Title
"Bridging the Gap: Developing an AI Curriculum for Internal Medicine Education"

Primary Investigator
Suzanne El-Sayegh, MD
Program Director,
Staten Island University Hospital Internal Medicine Residency Program,
Associate Chair of Medicine, Staten Island University Hospital – Northwell Health
Professor of Medicine, Zucker School of Medicine at Hofstra/Northwell

Co-Investigators:
Mario Castellanos, M.D.
Associate Chair of Medicine & Director of Research, Department of Medicine,
Staten Island University Hospital – Northwell Health
Research Associate Professor of Medicine, SUNY Health Science Center at Brooklyn

Theodore Strange, M.D., F.A.C.P.,
Chair of Medicine, Staten Island University Hospital
Associate Regional Physician Executive, Staten Island Region, Northwell Health System
Vice President of Strategic Initiatives, South West Region, Northwell Health System
Associate Professor of Medicine, Zucker School of Medicine at Hofstra/Northwell

Chloe Lahoud, MD
PGY-2
Staten Island University Hospital Internal Medicine Residency Program
Zucker School of Medicine at Hofstra/Northwell

Consultant
Maha Farhat, MD, MSc
Massachusetts General Hospital Division of Pulmonary & Critical Care Medicine
Associate Director, Bioinformatics and Integrative Genomics PhD Track
Gilbert Omenn Asso Professor, Biomed. Informatics, Harvard Chan School of Public Health.

Grant Focus: Graduate Medical Education (GME)

Contact Info for Primary Investigator
Suzanne El-Sayegh, MD
Department of Medicine
Staten Island University Hospital
475 Seaview Avenue
Staten Island, NY 10305
Tel: (718) 987-5942
Fax: (718) 226-9516
Email: Selsayegh@northwell.edu

ABSTRACT

Problem/Educational Issue:
With AI rapidly integrating into healthcare, Internal Medicine (IM) physicians frequently encounter AI-based tools in diagnostics and patient management. Yet, many clinicians lack the training to critically evaluate and effectively use these tools. While the American College of Physicians (ACP) stresses the need for comprehensive AI education, no structured AI curriculum exists for IM. This gap leaves IM residents unprepared to leverage AI advancements for improved patient outcomes, potentially compromising patient safety and the quality of care. These challenges highlight the urgent need for targeted AI education for IM.

Goal:
The primary aim is to develop and implement an innovative AI curriculum that equips IM residents and faculty with essential skills to understand and integrate AI tools into patient care while upholding a patient-centered approach.

Approach:
The curriculum includes four workshops over 12 months, beginning with foundational AI concepts and advancing to practical applications and ethical considerations. Each session combines pre-readings, interactive discussions, and case studies led by AI experts. Hands-on exercises will focus on diagnostics, decision support, and documentation, while addressing ethical issues like bias and data privacy. Grounded in Constructivist, Experiential, and Adult Learning theories, the program uses pre- and post-surveys and qualitative feedback for iterative refinements, ensuring relevance and measurable impact.

Predicted Outcomes:
Participants will improve their understanding of AI concepts and clinical applications by 50% or more. They will also better understand digital health tools and learn to critically review AI-based studies published in clinical journals.

Anticipated Impact and Dissemination Plan:
IM residents and faculty will have the foundation needed for AI integration in medicine. The curriculum framework and results will be shared through academic presentations, internal workshops, and publications to set a standard for approaching AI curriculum development for medical residency education in IM and other specialties.

Rationale & Statement of the Problem: The rapid integration of artificial intelligence (AI) into healthcare is transforming medical practice, particularly within Internal Medicine (IM). AI-based tools are increasingly utilized across diagnostics, clinical decision support, and patient management, creating unprecedented opportunities to enhance care delivery and optimize clinical outcomes (1,2,3). For instance, AI algorithms in some studies have demonstrated high accuracy in interpreting medical imaging, often matching or even surpassing specialists in detecting conditions such as lung nodules and diabetic retinopathy (4). Additionally, AI-powered decision support systems integrated into electronic health records are optimizing treatment recommendations, predicting patient outcomes, and advancing precision medicine (5,6).

However, despite the proliferation of these technologies, IM residents are often unprepared to critically assess and effectively utilize AI tools, as they lack formal training in this rapidly evolving field (7). This educational gap is significant, as insufficient knowledge may lead to misinterpretation of AI-generated data, resulting in potential medical errors, patient safety concerns, and suboptimal clinical decisions (8). Over-reliance on AI without a clear understanding of its limitations also raises ethical and legal risks, particularly around bias and patient privacy (9,10). While the American College of Physicians (ACP) has emphasized the need for comprehensive AI education, there remains a substantial gap in structured AI training specifically tailored to IM residency programs, unlike technology-focused specialties like Radiology (11).

Our team has already made strides in addressing this gap through a pilot AI-focused workshops conducted at Staten Island University Hospital (SIUH), which were recognized at the 2024 Society of General Internal Medicine (SGIM) Annual Meeting (14). These workshops, which included pre- and post-surveys, effectively enhanced AI knowledge among participants, resulting in a 54% increase in overall AI understanding, a 35% rise in awareness of clinical applications, and 84% of participants expressing motivation to integrate AI into their practice. This demonstrated our ability to develop impactful educational initiatives that systematically improved AI literacy among residents.

Building on this success, we aim to develop a more comprehensive AI curriculum tailored specifically for IM residents. This initiative will focus on equipping residents with the critical skills needed to evaluate and integrate AI tools into clinical practice. The structured curriculum will address the unique educational needs of IM residents, thereby preparing them to effectively navigate an AI-driven healthcare landscape.

Failing to address this gap has serious implications. Misapplication of AI may lead to inefficiencies in clinical practice and increased healthcare costs (12). Furthermore, a lack of understanding can contribute to resident burnout as they struggle to keep up with evolving AI tools, potentially affecting patient care and the professional autonomy of IM practitioners (13). By leveraging our prior experience and proven methodologies, this curriculum will set a new standard for AI education in IM residency program

Hypothesis: A structured AI curriculum will significantly enhance AI knowledge, confidence, and critical thinking skills among IM residents, leading to improved readiness to integrate AI into clinical decision-making.

Specific Aims

1) Develop and implement a structured AI curriculum tailored for Internal Medicine to enhance participants' foundational understanding of AI concepts, practical applications, and ethical considerations in clinical practice. **Objective Measure**: Track completion rates of the 4-part workshop series and participant engagement through attendance, interactive cases, and pre & post workshop surveys.

2) Assess the impact of the AI curriculum on participants' AI knowledge, confidence, and critical evaluation skills through pre- and post-workshop assessments, with a target of achieving a **30-50% improvement** in these competencies. **Objective Measure**: Compare pre & post-survey scores to quantify improvements in knowledge, confidence, and IM applications of AI.

3) Foster a culture of continuous learning among Internal Medicine residents, encouraging them to integrate AI tools into their medical education and research activities. **Objective Measure:** Conduct long-term follow-up surveys three months after completing the curriculum to assess sustained knowledge retention, confidence, and the practical application of AI in their educational and research activities.

Theoretical Framework: While specialties like Radiology have developed structured AI curricula, there remains a significant gap in AI education within Internal Medicine (IM) residency programs (15, 16, 17). To address this, our proposed curriculum is grounded in evidence-based educational theories that emphasize active learning, practical application, and continuous improvement**:**

1. **Constructivist Learning Theory**: Learners build upon their existing knowledge through active engagement with new concepts. The curriculum uses a modular, case-based approach where participants apply AI tools to real-world clinical scenarios (18).
2. **Kolb's Experiential Learning Theory**: Kolb's model emphasizes learning through experience, reflection, and application. Workshops includes hands-on exercises, interactive discussions, and opportunities for reflection. By engaging in these activities, participants develop a deeper understanding of AI concepts and gain practical experience (19).
3. **Adult Learning Theory**: Recognizing the time constraints and diverse learning styles of busy healthcare professionals, the curriculum follows adult learning principles, focusing on relevance, flexibility, and practical application. The use of microlearning techniques ensures that content is accessible, digestible, and directly applicable to participants' clinical duties (20).

Curriculum Design and Implementation: The proposed curriculum consists of a structured series of four interactive workshops conducted over 12 months. Each session builds upon the previous one to foster progressive learning, beginning with foundational AI concepts and advancing to practical applications and ethical considerations in Internal Medicine. The curriculum starts by introducing core AI principles (16, 17)., such as predictive analytics for patient outcomes, AI-enhanced diagnostics, and clinical decision support tools.

To bridge theoretical knowledge with real-world clinical practice, the program employs **case-based learning** inspired by the AI-RADS model. Through these clinical scenarios, participants will apply AI concepts directly to patient care situations, ensuring that learning remains highly

relevant to their daily practice. As the curriculum progresses, participants will engage in **experiential learning activities** aligned with **Kolb's model**, which emphasizes hands-on experiences, reflection, and active application (18). Residents will work with AI tools, including large language models (LLMs) and diagnostic algorithms, to interpret data outputs and apply insights to clinical decision-making. This approach is designed to enhance critical thinking skills, enabling participants to assess the benefits and limitations of AI technologies effectively.

To further enrich the learning experience, each workshop incorporates a **journal club and interactive discussions**, where participants critically evaluate recent AI research articles (19). These sessions foster continuous learning, peer mentorship, and collaborative knowledge sharing. By engaging in structured discussions and group problem-solving exercises, residents deepen their understanding of AI's potential impact on clinical care and research.

The program integrates a **continuous feedback loop** to ensure content remains adaptive and responsive. **Pre- and post-workshop surveys** will measure improvements in participants' knowledge, confidence, and critical evaluation skills, aiming for a **30-50% enhancement** (20). Thematic analysis of open-ended feedback will guide iterative refinements, keeping the curriculum relevant and engaging.

In addition, a **longer-term follow-up surveys** conducted three months after the final workshop will assess knowledge retention and the integration of AI tools into clinical practice (16, 17). This longitudinal evaluation will provide insights into the impact of the curriculum on residents' ability to apply AI in their medical education and clinical activities.

The Art and Science of Medicine in the Era of AI: Based on our recent JAMA publication (21) and feedback for our pilot workshops survey's (14, 22), this 20-minute session will examine how AI and big data are transforming healthcare while emphasizing the enduring importance of compassion, empathy, and patient-centered care. With many physicians concerned about being "replaced" by technology, Workshop #3 (below) reaffirms the C.A.R.E. framework (Compassion, Assistance, Respect, Empathy) as a crucial element of medical practice. We will demonstrate how integrating the art and science of medicine not only improves patient outcomes but also ensures that clinicians remain central to the healing process in a tech-driven world.

The team brings extensive expertise in medical education, clinical research, and AI integration. The study PI, Dr. El-Sayegh, is a leader in residency training with a strong track record of developing innovative educational programs. Co-investigators Dr. Castellanos and Dr. Strange bring significant experience in research, strategic initiatives, and patient-centered care. Dr. Farhat, a key consultant, is an Associate Professor at Harvard and Clinician, a recognized expert in bioinformatics and AI, where she directs a course on AI in Healthcare. The team includes Dr. Chloe Lahoud, an emerging clinician-researcher, adding fresh insights from the residency perspective. Workshops will feature talks by the core team and domain experts, by Northwell & Feinstein Institute, which are at the forefront of AI-driven medical innovation.

In summary, this educational initiative is designed to be transformative leveraging the AI advancements of our time. Our approach is scalable, with a flexible feedback mechanism that enables the workshops to adapt and evolve as technology advances. This approach ensures a lasting impact on AI literacy while supporting continuous professional development in an AI-driven healthcare landscape. We anticipate that this pilot curriculum will serve as a foundation for a sustainable, ongoing initiative, using collected data to validate and expand its integration into Internal Medicine residency programs.

Workshop Descriptions

Workshop 1: Foundations of AI in Medicine

Objective: Establish a foundational understanding of AI concepts, & practical applications.

1. **Introduction to AI and Machine Learning (ML) Basics**:
    - **Key Concepts**: Overview of supervised and unsupervised learning, neural networks, and natural language processing (NLP). **Focus**: Clinical decision support, predictive analytics, and diagnostic tools.
    - **Speaker**: AI-focused clinician experienced in implementing AI in healthcare.
2. **Large Language Models (LLMs) and Generative AI in Medical Research**:
    - **Case Discussion**: Leveraging LLMs in evaluating medical studies. **Focus**: Opportunities and limitations of tools like GPT models in clinical research.
    - **Speaker**: Researcher specializing in AI applications in medical education.

Workshop 2: AI Tools and Applications in Clinical Practice

Objective: Enhance understanding of AI tools across various IM subspecialties.

1. **AI in Cardiology, Pulmonology, and Medical Imaging**:
    - **Applications**: AI-driven ECG interpretation, risk prediction models, and pulmonary function analytics. **Case Studies**: Use cases in diagnostic imaging (e.g., chest X-rays, CT scans for lung nodules).
2. **AI in Chronic Disease Management (Endocrinology/Nephrology)**:
    - **Focus**: Continuous glucose monitoring, AI models for chronic kidney disease management, and personalized treatment plans. **Case-Based Learning**: Practical examples in managing diabetes and hypertension.
3. **Diagnostic Support Tools in Oncology and Pathology**:
    - **Discussion**: AI for early cancer detection, pathology image analysis, and limitations of current systems.
    - **Speaker**: Clinician using AI-driven diagnostic tools.

Workshop 3: Practical and Ethical Considerations of AI in Clinical Practice

1. **The Role of the Physician in the Era of AI**:
    - **Discussion**: The evolving role of physicians in AI-driven healthcare, focusing on empathy and compassion. **Case Study**: Insights from the JAMA article on compassionate care (21). **Speaker**: Dr. Strange, emphasizing the human touch alongside AI.
2. **Generative AI and LLM Use Cases**:
    - **Interactive Session**: Case studies on clinical decision-making.
    - **Speaker**: Expert in bioinformatics and clinical practice.

Workshop 4: Translating AI Research into Clinical Practice

Objective: Bridge the gap between AI research and real-world clinical implementation.

1. **Critical Appraisal of AI Journal Articles**:
    - **Activity**: Guided review of recent AI research papers, focusing on methodology, results, and clinical relevance.
    - **Speaker**: AI researcher experienced in clinical trials and implementation science.
2. **Future Trends in AI and Ambient Clinical Intelligence**:
    - **Overview**: Introduction to ambient AI technologies and their impact on patient care.
    - **Speaker**: Dr. Quiel, hospitalist focused on AI in healthcare management.
3. **Curriculum Feedback and Continuous Learning**:
    - **Discussion**: Gathering participant feedback, refining curriculum, and exploring future AI developments.
    - **Speaker**: Program leader and curriculum developer.

Program Evaluation and Continuous Improvement: To ensure the effectiveness of the AI curriculum, we will implement a comprehensive evaluation strategy using both quantitative and qualitative measures. **Pre- and post-surveys** will be administered for each workshop to assess participants' knowledge, confidence, and practical application of AI concepts, with a target of achieving a **50% improvement** in these areas. These surveys are designed to align with the curriculum's specific aims, informed by best practices from prior studies on physician awareness and acceptance of AI technologies (12, 23, 24, 25). By adapting established questions, we ensured that our surveys are align with the other AI educational studies, (Appendix A for pre & post survey).

In addition, we have piloted these pre & post surveys in two prior workshops at SIUH—one for residents and another for fellows and attendings. This initial testing provided valuable insights, confirming the survey's reliability and relevance (14,22). Beyond quantitative assessments, qualitative feedback will be collected through open-ended survey responses. Thematic analysis of this feedback will guide iterative refinements, ensuring the curriculum remains engaging, relevant, and aligned with participants' learning needs.

To assess the **longer-term impact**, follow-up surveys will be conducted three months after the final workshop. These surveys will evaluate sustained knowledge retention, confidence, and the integration of AI into clinical practice and research activities, helping us gauge the curriculum's lasting effect on fostering a culture of continuous learning.

Additionally, we will maintain ongoing collaboration with **multidisciplinary experts**, including clinicians, AI researchers, and educators, to ensure that the content reflects the latest advancements in the field during the AI initiative and beyond

By leveraging this robust educational strategy, we aim to cultivate a sustainable culture of AI competency, ultimately empowering residents to effectively integrate AI tools into patient care and research.

Plan for Dissemination of Project Outcomes: To ensure the widespread impact of our AI curriculum, we will implement a strategic dissemination plan targeting local, regional and national audiences. The primary avenue will be presenting our findings at prominent academic conferences such as the Society of General Internal Medicine (SGIM) and the American College of Physicians (ACP) meetings, where we can reach key educators, clinicians, and decision-makers in medical education.

In addition, we will publish detailed manuscripts outlining our curriculum design, implementation process, and evaluation results in peer-reviewed journals such as the Journal of General Internal Medicine and JMIR Medical Education. This will allow our work to contribute to the academic literature on AI in medicine. Regionally, we plan to collaborate with healthcare institutions to conduct workshops that expand the reach of our curriculum, encouraging adoption by other residency programs. Additionally, we will make our curriculum resources available on digital platforms like MedEdPORTAL, enabling broader access and adaptation by educational institutions nationwide.

To ensure that the Northwell/Hofstra Medical School community fully benefits, we will leverage our extensive professional networks, including Resident Research Day, GME symposia, and other annual academic events host internally. These venues will provide platforms to disseminate key insights, fostering engagement with the broader medical community and promoting interdisciplinary collaboration. This multi-pronged strategy will not only enhance the curriculum's impact within our institution but also support its scalability across the field of medical education

AI Curriculum Implementation Timeline

Months	Activities
1-2	Finalize initial workshop content, schedule speakers, and prepare pre/post-surveys. Send invitations to residents.
3	**Workshop 1**: Foundations of AI in Medicine. Conduct pre- and post-surveys to assess baseline knowledge. Collect feedback for refinement.
4-5	**Preparation for Workshop 2**: Analyze survey data and feedback from Workshop 1. Adjust content to address gaps and enhance relevance for the next session.
6	**Workshop 2**: AI Tools and Applications in Clinical Practice. Administer surveys to evaluate participant progress. Gather feedback for continuous improvement.
7-8	**Preparation for Workshop 3**: Review data from Workshop 2 surveys. Refine the curriculum to include emerging topics based on participant needs.
9	**Workshop 3**: Practical and Ethical Considerations of AI. Collect pre- and post-survey data to assess understanding of ethical challenges.
10-11	**Preparation for Workshop 4**: Use insights from Workshop 3 surveys to shape content for the final session. Integrate participant suggestions and current advancements.
12	**Workshop 4**: Translating AI Research into Clinical Practice. Conduct final assessments and gather comprehensive feedback for long-term evaluation.
13-14	**Follow-up Preparations**: Develop and distribute 3-month follow-up surveys to assess sustained knowledge retention.
15	**Conduct 3-month follow-up surveys** to evaluate practical application of AI concepts in clinical practice. Analyze both quantitative and qualitative data.
16-17	Manuscript preparation based on cumulative data from workshops and follow-up surveys. Submit to peer-reviewed journals.
18	Disseminate findings at academic conferences (SGIM, ACP), internal events (Resident Research Day), and share resources on MedEdPORTAL.

Budget

Item	Cost	Justification	More Information
Lecturer for grand-round or workshop	$1,000 x 2 = **$2,000**	Aiming to host experts in the field to provide high-quality and up-to-date educational lectures as part of the proposed curriculum	
Consultancy fees	**$2,000**	Aiming to get insights from professionals in the field of artificial intelligence and medical education to build the proposed curriculum	
Feinstein Institute Biostatistician	Rate $100 per hour x 5 hours = **$500**	Biostatistician fees for analysis of the pre- and post- curriculum survery results	https://feinstein.northwell.edu
iPad	**$499**	Aiming to offer portable access to learning resources and AI-powered applications for all medicine residents included in the proposed curriculum	https://www.apple.com/shop/buy-ipad/ipad
TOTAL cost:	**$4,999**		

REFERENCES

1. Thacharodi A, Singh P, Meenatchi R, Tawfeeq Ahmed ZH, Kumar RRS, V N, Kavish S, Maqbool M, Hassan S. Revolutionizinghealthcare and medicine: The impact of modern technologies for a healthier future-A comprehensive review..Health Care Sci. 2024 Oct 9;3(5):329-349.
2. Al Kuwaiti A, Nazer K, Al-Reedy A, Al-Shehri S, Al-Muhanna A, Subbarayalu AV, Al Muhanna D, Al-Muhanna FA.J Pers Med A Review of the Role of Artificial Intelligence in Healthcare. 2023 Jun 5;13(6):951.
3. Yu KH, Healey E, Leong TY, Kohane IS, Manrai AK. Medical artificial intelligence and human values. N Engl J Med 2024;390:1895-1904.
4. Pinto-Coelho L. How ArtificialIntelligence Is ShapingMedicalImagingTechnology: A Survey of Innovations and Applications. Bioengineering (Basel). 2023 Dec 18;10(12):1435.
5. Bajgain B, Lorenzetti D, Lee J, Sauro K Determinants of implementing artificial intelligence-based clinical decision support tools in healthcare: a scoping review protocol. BMJ Open. 2023 Feb 23;13(2):e068373
6. Topol EJ. High-performance medicine: the convergence of human and artificial intelligence. Nat Med. 2019 Jan;25(1):44-56
7. Chan, K. S., & Zary, N. Applications and challenges of implementing artificial intelligence in medical education: Integrative review. JMIR Medical Education 2019, 5(1), e13930.

8. Tolentino R, Baradaran A, Gore G, Pluye P, Abbasgholizadeh-Rahimi S. Curriculum Frameworks and Educational Programs in AI for Medical Students, Residents, and Practicing Physicians: Scoping Review. JMIR Med Educ. 2024 Jul 18;10:e54793
9. Al Kuwaiti A, Nazer K, Al-Reedy A, Al-Shehri S, Al-Muhanna A, Subbarayalu AV, Al Muhanna D, Al-Muhanna FA. A Review of the Role of Artificial Intelligence in Healthcare. J Pers Med. 2023 Jun 5;13(6):951.
10. Tolentino R, Baradaran A, Gore G, Pluye P, Abbasgholizadeh-Rahimi S. Curriculum Frameworks and Educational Programs in AI for Medical Students, Residents, and Practicing Physicians: Scoping Review. JMIR Med Educ. 2024 Jul 18;10:e54793
11. Daneshvar N, Pandita D, Erickson S, Snyder Sulmasy L, DeCamp M;ACP Medical Informatics Committee and the Ethics, Professionalism and Human Rights Committee Artificial Intelligence in the Provision of Health Care: An American College of Physicians Policy Position Paper. Ann Intern Med. 2024 Jul;177(7):964-967.
12. Sit C, Srinivasan R, Amlani A, Mandal S, Núñez A, Lee J, Succi MD, Kung J, Looker D, Riemer EC, Chan TM, Gisondi MA, Ostrom QT, Shaikh U, Kolokythas O, Mongan J, Langlotz CP, Lungren MP. Curriculum frameworks and educational programs in AI for medical students, residents, and practicing physicians: scoping review. JMIR Med Educ. 2024;10(1):e54793.
13. Al Kuwaiti A, Al Muhanna FA, Al Amri S. A review of the role of artificial intelligence in healthcare. J Infect Public Health. 2023;16(3):436-443
14. Di Pietro, G. E., El Sayegh, S., Diab, W., Gaballa, D., Castellanos, M. “Enhancing medical education & research: Leveraging the AI revolution”. Journal of General Internal Medicine (2024), 39 (Suppl 2): S582
15. Lindqwister AL, Hassanpour S, Lewis PJ, Sin JM. AI-RADS: An Artificial Intelligence Curriculum for Residents. Acad Radiol. 2021 Dec;28(12):1810-1816
16. Lindqwister AL, Hassanpour S, Levy J, Sin JM. AI-RADS: Successes and challenges of a novel artificial intelligence curriculum for radiologists across different delivery formats. Front Med Technol. 2023 Jan 4;4:1007708
17. Maria Jorina van Kooten, Can Ozan Tan, et al. A framework to integrate artificial intelligence training into radiology residency programs: preparing the future radiologist. Insights Imaging. 2024 Dec; 15: 15. Published online 2024 Jan 17
18. Nurunnabi ASM, Rahim R, Alo D, et al. "Experiential Learning in Clinical Education Guided by the Kolb's Experiential Learning Theory." International Journal of Human and Health Sciences. 2022;6(2):155-160
19. Aaron Lawson McLean. Constructing knowledge: the role of AI in medical learning. J Am Med Inform Assoc. 2024 Aug 1;31(8):1797-1798.
20. Mukhalalati, B. A., & Taylor, A. (2019). Adult learning theories in healthcare professional education: A quick guide for healthcare professional educators. *Journal of Medical Education and Curricular Development, 6*, 1-10.
21. Strange TJ, Castellanos MR. Medicine-Both a Science (Care) and an Art (CARE). JAMA. 2024 Apr 23;331(16):1357-1358.
22. Sharma, R., Di Petro, G., Rajupet, S., El-Sayegh, S., Kwok, Y. F. R., Dhar, M., Bershadskiy, A., Gut, T., Castellanos, M. R. “AI frontiers in oncology: Bridging the gap between humanity and machine”. Journal of Clinical Oncology, 42(16_suppl), e13657.
23. Schaye VE, Reich GA, Bosworth BP, et al. Collaborating with artificial intelligence in medical education. Acad Med. 2022;97(6):803-807.
24. Blease C, Kharko A, Locher C, DesRoches CM, Mandl KD. US primary care physicians' viewpoints on AI in healthcare: A national survey. J Am Med Inform Assoc. 2022;29(6):1057-1064.
25. Pinto dos Santos D, Giese D, Brodehl S, et al. Medical students' attitude towards artificial intelligence: a multicentre survey. Eur Radiol. 2019;29(4):1640-164

APPENDIX

Please see below: Pre & Post Workshop Survey Questions

Physician awareness/acceptance of AI

- **Aim 1**: Assess clinician/resident awareness/ knowledge about AI technology and its applications in the medical field
- **Aim 2:** Teach skills/applications in using generative AI for education and research
- **Aim 3:** Design AI lectures and workshops based on resident feedback via surveys with pre & post-intervention data
-

Brief Demographic questions:

- PGY year, attending, other
- How many years out of post-graduate education (MD, PhD, Masters etc)?
- How many years since graduating undergraduate?
- Do you have any formal computer science training?

Pre-Lecture Survey:

1) Baseline Assessment

a) **On a scale of 1-5/5-point scale, how would you rate your current knowledge of AI in medical applications?**

b) **Which clinical applications of AI in medicine are you aware of?**

- ☐ Diagnostic recognition
- ☐ Patient management (treatment, remote monitoring, medical error prevention, etc.)

- ☐ Data collection and research analytics
- ☐ Medical imaging analysis
- ☐ Medical science research application (drug development, genomics etc.)
- ☐ Other: (fill-in) _____

c) How significant do you believe AI will be in your future residency or medical profession?

- ☐ Not at all
- ☐ Somewhat Significant
- ☐ Very significant
- ☐ Extremely significant

d) Which clinical tools do you consider artificial intelligence mostly for?

- ☐ Diagnostic AI tools (e.g., Butterfly iQ for ultrasound imaging)
- ☐ Information management systems (e.g., EMRs with predictive analytics)
- ☐ General search engines (e.g., Google Search with AI-enhanced features)
- ☐ AI-based chatbots for patient interaction (e.g., ChatGPT, Llama)
- ☐ Clinical Decision Support Systems (CDSS)
- ☐ Other (please specify): _____

2) Perceived Importance:

a) In the next 5 years, how do you see AI's role evolving in medical practice?

- ☐ Assistive - AI will support healthcare providers by enhancing decision-making and efficiency.
- ☐ Autonomous - AI will independently perform tasks and make clinical decisions.
- ☐ Unsure - It is difficult to predict how AI will be utilized in healthcare.
- ☐ Limited Role - AI will be used, but its impact will be minimal.
- ☐ No Role - AI will not have a significant presence in medical practice.

b) Where do you believe AI will have the most impact in medicine in the coming years?

- ☐ Diagnostics - Improving accuracy in identifying conditions.
- ☐ Surgery - Guiding surgical interventions and robotics.
- ☐ Research - Streamlining drug and therapy development.
- ☐ Clinical Decision Support - Providing real-time analysis and recommendations.
- ☐ Medical Education - Customizing learning and simulation experiences.
- ☐ Healthcare Administration - Optimizing operational efficiency and resource allocation.
- ☐ Other – Please specify: _____

3) Perceived Challenges:

a) What are your primary reservations or concerns regarding the adoption of AI in medical practice?

- ☐ Data privacy
- ☐ Accuracy of recommendations
- ☐ Physician over-reliance
- ☐ Not concerned
- ☐ Other– (explain)_____

b) What challenges do you anticipate in integrating AI during your residency or future practice? Choose all that apply

- ☐ Lack of technical training
- ☐ Medical malpractice
- ☐ High costs
- ☐ Privacy concerns
- ☐ No challenges
- ☐ Other– (explain)_____

c) What is the acceptable error rate for AI in internal medicine compared to physicians?

- ☐ Worst-Performing Physician
- ☐ Average Physician
- ☐ Best-Performing Physician
- ☐ Above Best-Performing Physician

4) Likelihood of Future Use: Just in post

a) What topic would you find most valuable to cover in our next talk on AI in clinical practice, to enhance your understanding and use of AI as a resident?

- ☐ Fundamentals of AI and Machine Learning – understand how it functions
- ☐ Clinical Applications of AI
- ☐ Integration of AI with Clinical Workflow
- ☐ Ethical Considerations and AI - Discussing the ethical implications and responsibilities of using AI in medicine.
- ☐ AI and Patient Interaction - How AI can be used to enhance patient communication and education.
- ☐ Other – Please specify: _____

BIOGRAPHICAL SKETCHES
Please see attached biosketches for:

Primary Investigator
Suzanne El-Sayegh, MD

Co-Investigators:
Mario Castellanos, MD
Theodore Strange, M.D., F.A.C.P.,
Chloe Lahoud, MD

Initiative Consultant
Maha Farhat, MD, MSc - Dr. Farhat is the Gil Omenn Associate Professor of Biomedical Informatics at Harvard Medical School and a practicing physician in the Division of Pulmonary and Critical Care Medicine at Massachusetts General Hospital. Holding an MD from McGill University and an MSc in Biostatistics from Harvard, her research is centered on applying artificial intelligence to enhance diagnostics and clinical decision-making.

Dr. Farhat leads several NIH-funded projects, including initiatives in AI-driven genomics and precision medicine, focusing on leveraging machine learning to analyze large-scale clinical data for better patient outcomes. Her innovative "precision phenotyping" work uses AI to identify complex conditions in electronic health records, advancing precision medicine. She is also at the forefront of integrating AI into medical education and healthcare delivery, particularly to improve care in resource-limited setting

LETTERS OF SUPPORT

Please see attached letters of support for the PI and all co-investigators

BIOGRAPHICAL SKETCHES

BIOGRAPHICAL SKETCH

NAME: **Suzanne E El Sayegh, MD**

POSITION TITLE: Associate Chair, Medicine Department

EDUCATION/TRAINING:

INSTITUTION AND LOCATION	DEGREE *(if applicable)*	Completion Date MM/YYYY	FIELD OF STUDY
Lebanese University School of Medicine	MD	06/1997	Medicine
Staten Island University Hospital Staten Island, Staten Island, New York	Residency	06/2000	Internal Medicine
Staten Island University Hospital Staten Island, Staten Island, New York	Chief Resident	06/2001	Internal Medicine
Mount Sinai Medical Center, Manhattan, New York	Fellowship	06/2003	Nephrology

A. Personal Statement

I serve as an Attending and the Director of the Residency Program in the Department of Medicine at Staten Island University Hospital, Northwell Health. I currently oversee the residency training program and is responsible for evaluating, revising and implementing new training programs for residents to improve patient care delivery. As a leader of Staten Island University Hospital's Internal Medicine residency program, I am committed to educating future physicians to deliver quality care to diverse populations who turn to the hospital for their health and medical care. I am actively involved in research and administer performance improvement and quality practice for SIUH's Department of Medicine. I am instrumental in the development of educational programs to further the residents' and fellows' knowledge, and continuously strives to improve the programs so that they can achieve the highest level of competence which will carry them throughout their lifetimes. I received grant funding from the Empire Clinical Research Investigator Program in 2016 and 2019 to encourage and support research and was also awarded funding from P. Gold Foundation in 2016, as well as the Northwell Innovation Challenge 2017 to develop and execute a Patient-Centered Care Rounds Training program at SIUH, which was successfully implemented over the course of the past year. This program included development and dissemination of information in the form of workshops and lectures, as well as evaluations of program participants and caregivers to assess program success. I am the recipient of the KATZ Women in Medicine 2024 grant.

B. **Positions, Scientific Appointments, and Honors**

POSITIONS		
Program Director, IM Training Program/Associate Chair of Medicine	Staten Island University Hospital	11/2014-Present
Clinical Professor	Donald and Barbara Zucker School of Medicine Hofstra/Northwell	07/2022-Present
Adjunct Clinical Professor of Medicine	Touro College of Osteopathic Med.	10/2023- Present

Clinical Professor	SUNY, HSC Downstate	03/2011-07/2015
APPOINTMENT		
Member for APDIM Accreditation Committee		**2007**
APDIM		2005
ASN		2002
American College of Physicians		1999
Richmond County Medical Society		1999
Journal Review: Pediatric Transplant Journal		2007
HONORS		
Attending Physician Research Award	Northwell Health	2024
Attending Physician Research Award	Northwell Health	2023
Northwell Outstanding Teacher of the Year Award	Northwell Health	2018-2019
SIEDC Outstanding Performance and Lasting Contribution to Excellence in Quality Healthcare		2016
NSLIJ Ann Gottlieb Award for Excellence in Teaching	Northwell Health	2014
SIUH Sydney L. Lang, M.D. Award Outstanding Performance and Lasting Contribution to Excellence in Quality Healthcare	Northwell Health	2012
Attending Physician Research Award	Northwell Health	2012

C. Contributions to Science

2024 Katz Grant
A Comprehensive Approach to Detecting and Alleviating Obstructive Sleep Apnea Among Middle-Aged Women at Staten Island University Hospital
Goal: The study aims to refine the diagnostic accuracy of Obstructive sleep Apnea by utilizing the validated Enhanced STOP-Bang score for screening focused on promoting women's healthcare needs; also aims to create a female-specific predictive model to screen for OSA through the implementation of numerous baseline characteristics and comorbidities.
Role: Principal Investigator

2020-2022 Katz Grant
***Anxiety and Depression in Women on Hemodialysis: A Telehealth approach* for diagnosis and management.**
Goal: The project aims to screen for symptoms of anxiety and depression, assess its correlation to treatment compliance, and offer Cognitive Based Therapy via tele-health to patients during the dialysis appointment. Our team believes that identifying symptoms of anxiety and depression early on and offering real-time help will improve the patients' overall quality of life and significantly reduce psychosocial burden.
Role: Co-Investigator

2017 Northwell Health Innovation Challenge *-Patient Experience Enhancement Project R-PEEP*
Goal: Real time feedback to hospitalists and residents to improve patient/physician
Communication in real-time to enhance patient experience and allow for service recovery and improvement on the HCAP scores.
Role: Co-Investigator

2016 The Arnold P. Gold Foundation Picker Gold Challenge Grant for Residency Training
Patient Centered Multidisciplinary Point of Care Round
Goal: To enhance patient-centered care by a focused educational intervention utilizing multidisciplinary point of care rounds. Medical teams include physicians, residents and nurses who participate in series of workshops and didactic lectures. Knowledge of PGC model assessed prior and post education. Service assessed by evaluating trends on the Press Ganey Scores.
Role: Project Director

2008-2010 Empire Clinical Research Investigator Program
New York State Department of Health
High Fiber Diet and Coronary Artery Disease
Goal: To perform a dietary assessment of dialysis patients' adherence to a heart healthy diet regimen.
Role: Principal Investigator

2002-2003 National Kidney Foundation
Functional and Clinical Outcome of gene polymorphism in PD1
Goal: To study PD1-PDL1 polymorphisms and graft survival.
Role: Nephrology Fellow

D. Relevant Publications

Mustafa A, Asmar S, Wei C, Afif J, Khan S, Rizvi T, Grovu R, Weinberg M, El-Sayegh S. Underutilization of left heart catheterization in kidney transplant patients presenting with non-ST segment elevation myocardial infarction. Am Heart J Plus. 2023 May 4;30:100300. doi: 10.1016/j.ahjo.2023.100300. PMID: 38510924; PMCID: PMC10946038.

Javed, A., Alvi, M.J., Afif, J. El-Sayegh S, El-Charabaty E. Is Aquapheresis ready for prime time yet for congestive heart failure? A systemic review of the literature. Ren Replace Ther 9, 24 (2023). https://doi.org/10.1186/s41100-023-00477-0

Hamadi R, Sakr F, Aridi H, Alameddine Z, Dimachkie R, Assaad M, Asmar S, ElSayegh S. Heparin-Induced Thrombocytopenia in Chronic Hemodialysis Patients. Clin Appl Thromb Hemost. 2023 Jan-Dec;29:10760296231177993. doi: 10.1177/10760296231177993. PMID: 37253454; PMCID: PMC10233607.

Akel T, Elsayegh S. Renal Artery Rupture in Association With Fibromuscular Dysplasia. J Investig Med High Impact Case Rep. 2018 Mar 16;6:2324709618762585. doi: 10.1177/2324709618762585. PMID: 29568781; PMCID: PMC5858621.

Pandya B, Chalhoub JM, Parikh V, Gaddam S, Spagnola J, El-Sayegh S, Bogin M, Kandov R, Lafferty J, Bangalore S. Contrast media use in patients with chronic kidney disease undergoing coronary angiography: A systematic review and meta-analysis of randomized trials. Int J Cardiol. 2017 Feb 1;228:137-144. doi: 10.1016/j.ijcard.2016.11.170. Epub 2016 Nov 9. Erratum in: Int J Cardiol. 2017 May 15;235:205. doi: 10.1016/j.ijcard.2017.03.021. Chaloub, Jean [corrected to Chalhoub, Jean M]. PMID: 27863354.

Saad M, Karam B, Faddoul G, Douaihy YE, Yacoub H, Baydoun H, Boumitri C, Barakat I, Saifan C, El-Charabaty E, Sayegh SE. Is kidney function affecting the management of myocardial infarction? A retrospective cohort study in patients with normal kidney function, chronic kidney disease stage III-V, and ESRD. Int J Nephrol Renovasc Dis. 2016 Jan 22;9:5-10. doi: 10.2147/IJNRD.S91567. PMID: 26858529; PMCID: PMC4730996.

Khan A, Nasr P, El-Charabaty E, El-Sayegh S. An Insight Into the Immunologic Events and Risk Assessment in Renal Transplantation. J Clin Med Res. 2016 May;8(5):367-72. doi: 10.14740/jocmr2411w. Epub 2016 Mar 20. PMID: 27081421; PMCID: PMC4817575.

Khan A, El-Charabaty E, El-Sayegh S. Fungal infections in renal transplant patients. J Clin Med Res. 2015 Jun;7(6):371-8. doi: 10.14740/jocmr2104w. Epub 2015 Apr 8. PMID: 25883698; PMCID: PMC4394908.

Saifan C, Saad M, El-Charabaty E, El-Sayegh S. Warfarin-induced calciphylaxis: a case report and review of literature. Int J Gen Med. 2013 Aug 9;6:665-9. doi: 10.2147/IJGM.S47397. PMID: 23966800; PMCID: PMC3745288.

Geara AS, Azzi N, Bassil C, El-Sayegh S. Aspirin resistance in hemodialysis patients. Int Urol Nephrol. 2012 Feb;44(1):323-5. doi: 10.1007/s11255-010-9811-y. Epub 2010 Jul 25. PMID: 20658355.

Geara AS, Ayoub I, Abi Rached J, Siddique MN, Ghimire P, El-Sayegh S. Does hemodialysis affect clopidogrel resistance as measured by VerifyNow P2Y12 test? Am J Cardiol. 2011 Apr 1;107(7):1103-4. doi: 10.1016/j.amjcard.2011.01.003. PMID: 21419895.

BIOGRAPHICAL SKETCH

NAME: Mario R. Castellanos

POSITION TITLE: Associate Chair & Clinical Director of Research, Department of Medicine

EDUCATION

INSTITUTION AND LOCATION	DEGREE	Dates	FIELD OF STUDY
The Sophie Davis School of Biomedical Education-CUNY, New York, NY	B.S./M.D.	1984 -1989	7-year accelerated program Chemistry/Medicine
Albany Medical College, Albany, NY	M.D.	1989 - 1991	Medicine
New York Hospital - Cornell Medical Center, NY	Postdoctoral Fellow	1991 - 1993	Surgical Pathology
Staten Island University Hospital, Northwell Health, NY	Residency	1994 - 1997	Internal Medicine
Staten Island University Hospital, Northwell Health, NY	Chief Resident	1997 - 1998	Internal Medicine

Personal Statement:
As Associate Chair and Clinical Director of Research in the Department of Medicine at Staten Island University Hospital, Northwell Health, I have dedicated my career to advancing medical education, research, and patient care. My journey as a physician-researcher began with a focus on women's health, leading to discoveries in HPV-related diseases and innovative treatment strategies. Over the years, I have expanded my research to include antiviral development, leading to patents. My work in drug discovery sparked a strong interest in AlphaFold & Machine learning, leading to AI applications into clinical practice and medical education.

A core aspect of my professional mission has been integrating research into medical education. In my role as Associate Chair & Research Director, has led to numerous educational initiatives designed to enhance residents' clinical skills while fostering a culture of inquiry and continuous learning. My projects frequently involve interdisciplinary collaboration, creating an environment where clinicians and researchers can work together to turn scientific discoveries into tangible improvements in patient care.

Recently, I have spearheaded AI-focused initiatives within our department, including workshops and publications on integrating AI into clinical practice and education. This grant proposal aligns with my commitment to advancing medical education through innovative technologies. By incorporating AI into residency training, we aim to equip future physicians with the tools needed to thrive in an evolving healthcare landscape. My devotion to medical education, coupled with a proven track record in research and mentorship, positions me to successfully co-lead this initiative, ensuring that our residents are prepared to navigate the intersection of technology and compassionate patient care.

B. Positions and Honors

1999-Present University Faculty Practice Physician, Dept. of Medicine, Staten Island University Hospital
2002-Present Director, Medical Women's Health, Department of Medicine, Staten Island University Hospital,
2009-Present Clinical Director of Research, Department of Medicine, Staten Island University Hospital Site
2017-Present Research Associate Professor, Medicine Dept., SUNY Health Science Center at Brooklyn
2018-Present Associate Chair, Department of Medicine, Staten Island University Hospital

Selected Honors, Awards,

2005 Attending Physician Research Award. Awarded by Staten Island University Hospital, Department of Medicine. Dedication and commitment to research.
2013 Institutional Research Day, Best Research Project- Advancement of Science Awarded by GME Committee Staten Island Division Northshore-LIJ Health System
2021 Winning Finalist 2021, Innovation Challenge, Awarded by Northwell Ventures
2023 Research Innovation Awarded by Partner's Council for Women's Health & The Katz Institute for Women's Health

C. Contributions to Education: I have piloted AI initiative into residency training through workshops and research initiatives. Key publications, such as "Enhancing Medical Education & Research: Leveraging the AI Revolution" and "AI Frontiers in Oncology" , reflect collaborative projects with residents to advance AI literacy in clinical practice. Additionally, my recent work on the "CARE" framework underscores the importance of blending technology with compassionate patient care, equipping residents to excel in both scientific and humanistic aspects of medicine.

1. Di Pietro, G. E., El Sayegh, S., Diab, W., Gaballa, D., **Castellanos, M.** "Enhancing medical education & research: Leveraging the AI revolution". Journal of General Internal Medicine (2024), 39 (Suppl 2): S582

2. Sharma, R., Di Petro, G., Rajupet, S., El-Sayegh, S., Kwok, Y. F. R., Dhar, M., Bershadskiy, A., Gut, T., **Castellanos, M. R**. "AI frontiers in oncology: Bridging the gap between humanity and machine". Journal of Clinical Oncology, 42(16_suppl), e13657.

3. Strange TJ, **Castellanos MR**. Medicine-Both a Science (Care) and an Art (CARE). JAMA. 2024 Apr 23;331(16):1357-1358

4. Farberov, M., Strange, T., Yurkins, D., El Sayegh, S., Smith, M., Ahern, K., Khattar, G., Gut, T., **Castellanos, M.** "Enhancing patient experience through real-time feedback and a patient-centered care model". Journal of General Internal Medicine (2024), 39 (Suppl 2):S499

D. Additional Information: Research Support and/or Scholastic Performance

My research explores how cancer evolves to escape cellular control, using advanced technologies to identify new drugs. This work integrates efforts from postdocs, residents, and students, driving therapeutic developments through collaborative, multidisciplinary research teams

Selected key publications include:

1. **Castellanos MR,** Fanous E, Thaker R, Flory MJ, Seetharamu N, Dhar M, Starr A, Strange TJ. Expression patterns and clinical significance of estrogen receptor in non-small cell lung cancer. Pathol Res Pract. 2023 Jan;241:154298**.**

2. Einbond LS, Zhou J, Wu H, Mbazor E, Song G, Balick M, DeVoti JA, Redenti S, **Castellanos MR**. A novel cancer preventative botanical mixture, TriCurin, inhibits viral transcripts and the growth of W12 cervical cells harboring extrachromosomal or integrated HPV16 DNA. British J. Cancer 2021 Mar;124(5):901-913.

3. Madala S, Rasul R, Singla K, Sison CP, Seetharamu N, **Castellanos MR**.Gender Differences and Their Effects on Survival Outcomes in Lung Cancer Patients Treated With PD-1/PD-L1 Checkpoint Inhibitors. Clin Oncol (R Coll Radiol). 2022 Apr 7:S0936-6555(22)00153-4

4. Mukherjee S, Debata P, Hussaini R, Szerszen A, Chatterjee K, Baidoo J, Sampat S, Navarra J, Fata J, Severinova E, Banerjee P, **Castellanos MR**. "Unique Synergistic Formulation of Curcumin, Epicatechin Gallate and Resveratrol, TriCurin, Suppresses HPV E6, Eliminates HPV+ Cancer Cells, and Inhibits Tumor Progression". Oncotarget 2017 March 29.

5. Khadraoui H, Thappa S, Smith M, Davidov A, **Castellanos MR**. Age-Associated Trends of Vulvar Cancer in the US. Menopause. 2020 Oct 26;28(2):119-125.

Select Grant Funding

Awarded
National Cancer Institute
Program: NCI Cancer Prevention Clinical Trials Network (CP-CTNet)
Project: *"RG1-VLP Vaccine for Prevention of HPV-Associated Cancers"*
Description: Site PI at Northwell on this Phase I trial evaluating the safety and immunogenicity of an RG1 virus-like particle (VLP) vaccine for HPV prevention.
Co-investigator: Mario Castellanos, MD
Status: approved clinical trial in startup phase

National Institutes of Allergy, Immunology & Infectious Diseases
Program: FY18 Virology Branch In Vivo Efficacy Screening
Project: ***"****Novel Anti-viral Botanical Mixture (TriCurin-P) for Papillomavirus Infection"*
Description: TriCurin-P microemulsion was approved for i*n vivo* efficacy testing in an NIAID standardized animal model for screening anti-papillomavirus drug activity
PI: Mario Castellanos, MD
Award: Approved January 2020-2022, Biopharmaceutical Product Development Services

Empire Clinical Research Investigator Program **NY State Department of Health**
"Circulating Tumors Cells Profiles & Response to Immunotherapy in Lung Cancer Patients"
A study examining if tumor cells in the peripheral blood can predict response to checkpoint inhibitors
Role: **Principal Investigator**

July 2018 to Dec 2020 Award $150,000

Empire Clinical Research Investigator Program **NY State Department of Health**
"Ex vivo testing of plant-based formulation on cervical cells."
A study to examine a polyphenol composition with anti-HPV and anti-tumor properties
Role: **Principal Investigator**
July 2016 to July 2018 Award $150,000

Empire Clinical Research Investigator Program **NY State Department of Health**
"Improving Post-Colposcopy Surveillance of HPV-infected women."
A study that evaluates fluorescence spectroscopy and new biomarkers to predict HPV progression.
Role: **Principal Investigator**
July 2011 to July 2013 Award $220,000

BIOGRAPHICAL SKETCH

NAME: **Theodore J. Strange**

POSITION TITLE: Chairman, Department of Medicine

EDUCATION/TRAINING:

INSTITUTION AND LOCATION	DEGREE *(if applicable)*	Completion Date MM/YYYY	FIELD OF STUDY
Manhattan College, Bronx, New York	B.S.	05/1981	Biology
Downstate Medical College Brooklyn, New York	M.D.	05/1985	Medicine
Staten Island University Hospital Staten Island, Staten Island, New York	Residency	06/1988	Internal Medicine
Staten Island University Hospital Staten Island, Staten Island, New York	Chief Resident	06/1989	Internal Medicine

A. Personal Statement

Throughout my extensive career in academic medicine, I have been deeply committed to both the education and the art of healthcare. As Chairman of the Department of Medicine at Staten Island University Hospital, I have dedicated myself to shaping the next generation of healthcare professionals, ensuring that they not only excel in clinical competence but also embody the values of compassion, respect, and empathy. Leading a large internal medicine residency program, I actively engage with residents and fellows through morning reports and case-based discussions, nurturing their critical thinking, diagnostic acumen, and—most importantly—their capacity for patient-centered care.

In today's rapidly evolving healthcare landscape, I recognize that technology, particularly artificial intelligence, has the potential to transform medical practice. However, I firmly believe that it should serve as a tool to enhance, not replace, the essential human elements that define our profession. My philosophy of teaching focuses on integrating technological advancements while preserving the irreplaceable human touch in medicine.

Over the years, my leadership roles have allowed me to guide physicians and students in navigating the delicate balance between the scientific rigor of medicine and the art of healing. My work on initiatives such as the "C.A.R.E." framework (Compassion, Assistance, Respect, Empathy) underscores my dedication to ensuring that healthcare remains grounded in empathy, even as we embrace cutting-edge innovations. This was recent published in Journal of the American Medical Association (JAMA).

This commitment is reflected in my current focus on developing an AI curriculum that aims to foster both technological literacy and compassionate patient care among our trainees. I am passionate about creating educational experiences that not only equip young physicians with the knowledge of AI applications but also emphasize the importance of empathy in patient interactions. As a lifelong educator and mentor, I am dedicated to instilling in my students and colleagues the belief that, while medicine is indeed a science, its true power lies in its art—the ability to connect, comfort, and care.

B. Positions Held

July 2020 – Present	Chairman, Dept of Medicine, Staten Island University Hospital, Northwell Health
August 2020 – Present	Associate Regional Physician Executive, Northwell Health
August 2020 – Present	President, University Physicians Group, a Division of NHPP, Northwell Health
March 2016 – Present	Vice Chairperson, Primary Care, Northwell Health
September 2005 – July 2020	Associate Chairman of Medicine, Staten Island University Hospital, Northwell Health
November 2012 – Present	Office of Professional and Medical Misconduct NYS
January 2011 – Present	New York State Public Health and State Planning and Reviewing Council
October 2003 – Present	Honorary Police Surgeon, City of New York

C. Honors & Awards

November 2023	Arnold Obey "Good Guy Award". Staten Island Running Association, Inc.
December 2019	Physician Advanced Clinical Provider Advocate Award, Staten Island University Hospital
March 2019	SI Heart Society Community Hero Award
December 2018	New York State Senate Liberty Award
August 2018	Emergency Department Award – Employee of the Month
September 2016	Staten Island Economic Development Corporation Health Hero Award
2006 – Present	Department of Medicine for Participation and Distinguished Achievement in Medical Research and Scholarly Activity
2001- 2020	New York Magazine, Top 1500 Physicians, Geriatric Medicine NYC
2023, 2019, 2016, 2013, 2010, 2007, 2004, 1997, 1994, 1990	Physicians Recognition Award, American Medical Association

C. Contributions to Medical Education

Farberov, M., Strange, T., Yurkins, D., El Sayegh, S., Smith, M., Ahern, K., Khattar, G., Gut, T., Castellanos, M. **"Enhancing patient experience through real-time feedback and a patient-centered care model"**. Journal of General Internal Medicine (2024), 39 (Suppl 2):S499

Strange, T, Castellanos, M. Journal of the American Medical Association (JAMA): **Medicine-Both a Science (Care) and an Art (CARE).** JAMA. 2024 Apr 23; 331 (16):1357-1358

Workshops and talks:

Medicine: Both a Science (Care) and an Art (CARE), Bridging Compassion with Innovation. Staten Island University Hospital Grand Rounds, May 2024.

Medical Leadership in Difficult Times. United Nations Global Lecture, May 2024.

Standards of Care Lecture. Northwell Health, September 2018.

D. Additional Information: Research Support and/or Scholastic Performance

Ana Paola Mata Zetina, Sritha Rajupet, Theodore Strange, Meekoo Dhar, Mario R Castellanos. **"Increasing prevalence of HPV-positive vulvar cancer among older women in the US"**. Journal of Lower Genital Tract Disease 2024. Volume 28, Number 3, Supplement 1, pg. S18

Mata Zetina, A.P., Rajupet, S., Strange, T., Dhar, M., Dhulipalla, L., Mokhtar, A., Castellanos, M.R. **Raising trends in HPV(+) & HPV (-) vulvar cancers among US non-Hispanic White and Hispanic White females 50 years or older**. Journal of Clinical Oncology 2024, 42(16_suppl), 562

Kwok, Y.F.R., Einbond, L.S., Tantawi, H., Strange, T., Smith, C., Dhar, M., Bershadskiy, A., Castellanos, M.R. "**Effects of common nutraceutical supplements marketed for cancer prevention on tumor cell growth**." *Journal of Clinical Oncology* (2024): n. pag.

Wei C, Horeczko J, Mustafa A, Strange T, Patel V, Castellanos M. **US Trends of Vulvovaginal Melanoma: A Silent Increase Despite Improvements in Cervical Cancer Incidence Rates**. Journal of Clinical Oncology, 42 (16_suppl), e2250, July 2023,

Wei C, Mustafa A, Strange J, Grovu R, Strange T, Friedman AJ, Bradu S, Garg A, El-Sayegh SE. (2023). **Association of Chronic Kidney Disease with Hidradenitis Suppurativa: A retrospective study**. Journal of American Academy of Dermatology International

BIOGRAPHICAL SKETCH

NAME: Chloe Lahoud

POSITION TITLE: Internal Medicine Resident Physician (PGY-2)

EDUCATION/TRAINING:

INSTITUTION AND LOCATION	DEGREE *(if applicable)*	Completion Date MM/YYYY	FIELD OF STUDY
American University of Beirut, Beirut, Lebanon	B.S.	05/2017	Biology
American University of Beirut, Beirut, Lebanon	M.D.	05/2021	Medicine
Brigham and Women's Hospital, Boston, MA, USA	Post-doctoral fellowship	06/2023	Infectious Diseases
Staten Island University Hospital, New York, USA	Residency	Expected 06/2026	Internal Medicine

A. Personal Statement

I am a second-year Internal Medicine resident at the Staten Island University Hospital, Northwell Health, in Staten Island, New York. After medical school, driven by my strong interest in research, I completed a 2-year post-doctoral research fellowship at the Brigham and Women's Hospital in Boston. During this time, I worked on basic, clinical, and translational research, aiming to develop a breath-based diagnostic test for microbial etiology (bacterial and/or fungal) of pneumonia. I also participated in leading a clinical trial assessing the safety of the monoclonal antibody drug Sotrovimab (VIR-7831) for prophylaxis against COVID-19 infection in immunocompromised individuals with Impaired SARS-CoV-2 Humoral Immunity. In this role, I oversaw research projects and guided my teammates through research project designs.

After starting my internal medicine residency, my desire to continue contributing to the high-quality impactful body of research kept growing. I was selected for a competitive research track, which includes additional dedicated time for research. I completed certificates about good clinical practice research, principles of research, and ethical and regulatory aspects of clinical research. I am strongly drawn to medical education, and I am planning to pursue a career as a well-grounded academic physician-researcher contributing to medical education.

Throughout my first year of residency, I led multiple projects exploring the evolving role of artificial intelligence (AI) in medicine. Notably, my team assessed ChatGPT's accuracy in managing gastroesophageal reflux disease compared to traditional search engines, highlighting AI's potential to transform clinical practice. Building on this experience, I am now actively involved in developing the AI curriculum for this grant, collaborating with experts to design workshops that meet residents' learning needs. My commitment to advancing medical education, combined with my research background, positions me as a strong advocate for integrating AI into residency training. As a liaison for the resident perspective, I aim to ensure the curriculum is both impactful and relevant, bridging the gap between emerging AI technologies and patient-centered care.

B. Positions Held

July 2024 - Present	General Medical Education (GME) Resident Representative, Staten Island University Hospital, New York
June 2024 - Present	Research track, Internal Medicine Residency, Staten Island University Hospital, New York
October 2023 - Present	Teaching Task Force, Staten Island University Hospital, New York
June 2023 - Present	Internal Medicine resident physician (PGY-2), Staten Island University Hospital, New York
July 2021 - June 2023	Post-Doctoral Research Fellow, Brigham and Women's Hospital, Boston

C. Honors & Awards

2022 Brigham Research Appreciation, Brigham and Women's Hospital, Boston, USA
2019 Best Poster Award, Lebanese Society of Clinical Microbiology and Infectious Diseases
2018 Student Leadership Award

C. Contributions to Medical Education: I have advanced clinical knowledge through AI-focused research, including studies on ChatGPT's effectiveness in health information retrieval and the BISAP score's role in predicting acute kidney injury. My work in antimicrobial stewardship programs in Lebanon reflects my commitment to optimizing healthcare. As both a researcher and resident, I bridge AI technology with patient-centered care, making me well-suited to contribute to AI curriculum development in residency training

Chloe Lahoud, Mark Tawfik, Gaetano Di Pietro, Sherif Andrawes. Evaluating ChatGPT's accuracy and helpfulness in gastroesophageal reflux disease queries compared to traditional search engines: A new era of health information retrieval. SN Comprehensive Clinical Medicine. September 2024.

Mark Tawfik, Angelica Rozenfeld, **Chloe Lahoud**, Marc Ishak, Sherif Andrawes. Chat GPT vs. Traditional Search Engines: A New Era in Diverticulitis Information Retrieval. The Permanente Journal. September 2024

Tawfik M, Mourad O, Grovu R, **Chloe Lahoud**, Makram M, Khattar G, Grabie Y, El-Sayegh. BISAP beyond pancreatitis: a new horizon in acute kidney injury prediction. Journal of Pancreatology (Accepted, in press)

Workshops:
Shallal, A.; **Chloe Lahoud;** Merhej, D.; Youssef, S.; Verkler, J.; Kaljee, L.; Prentiss, T.; Joshi, S.; Zervos, M.; Matar, M. The Impact of a Post-Prescription Review and Feedback Antimicrobial Stewardship Program in Lebanon. *Antibiotics* 2022, *11*,642. https://doi.org/10.3390/antibiotics11050642

Anita Shallal, **Chloe Lahoud**, Marcus Zervos, Madonna Matar. Antibiotic stewardship in disaster situations: Lessons learned in Lebanon. Antibiotics 2022; 11(5):560. Available from: https://doi.org/10.3390/antibiotics11050560

D. Additional Information: Research Support and/or Scholastic Performance

Chloe Lahoud, Morcos Z, Njeim R, Tawfik M, Aslam T, El-Sayegh S. Understanding Acute Pancreatitis in End-Stage Renal Disease: Unraveling etiologies, clinical presentations, management strategies, and complications: a narrative review. Journal of Pancreatology ():10.1097/JP9.0000000000000182, April 12, 2024. | DOI: 10.1097/JP9.0000000000000182

Wahbah Makhoul, G., **Chloe Lahoud,** Asogwa, N. *et al.* Infective Endocarditis in Pregnancy: Unveiling the Challenges, Outcomes, and Strategies for Management. *SN Compr. Clin. Med.***6**, 66 (2024). https://doi.org/10.1007/s42399-024-01694-2

Chloe Lahoud, Mark Tawfik, Ahmed Elfiky, Harika Kandlakunta, Jean Chalhoub. Duodenal Gangliocytic Paraganglioma: A case report. ACG Case Reports Journal. September 2024.

Chloe Lahoud, Mark Tawfik, Liliane Deeb, Sherif Andrawes. Endoscopic Submucosal Dissection (ESD) for en-bloc removal of a large obstructing duodenal mass. Clinical gastroenterology and hepatology. September 2024.

Chloe Lahoud, Whitney Hovater, Angela Rosenberg, Gennifer Wahbah Makhoul, Gita Vatandoust, Mohamad Maruf. Calcium Channel Blocker and Angiotensin Receptor Blocker Toxicity. HCA Healthcare Journal of Medicine. August 2024.

LETTERS OF SUPPORT

Staten Island University Hospital
Northwell Health

November 6, 2024

To Whom It May Concern:

It is with great enthusiasm that I write this letter of support for Dr. Suzanne El-Sayegh for her project titled, "Bridging the Gap: An AI Curriculum for Internal Medicine Residents and Faculty". As the Program Director for the Internal Medicine Residency Program and Associate Chair for the Department of Medicine at Staten Island University Hospital, this project aligns with your continued mission to drive the academic endeavors of SIUH and Northwell.

This project is particularly interesting as it looks to advance the knowledge of our students, residents, and faculty in an evolving field. The educational components of this project are sure to improve our residents' knowledge, comfort, and skill, and prepare them for the future of clinical care using AI. It was said to me: "AI will not replace physicians, rather physicians that don't use AI will be replaced by those that do". I believe this to be the case.

This project is forward thinking and will enhance the competence and understanding of AI in medicine. It is projects like this that prepare us for the future practice of medicine, fostering the delivery of high-quality, patient-centered care for years to come. I offer my full support for your proposal. Please feel free to contact me with any questions.

Sincerely,

Nicole Berwald, MD, FACEP
Medical Director
Staten Island University Hospital
Northwell Health

Northwell[SM]
Staten Island University Hospital

November 12, 2024

Academy of Medical Educators
The Lawrence G. Smith Fund for
Innovation in Medical Education
Grant Review Committee

Re: Mario Castellanos, M.D.

Dear Committee Members:

I am especially pleased to write a letter supporting the application of Dr. Mario Castellanos for a Medical Innovation Grant from the Academy of Medical Educators. In my capacity as Chair of the Department of Pediatrics for 20 years (thru June 2024) and Associate DIO and Vice President of Medical Education for 12 years (and running), I have interacted with Dr. Castellanos extensively in the realms of medical education, research, and innovation. Throughout those years, he has consistently shown an astute appreciation for gaps in clinical education and care and the ability to devise solutions to close them. Early in his tenure at SIUH after recognizing deficits in the training of internal medicine residents in many aspects of women's health, he established a comprehensive Women's Health Program including Medical -gynecology clinics for these trainees. As he consolidated that program, he was named Director of Medical Women's Health in the Department of Medicine. To this day, this clinic has been a mainstay for Internal Medicine Residency

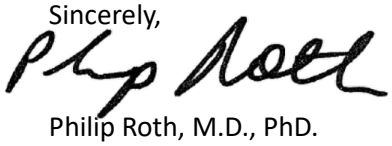
In his research endeavors, which have been extensive, he applied similar problem-solving skills to address the subjectivity and inaccuracy of the cervical intraepithelial neoplasia (CIN) label in the classification of cervical cancers. With this deficit in clinical care identified, he systematically went about identifying biomarkers to more precisely define CIN and also developed a method using fluorescence spectroscopy in cervical biopsy hematoxylin and eosin-stained preparations to grade CIN in a more precise manner. Alongside his many research endeavors, he took on a central role as Clinical director of Research in the Department of Medicine in mentoring residents in research methodology beginning with hypothesis development, data analysis and manuscript preparation. I am confident in saying that his efforts have resulted in many resident abstract submissions, poster presentations, oral presentations and publications in the medical literature.

A consistent theme for Dr. Castellanos has included the adoption of novel approaches to address a variety of problems. It therefore comes as no surprise that he was one of the early adopters of the use of Artificial Intelligence (AI) at our institution. In fact, he helped organize a symposium at SIUH examining the role of AI in medicine and has consistently advocated continued exploration of its clinical applications within a thoughtful and ethical framework. As it becomes clear that physicians who not use AI will be displaced by those that do, I can think of few people more qualified than Dr. Castellanos to help create an educational program for internal medicine trainees to learn the basics of AI and its myriad

potential roles. I therefore give my wholehearted support to Dr. Castellanos in his application for the the Lawrence Smith Fund for Innovation in Medical education grant and assure you that I, together with the SIUH Office of Academic Affairs, will enthusiastically support his efforts in this endeavor.

If you require additional information, please do not hesitate to call upon me.

Sincerely,



Philip Roth, M.D., PhD.
Vice President of Medical Education
Staten Island University Hospital
Associate DIO and Professor of Pediatrics
Vice President of Academic affairs
Zucker School of Medicine at Hofstra/Northwell

Staten Island University Hospital
Northwell Health®

November 6, 2024

To Whom It May Concern:

It is with great enthusiasm that I write this letter of support for Dr. Theodore Strange for his project titled, "Bridging the Gap: An AI Curriculum for Internal Medicine Residents and Faculty". As the Chair for the Department of Medicine at Staten Island University Hospital, this project aligns with your continued mission to drive the academic endeavors of SIUH and Northwell.

This project is particularly interesting as it looks to advance the knowledge of our students, residents, and faculty in an evolving field. The educational components of this project are sure to improve our residents' knowledge, comfort, and skill, and prepare them for the future of clinical care using AI. It was said to me: "AI will not replace physicians, rather physicians that don't use AI will be replaced by those that do". I believe this to be the case.

This project is forward thinking and will enhance the competence and understanding of AI in medicine. It is projects like this that prepare us for the future practice of medicine, fostering the delivery of high-quality, patient-centered care for years to come. I offer my full support for your proposal. Please feel free to contact me with any questions.

Sincerely,

Nicole Berwald, MD, FACEP
Medical Director
Staten Island University Hospital
Northwell Health

475 Seaview Avenue | Staten Island, NY 10305 | Tel (718) 226-9000
375 Seguine Avenue | Staten Island, NY 10309
One Edgewater Plaza | Staten Island, NY 10305

Staten Island University Hospital
Northwell Health

November 12, 2024

To Whom It May Concern,

I am delighted to write this letter in strong support of Dr. Chloe Lahoud for her application to "The Lawrence G. Smith Fund for Innovation in Medical Education" through the Academy of Medical Educators (AME). Dr. Lahoud, currently a resident physician in the Research Track at Staten Island University Hospital's Internal Medicine Department, has demonstrated exceptional dedication to advancing medical education through innovative approaches.

Dr. Lahoud's project, "Bridging the Gap: An AI Curriculum for Internal Medicine Residents and Faculty," aligns seamlessly with the goals of this prestigious grant. Her experience in research, including her post-doctoral fellowship at Brigham and Women's Hospital's Infectious Diseases Department, has uniquely equipped her with the skills necessary to lead a project at the intersection of artificial intelligence and medical education. Her project proposes a forward-thinking curriculum that will empower residents and faculty alike to integrate AI effectively into clinical practice, enhancing diagnostic accuracy and patient care.

Dr. Lahoud has established herself as a leader in research and education. Her published works span a range of impactful topics, including AI applications in gastroenterology and infectious diseases, antimicrobial stewardship, and predictive models for complex clinical conditions. Her dedication to improving healthcare delivery through research and education exemplifies the innovative spirit that this fund seeks to promote.

I am confident that Dr. Lahoud's expertise, combined with her collaborative approach and commitment to education, will make her a valuable asset to this initiative. I offer my enthusiastic support for her application to "The Lawrence G. Smith Fund for Innovation in Medical Education." Please feel free to contact me should you require any further information.

Sincerely,

Thomas Gut, D.O.
Associate Chair of Medicine
Associate Program Director - Internal Medicine Residency
Assistant Professor of Medicine
Donald and Barbara Zucker School of Medicine at Hofstra/Northwell
Tel: 718-226-8677
Cell/Text: 347-370-2205 (Preferred)

INSTITUTIONAL REVIEW BOARD (IRB) APPROVAL Documentation

Below is a screenshot of the IRB application that was submitted for this proposal. The study is under review and is expected to have all the IRB approvals by the time the proposal is reviewed.

Use this form to submit a new study for IRB review to Northwell IRB or for institutional approval when using an external IRB.

Initial Application Data Entry
- Submitted 11/14/2024 5:14 PM ET by Lahoud, Chloe

General Information

Submitted by Add Note View Audit

Lahoud, Chloe
Email: clahoud@northwell.edu **Phone:**

Submitter Phone Number Add Note View Audit

8572689329

Study Title Add Note View Audit

Bridging the Gap: Developing an AI Curriculum for Internal Medicine Education

If this is a grant, please make sure the study title matches the grant title exactly.

Principal Investigator Add Note View Audit

El-Sayegh, Suzanne E MD
Email: Selsayegh@northwell.edu **Phone:**

Enter PI name here. If the PI name is not coming up, PI has not signed into IRBmanager to create his/her account. Please contact the PI and ask him/her to sign in to IRBManager one time so his/her account is activated.