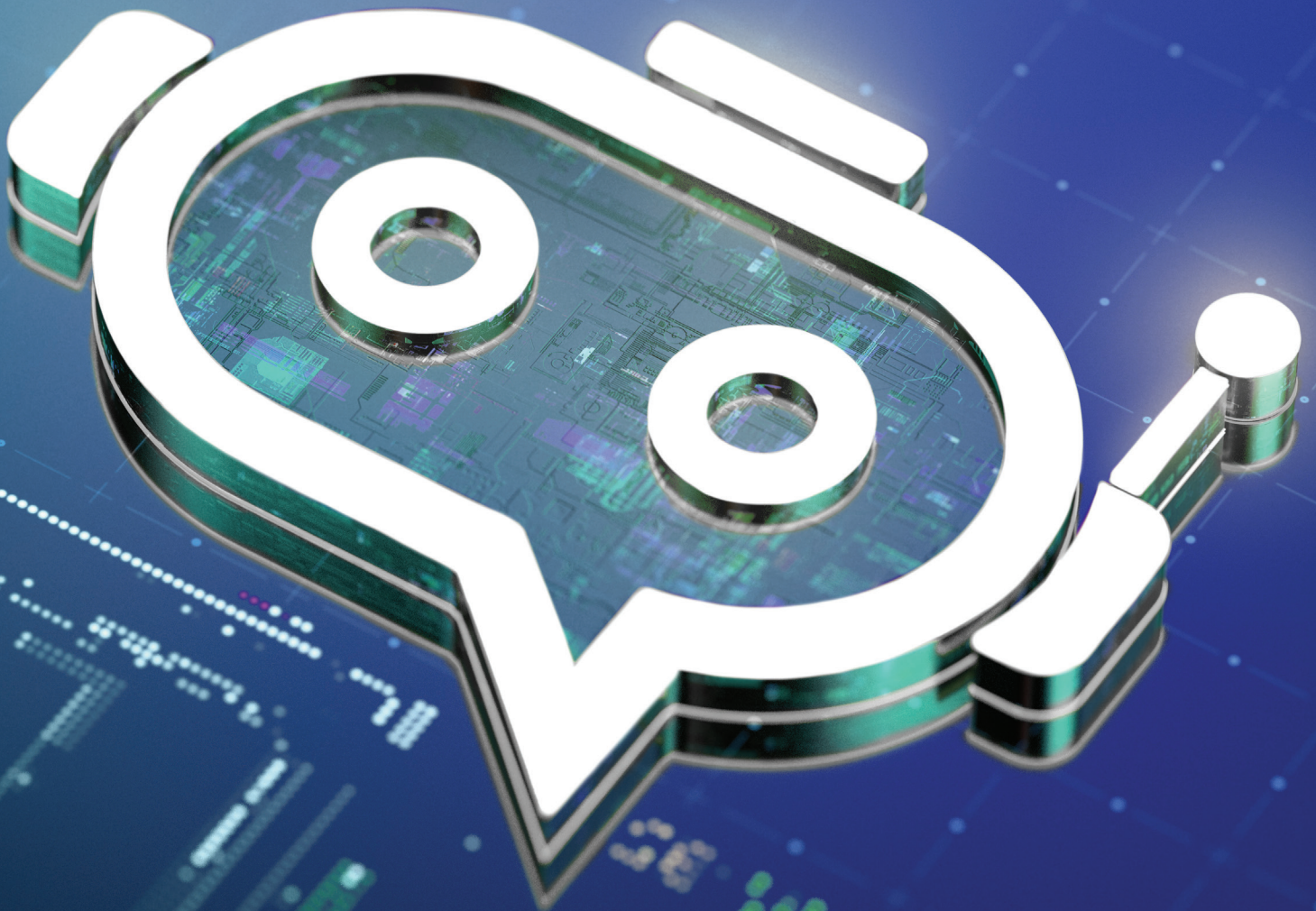


# Precision+Innovation

Defining the Future of Ophthalmology | Spring 2024



New York  
Eye and Ear  
Infirmary of  
Mount  
Sinai







## **13th Annual Steven M. Podos, MD, Symposium and Lecture: Connectivity and Community in Ophthalmology**

### **Date and Time:**

Friday, June 7, 2024  
7:45 am - 4:30 pm EDT

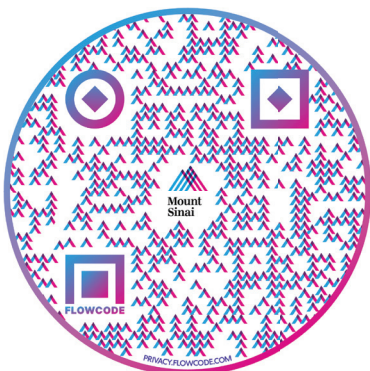
### **Location:**

New York Academy of Medicine  
1216 5th Avenue, NY, NY

This live and on-site activity is designed to provide participants with an update on a variety of topics related to innovations in the fields of cornea, glaucoma, neuro-ophthalmology, oculoplastics, pediatric ophthalmology, retina, and oncology.

**For additional information and to register, visit:**

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## Message From James C. Tsai, MD

*President, New York Eye and Ear Infirmary of Mount Sinai  
Delafield-Rodgers Professor and Chair, Department of Ophthalmology  
Icahn School of Medicine at Mount Sinai  
Mount Sinai Health System*

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As ophthalmologists, we've all heard about the potential of artificial intelligence (AI) to reshape our field—to transform how we diagnose and treat ocular disease. But how much of that talk is just hype?

The findings of a new breakthrough study from New York Eye and Ear Infirmary of Mount Sinai (NYEE), described in one of the two accompanying articles, should help put that question to rest. Pitting a large language model AI system, GPT-4, against a group of our glaucoma and retina specialists, AI matched or in some cases even outperformed humans in terms of case assessments and treatment plans.

As technology continues to improve, the benefits of AI and machine learning will come into sharper focus. While we'll always need skilled ophthalmologists to manage patient care, a new era of algorithmic tools can significantly enhance that care by augmenting, verifying, and providing new clinical insights. The biggest beneficiary will be patients, who can expect better outcomes as physicians have more time to communicate with them about their conditions and the importance of maintaining therapeutic regimens and necessary lifestyle changes.

I'm proud to say that NYEE is in the vanguard of the AI movement through the recent creation of the Center for Ophthalmic Artificial Intelligence and Human Health, which I serve as founding director. The critical research this Center is

conducting will not only leave its mark on ocular disease, but on cardiovascular, neurologic, and retinal vascular disorders, thanks to the unique window ophthalmology affords into these systemic conditions.

I think you'll find the second article in this package just as informative, as it underscores how structured and coordinated care from a multidisciplinary team can make a difference for patients with highly complex needs. In this case, the patient is a three-year-old whose concurrent issues of dermolipoma, eyelid coloboma, amblyopia, astigmatism, and ectropion were jointly addressed in an eight-hour, multi-part surgical procedure at The Mount Sinai Hospital last fall. That surgery brought together an oculoplastic surgeon, a cornea specialist, an ENT doctor, and a pediatric ophthalmologist.

At NYEE, we've learned the importance of not just having a full team of specialists in the room, but making sure they have the most appropriate tools and technologies to deliver the best possible results to patients. For the latter, we're fortunate to be able to draw on the vast resources of the Icahn School of Medicine at Mount Sinai, one of the nation's leading research institutions. While not everyone has that benefit, of course, our experience with complex surgery and ongoing patient care can hopefully offer some insights to enlighten your ophthalmic practice. For that reason, we invite you to peruse the attached articles.





# How Good Is AI?

## A New Study From NYEE Shows It Can Outperform Seasoned Ophthalmology Specialists

**Ophthalmologists skeptical about the performance of artificial intelligence (AI) in their specialized field may find a new study from New York Eye and Ear Infirmary of Mount Sinai (NYEE) an eye-opener.**

Researchers demonstrated that a large language model (LLM) AI system can match, or in some cases outperform, human ophthalmologists in diagnosis and decision-making about glaucoma and retina disease. The study, published in the February issue of *JAMA Ophthalmology*, compared the knowledge of ophthalmic

specialists against the capabilities of the latest-generation LLM system, GPT-4 (Generative Pre-trained Transformer 4) from OpenAI, designed to scale up deep learning to replicate human-level performance.

“We applied GPT-4 to clinical data it had never seen before, and it proved in our small sample size to be better than glaucoma specialists in its assessments and treatment plans, and at least as good as retina specialists in those same areas,” says Louis Pasquale, MD, senior author of the study and Deputy Chair for Research, Department of Ophthalmology,

Icahn School of Medicine at Mount Sinai. “Artificial intelligence is pretty astounding in terms of what it can do. Access to GPT-4 is like having the world’s knowledge at your fingertips.”

Advanced AI tools are seen by many as revolutionizing the field of medicine in the years ahead. Trained on vast amounts of patient data, text, and images, they have already shown an ability to diagnose and provide treatment guidance and confirmation on cases ranging from routine to complex. Those strengths could prove particularly valuable to ophthalmic specialists who typically handle large

caseloads. Through its high level of accuracy and the comprehensiveness of its LLM-generated clinical responses, AI has the potential to ease some of that workload, giving ophthalmologists more time to practice evidence-based medicine.

For the human side of their study, the NYEE research team recruited 12 attending specialists and three senior trainees from the Department of Ophthalmology at Mount Sinai. A basic set of 20 commonly asked questions (10 each for glaucoma and retina disease) by patients was randomly selected from the American Academy of Ophthalmology's "Ask an Ophthalmologist," along with 20 de-identified patient cases culled from Mount Sinai-affiliated eye clinics. Responses from both the GPT-4 system and human specialists to each question and patient case were then elicited, and statistically analyzed and rated for accuracy and comprehensiveness using a Likert scale, commonly used in clinical research to score responses.

The results showed that AI matched or outperformed human specialists in terms of both accuracy and completeness of its assessments. More specifically, it demonstrated superior performance in response to glaucoma questions and case management advice, while reflecting a more balanced outcome in retina disease, where AI matched



**Andy S. Huang, MD**



**Louis Pasquale, MD**

humans in accuracy but exceeded them in completeness.

GPT-4 is currently in use by a coterie of early adopters at NYEE, including Andy S. Huang, MD, a PGY-2 ophthalmology resident and lead author of the study. "Most of the time we use AI to confirm what we already know—the nitty-gritty details of a case—but other times it can give us new insights and point us in directions we hadn't thought about," Dr. Huang says. "For me, it's been transformative in providing access to information and generating assessment plans that, as our study showed, are similar to if not better than those of top-level subspecialty doctors."

Beyond diagnosis and treatment of ocular disorders, artificial intelligence could potentially play an important role in physician education and research—pathways that are being carefully explored at NYEE. According to Dr. Pasquale, plans are afoot to incorporate AI into lectures and the overall resident training experience, as well as into research projects as a way of familiarizing young investigators with the promising new technology.

Another way NYEE plans to set the stage for AI in clinical practice is by working with the Center for Ophthalmic Artificial Intelligence and Human Health, launched last year by NYEE in partnership with Icahn Mount Sinai, to develop breakthrough applications for AI-driven diagnosis and clinical care of eye disease. As one example, the Center will soon embark on a program to further automate, using artificial intelligence, NYEE's innovative central retinal artery occlusion initiative to reduce the time it takes to diagnose this medical emergency and get patients started on sight-saving treatment.

"I've started using GPT-4 along with colleagues who have very busy ophthalmology practices, and we're excited about the prospect of putting the technology to work in ways that aren't even clear to us yet," notes Dr. Pasquale.



# A Three-Year-Old With Multiple Disorders Meets an Ophthalmic Team With Multiple Talents

**By three years of age, Avery Mury nec had made up her mind to become an ophthalmologist. She certainly had no lack of role models.**

The toddler, born with malformations of the right side of her face and eyelid, and her parents were no strangers to doctors' offices and operating rooms. Many were at New York Eye and Ear Infirmary of Mount Sinai (NYEE), whose multidisciplinary specialists have addressed, nearly since Avery's birth, such recurring issues as dermolipoma, eyelid coloboma, amblyopia, ectropion, astigmatism, and repeated ear infections.

At no point was the breadth and depth of that clinical brilliance on fuller display than in an eight-hour operation in September 2023, which brought together an oculoplastic surgeon, a cornea specialist, a pediatric ophthalmologist, and an otolaryngologist for a marathon day of surgery.

"It was amazing how they were able to coordinate all these specialists in one room to get such a complex job done," remarks Avery's father, Mark. "It took a tremendous load off our minds."

Timing was of utmost concern for the team. "Because good vision is still forming in a child that young, any interruption can freeze the process in a less-than-perfect state," says Tamiesha Frempong, MD, MPH, Assistant Professor of Ophthalmology at the Icahn School of Medicine at Mount Sinai, who has played a critical role in managing Avery's ongoing care as her pediatric ophthalmologist. "For that reason, we knew we had to address her problems quickly."

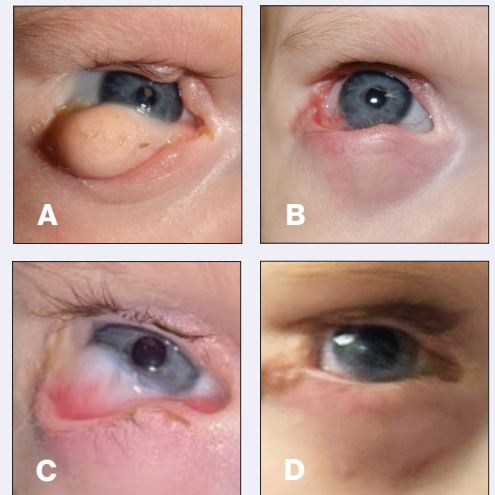
Indeed, the problems that confronted team members as they entered the surgical suite at The Mount Sinai Hospital last fall were manifold. Avery's lower eyelid was turned out and



essentially stuck to her cornea, making it difficult to close the eye. A large dermolipoma mass was present with scar tissue that had regrown on the surface of the cornea. Astigmatism aggravated by recurring scar tissue was compromising visual development of the affected right eye and, if not properly treated and managed, could lead to irreversible blindness in that eye.

"Aware of the high stakes involved, we made the collective decision to perform the multi-part, same-day surgery, including major eyelid reconstruction," explains Valerie I. Elmaleh, MD, Associate Professor of Ophthalmology at Icahn Mount Sinai and the oculoplastic surgeon on the case.

Adds Neha Shaik, MD, a cornea specialist who, like each member



**A:** Appearance as an infant, age 6 months, prior to the first surgery on her eye. Large inferior fornix lesion removed initially measured 2.2 cm x 1.5 cm x 0.4 cm. **B:** After first removal of the dermolipoma with no lesion on the cornea. **C:** Regrowth of the dermolipoma/scar tissue onto the cornea with ectropion, age 2.5 years. **D:** Four months after the second surgery, age 3 years 10 months. The cornea is clear and the lower eyelid is in good position.

of the team, remained in the OR and assisted others throughout the entire procedure: “Most hospitals would have had trouble handling this type of long and complex case, but everybody was on board and we came up with a common plan to enable this very young patient to hopefully see better for the rest of her life. And for me, it was fascinating to see the different specialties interacting so seamlessly.”

Dr. Shaik, an Assistant Professor of Ophthalmology at Icahn Mount Sinai, was familiar with Avery’s pathology. She had been part of the surgical team that operated on four-month-old Avery to help close a coloboma of the upper eyelid, as well as to remove the dermolipoma attached to the cornea and lower fornix of the inside of the eyelid. Not unexpectedly, that scar tissue soon returned, fueling the patient’s astigmatism—and bringing Dr. Shaik back to the OR in September to again excise a benign mass on the inferior cornea. That fibrous tissue was now huge compared to the size of the eye itself, was deep seated, and had grown multiple connections to not just the cornea but the skin and inferior fornix. Given its complexity, Dr. Shaik decided to perform a conjunctiva autograft once the dermoid was removed. Taking a small piece of tissue from the upper conjunctiva under the eyelid, Dr. Shaik transplanted it to the bottom part of the sclera, securing it in place with fibrin glue—followed by placement of a large amniotic membrane graft to promote healing and prevent recurrence of the inferior corneal mass.

The spotlight then turned to Dr. Elmalem’s reconstructive surgery to address the eyelid malformations, lower fornix, and orbital portions of the dermolipoma mass, and to try to prevent recurrence of the eyelid scarring to the cornea. To minimize damage to the eye muscle, Drs. Elmalem and Frempong worked together to remove the large inferior orbital portion of the dermolipoma that was attached to the inferior rectus muscle.

Also integral to this procedure was harvesting a mucous membrane graft from the inside of the patient’s mouth with the assistance of Aldo Londino III, MD, Assistant Professor of Pediatric Otolaryngology at Icahn Mount Sinai, allowing Dr. Elmalem to transplant it to the inside of the eyelid to basically recreate the conjunctival fornix. (Dr. Londino also played a

key role in the day’s surgery by implanting ear tubes to guard against the patient’s frequent inner ear infections.)

Dr. Elmalem applied amniotic membrane to the remaining regions of exposed sclera and affixed symblepharon rings under the upper and lower eyelids to keep the conjunctiva and eyelid from fusing with scar tissue. The ectropion was also repaired to allow better closure of the eyelids.

A postsurgical assessment underscores the importance of Avery’s omnibus surgery. “She still has astigmatism in the right eye, but it’s much better than it was before the dermoid was removed, and will continue to improve,” advises

Dr. Frempong. “She’s also able to close her eye now, and vision in her right eye (now 20/70) is much better than before, when measuring acuity wasn’t even possible.”

Dr. Frempong’s intensive hands-on management includes working closely with the parents to ensure full-time use and the proper strength of corrective glasses, and the application of atropine drops and patching to “penalize” the good eye (which remains at 20/20) while promoting visual growth of the far weaker eye.

“The doctors have tempered our expectations of Avery’s left and right eyes ever looking or performing the same,” acknowledges Lauren, the patient’s mother. “But we’re hopeful that, as she grows and technology and surgical techniques advance, she will benefit from future opportunities. We feel extremely fortunate that NYEE has been part of our team at every step of the way, and that they’ll continue to be with us in the future.”



**Valerie I. Elmalem, MD**



**Tamiesha Frempong, MD, MPH**



**Neha Shaik, MD**



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