
- Simulation Lab Operations: 14%

**PROJECTED EXPENSE SOURCES**

(FY22 - FY25)

- Physician Leadership: 71%
- PM/RA Support: 20%
- Simulation Lab Operations: 9%
HEA$_3$RT has experienced tremendous growth in its first two years thanks to successful partnerships with industry and support from outstanding leadership within Stanford Medicine. Under the current growth projections set forth in this plan, HEA$_3$RT expects its revenue to exceed its expenses by the end of FY 2022 and reach financial sustainability by the end of FY 2025.
Learner Engagement

"I am so happy to hear that [the HEA_{3}RT team] imagines the future of medicine to be different than what it is today – that provides me with hope to continue pursuing my MD."

Anna, Pre-Medical Student
Learner Engagement

BACKGROUND
At HEA³RT, we aim to engage learners across all levels in research and process improvement to bridge implementation gaps in the integration of leading-edge AI/ML technologies in healthcare.

SUMMARY OF GOALS

• Energize a multi-disciplinary community of learners who value the role of AI/ML-enabled solutions in healthcare and approach development and implementation with an improvement mindset

• Build a repository of data and project proposals that are well-defined, appropriately scoped, and organized by topic area so that learners can easily evaluate and connect with robust and important research opportunities

• Ensure that our learners understand the complexities inherent to responsible AI/ML practices and pursue research that promotes equitable AI/ML development and implementation

• Collaborate with national organizations to learn from leaders in the field, design high-quality educational opportunities, and bring together ideas and perspectives from diverse learners across the country

GOAL 1

Introduce undergraduate students to the intersection of traditional research and quality improvement methodologies, and the development and implementation of AI/ML technologies in healthcare

1. Offer educational experiences for undergraduate students within and outside of Stanford to introduce them to our team, projects, and the HEA³RT Method
2. Integrate learners in team and project meetings to offer insights into the scope and depth of HEA³RT activities
3. Pair learners with specific projects and faculty mentors to provide hands-on and in-depth learning opportunities through structured mentorship
4. Partner with existing undergraduate courses at Stanford to increase the visibility of HEA3RT and form meaningful bridges within and among existing programs

**GOAL 2**

*Inspire graduate students to appreciate the value of using a quality improvement approach when using AI/ML translational research to solve complex problems in healthcare*

1. Offer research and project collaboration opportunities and experiences for medical and physician assistant students, residents, and fellows to introduce them to our team, the scope of projects we work on, and the HEA3RT Method
2. Define opportunities for Stanford graduate students to receive course, scholarly concentration, and/or application area credits for HEA3RT project work
3. Partner with existing graduate-level courses in the Stanford School of Medicine to increase the visibility of HEA3RT and form meaningful bridges within and among existing programs

**GOAL 3**

*Support faculty to study and implement AI/ML-enabled solutions in healthcare*

1. Develop a faculty affiliates program that encourages members to identify problem areas, submit seed grant applications, and connect to HEA3RT’s internal and external network of learners, developers, workflow specialists, and data to bring these ideas to life
2. Empower clinicians who do not have a background in computer science to engage in AI/ML translational research by contributing to the design and implementation of technology-enabled solutions in healthcare
3. Develop the next generation of AI/ML translational researchers who come together with a shared mindset, shared language, and shared commitment to developing a skillset that complements that of technologists
4. Connect faculty affiliates with relevant courses and educational opportunities, including but not limited to Stanford courses, national conferences, pertinent literature, and thought leaders
5. Grow faculty to become mentors for other learners in the HEA3RT community
# Landscape of Learner Programs

## Undergraduate
- **Stanford Medical Scribe Fellowship (COMET)**
- **Clinical Summer Internship**
- **Computer Science Department**
- **CS + Social Good**
- **Stanford Health Innovation in Future Technologies (SHIFT)**
- **Stanford Pre-Medical Association**

## Graduate
- **Anesthesia Informatics Fellowship**
- **Stanford Artificial Intelligence Laboratory (SAIL)**
- **Stanford Artificial Intelligence & Law Society**
- **Clinical Informatics Fellowship**
- **Golub Capital Social Impact Lab**
- **Internal Medicine Residency Pathways of Distinction (POD)**
- **MS in Clinical Informatics Management (MCIM)**
- **Quality Improvement Scholarly Concentration**
- **Stanford Intermountain Fellowship**

## Faculty
- **Stanford Byers Center for Biodesign**
- **SAFE: Stanford Center for AI Safety (SAFE)**
- **Center for Artificial Intelligence in Medicine & Imaging (AIMI)**
- **Human-Centered Artificial Intelligence (HAI)**
- **Stanford Medicine Center for Improvement (SMCI)**
- **Systems Utilization Research for Stanford Medicine (SURF)**

## National
- **Algorithmic Justice League (AIL)**
- **American Academy of Family Physicians (AAFP)**
- **American Board of Artificial Intelligence in Medicine (ABAIM)**
- **American Board of Family Medicine (ABFM)**
- **Association of American Medical Colleges (AAMC)**
- **Center for Humane Technology**
- **Center for Professionalism & Value in Health Care**
- **National Academy of Medicine (NAM)**
- **Society of Teachers of Family Medicine (STFM)**

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**Strategic Area 2: Learner Engagement**
Information Technology Integration

"The [HEA$_3$RT] Simulation Lab is a big step forward for Stanford Medicine because it allows us to think about how we put these tools into practice and how we can take better care of our patients with the tools we now have available."

Dr. Robert Harrington, Chair of Stanford Department of Medicine
BACKGROUND

Integral to HEA3RT’s mission to build a collaborative AI/ML translational research pathway is the need to develop a pipeline for information technology (IT) integration. HEA3RT plans to drive innovation to enhance cost-effective healthcare delivery through partnership with organizational stakeholders and IT leadership, and alignment with the organization’s strategic priorities.

SUMMARY OF GOALS

- Increase the portfolio of HEA3RT projects that achieve end-to-end IT integration at SHC
- Develop a process for intake and prioritization of HEA3RT projects requiring IT integration at SHC in collaboration with IT leadership
- Expand HEA3RT’s role as a key partner for Stanford Medicine to drive innovative AI/ML solutions for healthcare delivery and organizational strategic priorities

GOAL 1

Increase the portfolio of HEA3RT projects that achieve end-to-end IT workflow integration within SHC

1. Build a collaborative pathway for HEA3RT projects that may require IT integration including (a) projects that HEA3RT brings to IT partners and (b) projects that Stanford Medicine (including IT partners) bring to HEA3RT
2. Nurture existing and new partnerships with Stanford Medicine and Stanford University groups committed to improving the IT infrastructure that enables applied AI/ML research
3. Demonstrate outcomes of AI/ML from successful projects to reinforce support for continued IT workflow integration

1. Stanford Health Care (SHC)
GOAL 2

Develop a process for intake and prioritization of HEA₃RT projects requiring IT integration at SHC with IT leadership, which aligns with the existing IT governance infrastructure

1. Partner with TDS' leadership and other Stanford Medicine stakeholders to develop a prioritization process to identify which projects should be selected for technology integration; considerations should include alignment with strategic priorities, alignment with the Quintuple Aim, as well as IT resource and funding requirements

2. Develop a needs assessment process for HEA₃RT projects that may require technology integration – including assessment of potential IT resource requirements – and determine if the project needs to route through an existing IT governance process for review

3. Apply and iterate the needs assessment and prioritization processes over time

1. Technology & Digital Solutions (TDS)
GOAL 3

Increase HEA3RT’s role as a key partner for Stanford Medicine to drive innovative IT solutions for healthcare delivery and organizational strategic priorities

1. Use AI/ML in healthcare to deliver cost-effective care for patients (e.g. adaptive clinical decision support, risk stratification and prediction for managed care, electronic consultation optimization)
2. Leverage AI/ML in healthcare to improve the provider experience and improve wellness by decreasing administrative burdens (e.g. in-basket management, documentation assistance)
3. Partner with Stanford Medicine stakeholders and TDS leadership to prioritize solutions and secure necessary funding for any IT resources required
Equity & Community Engagement

"The [HEA$_3$RT] team brings not only clinical expertise but also operational excellence. For our project, [HEA$_3$RT] led the team to think through every aspect of the clinical workflow to ensure the best patient and provider experiences possible."

Jiayin Xue, Adjunct Professor at Clinical Excellence Research Center
Equity & Community Engagement

BACKGROUND
At HEA3RT, we aim to be more intentional about engaging in research that advances health equity to ensure that the innovations we push forward are equitable and accountable, and do not leave anyone behind.

SUMMARY OF GOALS

- Incorporate health equity principles at every step throughout the research process, from the inception of an idea to the evaluation of an AI/ML solution
- Connect and collaborate with providers, researchers, students, and advocates committed to promoting the development and implementation of equitable AI/ML technologies in healthcare
- Advocate for the development of fair, equitable healthcare AI/ML technology in our scholarly work and communications

GOAL 1
Incorporate health equity principles at every step of the research process, from the inception of an idea to the evaluation of an AI/ML solution

1. Involve stakeholders and researchers from historically marginalized and minority groups to amplify their voices and account for varied perspectives and experiences
2. Leverage existing frameworks such as Stanford HAI’s Ethics and Society Review or WHO’s Key Ethical Principles for Use of AI in Health to discuss ways in which AI/ML might help address and/or exacerbate healthcare inequities; if any risks/threats are found, promote methods to mitigate them
3. Establish equity-sensitive metrics and criteria when determining research goals and use them to evaluate algorithm fairness and performance
4. Assess the quality and representativeness of training data and address any biases

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1. World Health Organization (WHO)
5. Involve end users in workflow design and consider how proposed workflows may impact different stakeholders
6. Gather feedback from stakeholders impacted to inform Plan-Do-Study-Act (PDSA) cycles; consider populations the intervention may not be reaching to ensure that the implementation, as well as the algorithm, is equitable
7. Share research findings and learnings in ways that are accessible and transparent to the general public

## INCORPORATING HEALTH EQUITY PRINCIPLES IN THE HEA₃RT METHOD

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<thead>
<tr>
<th>HEA₃RT METHOD</th>
<th>HEALTH EQUITY PRINCIPLE</th>
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<td>Seek out feedback from stakeholders directly and indirectly impacted to inform PDSA cycles; consider populations the intervention may not be reaching</td>
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<tr>
<td>Evaluate AI/ML solutions</td>
<td>Use established equity-sensitive metrics to assess algorithm fairness and performance</td>
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<tr>
<td>Disseminate learnings</td>
<td>Disseminate learnings in ways that are accessible and transparent to the general public</td>
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**STRATEGIC AREA 4: EQUITY & COMMUNITY ENGAGEMENT**
GOAL 2

Connect and collaborate with providers, researchers, students, and advocates committed to promoting the development and implementation of equitable AI/ML technologies in healthcare

1. Connect with and learn from national organizations and individuals advocating for the development of equitable AI/ML technologies, including but not limited to the Algorithmic Justice League and the Center for Humane Technology
2. Connect with and learn from Stanford organizations and individuals advocating for the development of equitable AI/ML technologies, including but not limited to Stanford HAI and Presence
3. Foster research collaborations with clinics and providers providing care in underserved communities, including but not limited to federally qualified health centers such as Ravenswood Family Health Center and Roots Community Health Center

GOAL 3

Advocate for the development of fair, equitable health AI/ML technologies in our research collaborations, scholarly work, and communications

1. Advocate for research methods that prioritize the development of equitable AI/ML technologies in our collaborations (e.g. working with representative datasets, including social determinants of health data, measuring algorithm fairness)
2. Utilize various platforms – academic journals, conferences, news media, social media – to speak out about the importance of developing AI/ML solutions and associated workflows that uplift and promote the health and well-being of all communities
Communications

"[HEA₃RT] enables an ecosystem of working with partners and newer companies that would be impossible in a [traditional] operational framework."

Murari Srinivasan, Co-Founder of Codex Health
Communications

BACKGROUND

At HEA₂RT, we aim to spread awareness of our mission and research, position our team as a leader in healthcare AI/ML applied research, and inspire future generations of leaders in this field by proactively and intentionally engaging with individuals and organizations through various communications platforms.

SUMMARY OF GOALS

- Position HEA₂RT as a leader in healthcare AI/ML applied research and share our mission and research with individuals, communities, and the general public to increase awareness of our work, foster discussions, and inspire future generations of leaders in this field
- Find opportunities to collaborate with academic researchers, healthcare professionals, students, non-profit organizations, and industry members

GOAL 1

Position HEA₂RT as a leader in healthcare AI/ML applied research and share our mission and research with individuals, communities, and the general public to increase awareness of our work, foster discussions, and inspire future generations of leaders in this field

1. Update our website regularly with information about our ongoing projects, Simulation Lab, recent news and publications, and conference presentations
2. Establish our presence on social media platforms, and use them to share updates about our work and engage in discussions with individuals and organizations
3. Leverage existing communications platforms within the Stanford community (e.g. StanfordMed Pulse, Department of Medicine website, SMCI¹ blog) to expand the reach of our influence
4. Connect with local and national news outlets to make our work more accessible to the general public

¹. Stanford Medicine Center for Improvement (SMCI)
GOAL 2

Find opportunities to collaborate with academic researchers, healthcare professionals, students, and industry members

1. Update our website regularly with information about how to work with our team to collaborate on research projects and/or utilize our Simulation Lab
2. Create and send out quarterly digital newsletters to communicate our ongoing projects and collaboration opportunities to Stanford faculty, staff, researchers, and students
3. Curate and post content that caters to potential collaborators in industry, academia, and non-profit organizations on our social media platforms (e.g. journal publications, news articles featuring HEA₃RT, Simulation Lab features)

HEA₃RT COMMUNICATIONS PLAN

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<th>OBJECTIVES</th>
<th>TACTICS</th>
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<tr>
<td>• Share our mission and ongoing research efforts</td>
<td>• Website</td>
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<td>• Inspire future generations of applied AI/ML leaders at Stanford</td>
<td>• Social media platforms</td>
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<tr>
<td>• Identify opportunities for collaboration</td>
<td>• Quarterly newsletter</td>
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<td>• Existing Stanford Medicine communications platforms</td>
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STANFORD

• Share our mission and ongoing research efforts
• Highlight the importance of and need for healthcare AI/ML applied research
• Identify opportunities for collaboration

COLLABORATORS

• Share our mission and ongoing research efforts
• Spread awareness of healthcare AI/ML applied research
• Inspire future generations of applied AI/ML leaders

GENERAL PUBLIC

• Share our mission and ongoing research efforts
• Website
• Social media platforms
• Local and national news outlets
Meet Our Team

STEVEN LIN, MD
Founder and Executive Director

MARGARET SMITH, MBA
Director of Operations

AMELIA SATTLER, MD
Associate Medical Director

SHREYA SHAH, MD
Associate Medical Director

GRACE HONG
Lead Research Associate

MARISSA MARAPAO
Lead Administrative Associate

SCAN TO LEARN MORE ABOUT OUR TEAM
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Stanford Health Care

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Vice Chair for Quality
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ELIZABETH FREEMAN, MBA
Senior Advisor
Stanford Medicine Center for Improvement
Contact Us

We enjoy collaborating with individuals and teams who are committed to improving the health and well-being of patients, providers, health systems, and communities.

Whether you are a prospective industry collaborator, start-up, academic researcher, student, patient, provider, health system leader, policymaker, investor, or healthcare philanthropist, we invite you to visit our website and connect with us.

We look forward to partnering with you!