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Development and planning for future scenarios in ophthalmology: content generation using a modified Delphi process

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Abstract

Purpose: To identify the most influential drivers shaping the field of ophthalmology and develop expert-derived, consensus-driven future scenarios.
Design: A mixed-methods study.
Methods: A modified Delphi process was performed to develop and build expert consensus on future scenarios within ophthalmology. Initial faculty surveys were used to identify critical drivers in the field. Focus groups with key opinion leaders (KOLs) in the United States were conducted to discuss implications of these drivers within the field in the context of “aspirational”, “conventional”, and “bleak” state scenarios. Focus groups and surveys were qualitatively analyzed using grounded theory principles of coding to develop the future scenarios. Drafted scenarios were then sent back to KOLs for feedback to achieve consensus.

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Results: Twenty-seven faculty responded to an initial survey, identifying five key drivers: artificial intelligence in eye care, health policy and financial reform, physician shortages, the aging population, and research funding. Thirty-one experts participated in five focus groups, yielding 276 coded quotations. Discussion centered most heavily on artificial intelligence (AI) and least on aging. Across all drivers, 51% of coded data reflected conventional projections, 30% aspirational, and 19% bleak. Aspirational futures emphasized whole-person preventive care, AI integration with proper safeguards, equitable workforce distribution, enhanced advocacy for research, and improved care access utilizing assistive technologies. Conversely, bleak futures involved drastic funding cuts, regulatory misalignment in AI, worsening physician shortages, and system overload from demographic pressures.
Conclusion: Scenario planning reveals that ophthalmology's trajectory depends on proactive strategies to strengthen research advocacy, adopt population-based care models, optimize the workforce, and ensure responsible AI implementation.

Keywords: artificial intelligence, future scenarios, ophthalmology, physician shortage, research funding, scenario planning

Introduction

The field of ophthalmology has established itself as a pioneer in medicine, often being an early adopter of technological advancements and driver of innovation and discovery science.[1,2] However, the field faces many uncertainties in the coming years. Vision research funding faces potential challenges in the setting of possible governmental restructuring. Additionally, the field will soon be saturated with patients in need of ophthalmic care. The number of Americans over the age of 65 is expected to increase from 56 million to over 71 million by 2030 and the Baby Boomer generation is aging into common age-related ophthalmic diseases such as cataracts, age-related macular degeneration, and glaucoma.[3] Furthermore, the increased adoption of screening devices assisted by artificial intelligence (AI) amidst a growing epidemic of diabetes and metabolic disease portends an influx of patients into the ophthalmology care system.[4-6] This is compounded by the risk of increasing shortages of ophthalmologists. Estimates project that by 2035, ophthalmology workforce adequacy will drop to 70%, with rural areas projected at a mere 29% adequacy.[7] Considering the unpredictable future within the field, these possibilities must be explored proactively to prepare for adverse outcomes and to strategically plan towards an ideal state in which efficiency, equity, and outcomes are maximized.

The future is far more dynamic than we tend to acknowledge. This makes linear forecasting unreliable, even over short periods, especially in today's rapidly changing environment.[8,9] The further out we try to forecast, the more our predictions are diluted by the compounding effects of unknowns. To deal responsibly with irreducible uncertainties requires a style of thinking based on “scenarios” that embraces and explores uncertainty instead of repressing it: thinking proactively, not reactively. Scenarios serve the following purposes:

- To create boundaries of uncertainty and display the broad range of possibilities ahead.
- To stimulate the exploration of both dangers to be avoided and positive possibilities that can be used to construct a vision of the preferred future.
- To test how potential strategies and actions might work in different future circumstances and how “robust” strategies are across multiple scenarios.

Scenario planning has been previously employed by organizations such as the Accreditation Council for Graduate Medical Education in Family Medicine,[10] the American College of Radiology,[11] the Robert Wood Johnson Foundation,[8] and others both within and beyond medical fields.[12-15] Each of these exercises were performed in an effort to strategically plan for influential variables within their respective fields.

Scenarios may be depicted in a variety of ways, including stratification across three future states: conventional, aspirational, and bleak (Fig. 1).[8] The conventional state is the most likely or expected future if current trends continue (the “best guess” scenario). The aspirational state depicts an optimistic or highly desirable future where positive trends dominate, and successes are achieved at greater rates than failures (the “if everything goes right” scenario). The bleak state depicts a pessimistic future where negative trends dominate, and failures occur at a greater rate than successes (the “if everything goes wrong” scenario). Successes may be

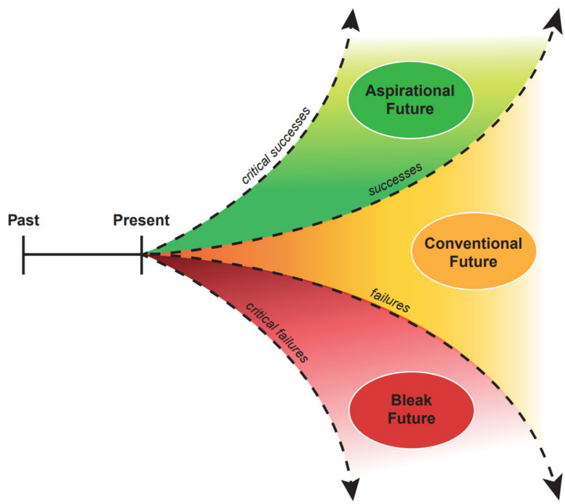

Fig. 1. Graphical depiction of possible future scenarios played out over time.

conceptualized as actions taken by key stakeholders which move the field closer to an ideal state. Conversely, failures may be conceptualized as inaction in the face of environmental or systemic challenges or as actions taken by key stakeholders that move the field further from the "ideal state".[8]

Below, we describe the first documented implementation of this scenario planning practice in the field of ophthalmology and visual science. We portray the consensus-driven futures of five key drivers in ophthalmology derived and endorsed by experts in the field. We go on to discuss their implications, and potential strategies to alter their trajectory toward aspirational futures.

Methods

All research and data collection were conducted in accordance with the Declaration of Helsinki and exemption from the University of Michigan Institutional Review Board (HUM00278530). This study utilized a modified Delphi process to build consensus on the future scenarios presented in the results of this paper. This multi-step process involved multiple rounds of expert input including the use of 1) surveys to identify key drivers, 2) focus groups to build potential future scenarios, and 3) elicitation and implementation of feedback to reach consensus.

Survey generation

A literature search was conducted and a Qualtrics survey was drafted and reviewed by the Strategic Planning Committee at Kellogg Eye Center – University of Michigan. The survey, asking which healthcare drivers are most likely to impact the field of ophthalmology over the next five years, was sent to all faculty members in the Department of Ophthalmology and Visual Sciences (Appendix A). Surveys utilized multiple choice and free-response questions and were received anonymously unless the respondent willingly offered to participate in a focus group on the given topics. Five healthcare drivers were selected to develop future scenarios based on the survey responses. This step was the first in gathering initial expert opinion on the future scenarios.

Focus groups

Based upon the five drivers identified by survey, a focus group guide of open-ended questions was drafted and reviewed by the Strategic Planning Committee (Appendix B). Focus group invitations were sent to a) institutional faculty that expressed interest in participating and denoted an area of expertise and b) key opinion leaders (KOLs) in ophthalmology, vision science, health policy, artificial intelligence, technology, and medical education. These included current and former chief medical officers and ophthalmology department chairs at academic institutions across the United States, leaders in healthcare administration and computer science, current and former ophthalmology residency program directors, National Institutes of Health (NIH)-funded vision scientists, editors in chief of scientific journals, and leadership in the American Academy of Ophthalmology (AAO) and the Association of University Professors of Ophthalmology (AUPO). Collective KOL experience has been summarized in Table 1 to maintain individual anonymity. Five focus groups were conducted, each running for one hour. KOLs were asked for their availability over the five dates and times offered. Groups were subsequently arranged to satisfy availability and, when possible, to enable differing voices within each group based on work sector, gender, and age. Focus groups were moderated by experienced facilitators, who posed open-ended questions for the group based on the focus group guide. Follow-up questions were directed to content experts within the group when possible. Facilitators guided the discussion to ensure all five drivers were addressed within the timeframe and that all KOLs were contributing to discussion. Groups were recorded for subsequent transcription and analysis.

Table 1. Number of key opinion leaders (*N* = 31) represented in focus groups by specific roles, sectors, or demographics

Role	**Number of KOLs**
NIH-funded scientist**	15
AAO leadership*, ^	14
Journal editor	13
Ophthalmology department chair*	12
Ophthalmology program director*,#	9
AUPO leadership*, ^	9
CMO or CEO of healthcare organization	6
Professor in computer science/technology	1
Demographic	**Number of KOLs**
Female	6

KOLs: Key opinion leaders; NIH: National Institutes of Health; AAO: American Academy of Ophthalmology; AUPO: Association of University Professors in Ophthalmology; CEO: Chief Executive Officer; CMO: Chief Medical Officer
* Number of KOLs indicate those with current or former experience in that role.
** As determined by holding a current K or R grant.
# Indicates either residency or fellowship program directors.
^ As determined by holding a board, council, or committee seat.

Qualitative analysis and content generation

Recordings of focus groups were transcribed and deidentified using Microsoft Office and manually edited to ensure responses were transcribed verbatim. Focus group transcripts and faculty survey responses were uploaded to Atlas.ti software (ATLAS. ti Scientific Software Development, Lumivero, LLC, Denver, CO, USA) and thematically analyzed using inductive and *in vivo* coding principles.

Transcripts and surveys were coded *in vivo* using deductive and inductive approaches of qualitative analysis.[16] A codebook was developed using deductive principles whereby quotations and themes were mapped into one of three a priori states (aspirational, conventional, bleak) derived from existing scenario-planning frameworks and in the context of the discussion (*e.g.*, when group discussion revolved around potential risks or harms that come with AI).[8] Inductive coding allowed the data to determine emergent themes across the varying interviews and responses. These *in vivo* codes were added to the codebook. Each transcript was independently coded and reviewed by two coders using the same inductive and deductive processes until no new codes were generated, inter-coder discrepancies resolved, and coding decisions were finalized.[16]

This codebook was then used to develop the initial draft of scenarios whereby direct quotations from focus group participants and survey respondents via *in vivo* codes were implemented into their respective driver and state scenarios. Recurring themes within the data were prioritized over isolated codes/quotations in the drafting of scenarios to prioritize group over individual opinion and to keep the resulting product verbally concise. Given that certain topics and scenarios were discussed in greater depth than others, some quotations were extrapolated to produce content for the opposite scenario within that driver. For example, if a statement given described an aspirational scenario for the aging population (*e.g.*, “emphasis on whole-person care and chronic disease management”), the opposite of that projected outcome or depiction would be outlined in the bleak state scenario for that topic (*e.g.*, “lack of emphasis on chronic disease management”).

Establishing expert consensus

Upon completion of the initial draft of future scenarios, the draft was sent back to all the focus group members for their review and feedback as the final step in our modified Delphi methodology. Based on the feedback received by KOLs, the future scenarios were revised to produce the final form seen in the results of this paper. All reviewer comments were incorporated into the final draft.

Results

Twenty-seven institutional faculty responded to the initial survey. The top five drivers projected to be most influential to the delivery of vision care and research over the next five years were AI in eye care, health policy and financial reform, physician shortages, aging population, and research funding (Table 2).

Five focus groups took place between April and May of 2025 with 31 members across the five sessions. KOL sector and demographic information can be seen in Table 1. In total, 276 quotations were coded, with most of the survey responses and focus group discussion pertaining to AI in Eye Care (80 quotations) and the least pertaining to Aging Population (13 quotations).

The majority (51%) of the coded quotations within the focus group and survey data was in the conventional state for each driver (140 quotations), with aspirational quotations comprising 30% of the coded data (83 quotations) and bleak quotations comprising 19% of the coded data (53 quotations). The recurring themes across the data are depicted in their respective scenarios in Tables 3–5.

When asked for feedback on the initial draft of future scenarios, ten of the KOLs approved as it was and five of the KOLs had a combined 33 comments or suggestions for improving the initial draft. All of these suggestions were implemented into the revised draft and examples of these may be found in Table 6. The resulting group consensus of the future scenarios is depicted in Tables 3–5.

Table 2. Frequency of faculty (*N* = 27) survey responses when asked to select up to five drivers most likely to influence the field of ophthalmology over the next five years

Drivers	Responses
Artificial intelligence	18
Health policy and reform	17
Physician shortages	15
Aging population	14
Research funding	10
Data security and privacy	7
Telehealth and virtual/hybrid medicine	6
Precision/personalized medicine	6
Value-based care	4
Preventative care	3

Table 3. Summary of aspirational future scenarios across five key drivers in ophthalmology

Driver	**Aspirational future**
Health policy and reform	Stronger incentives placed on population-based screening, preventative care, and early treatment. The need for costly specialty interventions decreases. Shift towards value-based and population-based care models. Enhanced support for policies that incentivize innovation and implementation of technology infrastructure, especially in remote and underserved areas, making care more cost-effective. Care teams are led by physicians with ready access to data and decision-support tools. Physicians receive inflation-adjusted compensation. Insurance reimbursement rates keep up with rising costs of care. Medical liability laws are reformed to reduce burden and improve access.
AI in healthcare	AI advances on pace with appropriate regulations. Data from large databases and registries are distilled by AI into key insights for both clinical care and research. Tools/devices utilizing AI are preprogrammed to have everything needed for easy implementation across a variety of settings (plug-in and ready-to-go). AI screening tools in non-clinical settings (at home, pharmacy, etc.) appropriately triage patients. AI maximizes efficiency in finance/operations/documentation tasks. Patient data is well-secured.
Physician shortages	Incentives put in place to draw physicians to underserved areas. Ophthalmologists distributed more evenly across specialties and locations. Ophthalmology screenings are incorporated into primary care with AI-assisted fundus photo and OCT grading. Training of PA's and NP's increases to enhance community outreach and education, screening, and preventive care. Primary care physicians and community-based optometrists align with tertiary care academic ophthalmologists to create more efficient funnel of patients-in-need to the right care at the right time. Accelerated medical education pathways increase. Training positions expand through alternative funding and/or community/academic partnerships. AI, telehealth, and advanced practice providers (PAs/NPs) are optimized to reduce burnout/administrative burdens on physicians, lowering healthcare costs without sacrificing quality of care.

Driver	Aspirational future
Aging population	Introductory eye screening (done by OD's, OT's, AI, etc.) begins at Medicare age or younger to establish vision care and triage more efficiently. More integrative, whole-person care becomes standard in eye clinics with more emphasis placed on managing chronic disease. Improved healthcare coverage for chronic disease management. Multidisciplinary workforce adequately trained to meet the complex needs of older adults.
Research funding	Bipartisan consensus on the importance of federal support for biomedical research grows. Funding improves for NIH, NSF, CDC, NEI, and DOD. Universities and organizations increase advocacy for scientific research. Public support/investment increases. Regulatory changes unleash a wave of private sector investments in medical product innovation. Diversified funding increases on all fronts (philanthropy, industry sponsors, DOD contracts, non-federal state funding, contracting of material, and intellectual resources). Digital/computer-based approaches make research more cost-effective. More trainees are inspired to pursue physician-scientist careers.

AI: Artificial intelligence; OCT: Optical coherence tomography; PA: Physician assistant; (), NP: Nurse ractitioner; OD: Doctor of optometry; OT: Ophthalmic technician; NSF: National Science Foundation; CDC: Centers for Disease Control and Prevention; NEI: National Eye Institute; DOD: Department of Defense

Table 4. Summary of conventional future scenarios across five key drivers in ophthalmology

Driver	**Conventional future**
Health policy and reform	Investment in healthcare and technology remains flat. Public coverage decreases. Alternative care models emerge but have difficulty scaling widely, with fee-for-service remaining the primary model. Reimbursements continue to decrease at a slow but steady rate. Patients bear more out-of-pocket costs with high-deductible insurance plans. Lower-income patients are underserved and arrive at later stages of disease. Academic medical centers absorb more complex, less profitable cases and struggle to offer competitive salaries.
AI in healthcare	AI steadily improves but is adopted unevenly. Younger ophthalmologists and researchers are quicker to implement. Electronic medical records that integrate AI gain more favorability. AI begins assisting in tasks like triaging, scribing, and differential diagnosis in clinical settings. Access remains limited by cost and inconsistent regulations. Large practices and institutions have their own AI tools with limited data sharing. Patients have limited control over their data with challenges in image/data transfer.
Physician shortages	Ophthalmologist shortages persist, especially in underserved areas. Advanced practice providers’ scope of practice expands modestly to meet demands. Subspecialist shortages worsen disproportionately. It becomes more difficult for patients to see subspecialists. Residency spots remain capped. Pathways allowing IMGs to enter the workforce become more accessible.

Driver	Conventional future
Aging population	Need for ophthalmology increases as baby boomers age into common ophthalmic conditions. As individuals live longer, the incidence of chronic conditions/comorbidities increases. Patients seen at academic centers are increasingly complex. The number of patients dependent on Medicare increases. Longer wait times lead to disparities in accessing eye care.
Research funding	Cuts to NIH funding worsen. Grants are delayed and/or cancelled. Relative increase in philanthropy and industry sponsorships, but still a net decrease in funding. Public misunderstanding of NIH’s role persists. Vision research is diluted as the NEI folds into a broader institute.

AI: Artificial intelligence; IMG: International medical graduate; National Institutes of Health; NEI: National Eye Institute

Table 5. Summary of bleak future scenarios across five key drivers in ophthalmology

Driver	**Bleak future**
Health policy and reform	Physician payments decline without inflationary adjustments. Providers driven away from complex care and academic centers struggle to stay afloat. Rural hospitals suffer as cuts to Medicaid deepen. Disproportionate healthcare impacts rise dramatically. Those with money find care, while those without are left behind.
AI in healthcare	AI development outpaces regulation and is implemented prematurely or overburdensome regulations stall the development and implementation of AI programs. AI programs and machine learning models based on small subsets of the population are inappropriately applied in broader contexts, resulting in disparities. AI tools are used outside their limits or capacity. Physicians and/or healthcare systems become overly dependent on AI, leading to patients being misdiagnosed and interventions missed. AI-related malpractice cases skyrocket, increasing insurance rates. Patient data is unsecure and/or exposed. Trust in healthcare erodes.
Physician shortages	On top of growing shortages, many ophthalmologists retire or leave the field early. There are no new residency positions or pathways for IMGs to replace them. If more positions are opened, new graduates go into the already-saturated subspecialties and geographic locations and patients still go underserved. Physicians are burdened by administrative and clerical tasks that slow them down. Advanced practice providers scope of practice expands rapidly, leading to poor patient outcomes. Patients are unable to get the care they need. Those with fewer resources suffer the most.

Driver	Bleak future
Aging population	The number of patients far exceeds the system's capability to deliver optimal care. Delays in care across the system result in progression to further stages of blinding eye diseases/conditions. As the complexity of cases rises with multiple conditions/comorbidities, current interventions become less effective and cost of care increases. Lack of emphasis on multidisciplinary care/coordination.
Research funding	NIH funding is cut drastically. Public support of science fades. Philanthropic giving diminishes. Younger academics are unable to pursue careers in science. Scientific talent and trainees move to other countries and other fields. Research narrows to only translational work to secure funding, severely limiting innovation and discovery science. Decreased economic growth in biomedical research in the United States.

AI: Artificial intelligence; IMG: International medical graduate; National Institutes of Health

Table 6. Examples of feedback given by key opinion leaders in refining the future scenarios

Feedback type	Initial scenario excerpt	KOL comment	Revised scenario excerpt
Grammatical	Research funding/ Bleak: Philanthropic giving diminished.	Change from past to present tense to match the rest of the scenario.	Philanthropic giving diminishes.
Thematic	AI in healthcare/ Aspirational: AI maximizes efficiency in finance/ operations tasks.	Add “and physician documentation tasks”.	AI maximizes efficiency in finance/ operations tasks and physician documentation tasks.
	Health policy and reform/Conventional: Academic medical centers absorb more complex, less profitable cases.	These complexities in care also make it more difficult for academic medical centers to hire and maintain competitive salaries.	Academic medical centers absorb more complex, less profitable cases and struggle to offer competitive salaries.
Interpretability	Research funding/ Conventional: Relative increase in philanthropy and industry sponsorships, but still leaving a deficit.	Unclear what “deficit” means, please clarify by stating net-decrease.	Relative increase in philanthropy and industry sponsorships, but still a net decrease in funding.
	Physician shortages/ Aspirational: AI, telehealth, and advanced practice providers are optimized to reduce burnout/ administrative burdens on physicians, lowering healthcare costs without sacrificing quality of care.	In this section, the phrase “advanced practice providers” needs some clarity in exactly who we are talking about, PAs and NPs, or optometrists as well.	AI, telehealth, and advanced practice providers (PAs/ NPs) are optimized to reduce burnout/ administrative burdens on physicians, lowering healthcare costs without sacrificing quality of care.

KOLs: Key opinion leaders; PA: Physician assistant; NP: Nurse practitioner

Discussion

Our findings highlight five key drivers that are likely to impact the field of ophthalmology in the next five years: research funding, health policy and financial reform, physician shortages, artificial intelligence, and an aging population. Though the conventional states currently appear to depict more problems than solutions, our study also reveals that there are opportunities to positively alter the course of vision care through the prioritization of preventive and population-based, holistic care, optimization of the workforce, collaboration between industry, government, and academic entities, and enhanced advocacy for research. Though the future is inherently uncertain, the ability to anticipate future challenges and forecast trends is important for physicians, researchers, and lawmakers alike as these projections can facilitate strategic planning and investment in the present.[9]

With respect to research funding, KOLs expressed concern for the impact of NIH cuts to vision science. According to an analysis published in *JAMA* in May of 2025, between February 28, 2025, and April 8, 2025, nearly 700 NIH grants were terminated totaling US$1.81 billion.[17] Of these cancelled grants, US$5.8 million were administered by the National Eye Institute (NEI), comprising 0.5% of the nearly US$970 million total of NEI grants.[17] For fiscal year 2025, Congress appropriated US$47.3 billion to the NIH, the same amount as the previous year. Though the passing of the One Big Beautiful Bill Act on July 3, 2025 has no direct impact on NIH funding, the proposed budget from the White House for fiscal year 2026 suggests decreasing that amount to US$27 billion, a nearly 40% reduction.[18] The potential consolidation of the NEI into a broader federal institute further amplifies concerns over diminished prioritization of eye and vision research. While federal reorganization remains speculative, advocacy organizations such as the AAO, AUPO, Association for Research in Vision and Ophthalmology (ARVO), and National Alliance for Eye and Vision Research (NAEVR) are actively lobbying to preserve the NEI's independence.[19]

A proposed solution to this potential dilution of federal funding for vision research is the diversification of funding through philanthropic gifts and industry sponsors. Our study found this to be a common sentiment among KOLs. Increased support from the private sector and industry sponsors may raise its own potential concerns. Opponents argue that conflicts of interest, burdensome restrictions on the sharing of intellectual property between academics, and motivation by profit undermine the integrity of research done for the public good.[20,21] Regardless, we propose that enhanced communication between scientists and the public is a necessary step toward securing continued support for innovation and discovery science. In 2022, 88% of Americans agreed that scientific research is necessary and deserving of support from the federal government.[22] A 2016 survey found that 81.5% of Americans felt that national support for eye health research is important, but less than half felt that vision research should receive more funding.[23] A separate survey in 2024 found that 83% of respondents globally desire more direct and transparent communication from scientists.[24] Our findings corroborate those in the broader literature that enhancing public support of vision science begins with investing more effort into transparent communication of research and its value to the general public.[23,24]

With an increasing number of adult Americans aging into common ophthalmic conditions, and the number of patients with multiple complex diseases rising, it is imperative to prioritize whole-person care and expand coverage for chronic disease management.[3,25] Our findings support the early implementation of vision screening for all individuals by age 65 (and sooner with other risk factors) to facilitate early triage and alleviate downstream burden on physicians. While current AAO guidelines recommend that adults aged 65 years and older undergo an eye examination at least every two years, survey data indicate that one in five seniors does not receive care at this recommended interval.[26] Moreover, KOLs advocated for a more integrative model of care delivery that empowers patients to manage chronic conditions such as diabetes and glaucoma. Interventions such as patient education and disease-specific coaching are proven strategies to improve adherence and long-term outcomes in chronic disease management.[27-29]

In discussing AI, the groups consistently referred to the potential harm that could come from the premature implementation of AI in clinical settings where it has not yet met standards for approval or is being used out-of-context. This is a shared concern in the field.[30-32] However, AI has already demonstrated tremendous potential to improve patient outcomes and clinical efficiency while decreasing health disparities and cost of care.[33-38] Reasonably, the Food and Drug Administration (FDA) has taken a conservative stance on the approval of AI and machine learning technologies in clinical practice.[39,40] Therefore, an alternative bleak scenario is one in which overly restrictive regulations prevent the innovation and implementation of promising programs. Subsequently, the optimal scenario is one in which there is early collaboration and communication between investigators, key stakeholders, and the FDA. This is evident in the development of networks such as the Collaborative Community on Ophthalmic Innovation (CCOI), which exist in part to streamline the process from discovery to deployment.[41]

Regarding the physician shortage in ophthalmology, our study suggests that geographic distribution is more of an issue than the numbers themselves. Though the exact numbers are disputed, it is evident that ophthalmologists are in high demand, particularly in rural areas.[7] The San Francisco Match Report from 2025 showed that 35% of all match participants did not match into ophthalmology.[42] New physicians are being turned away from the field despite this shortage. However, simply increasing training capacity may not address these service gaps if new graduates predominantly practice in already saturated urban centers. This sentiment is shared by others, as well as concerns of increased burnout, and a desire for more work-life-balance in younger physicians.[43] A different solution proposed to ameliorate this shortage is a more accessible pathway for international medical graduates to begin practicing in the United States. In April of 2023, Tennessee passed Senate Bill 1451 allowing international medical graduates (IMGs) to apply for an unrestricted license after meeting certain benchmarks and practicing in the state for two years with certain restrictions.[44] Other states have also passed regulations to create new pathways for international medical graduates to practice stateside, and others more may soon follow suit.[45]

The development of these scenarios is not without its limitations. For one, though great care was taken in selecting group members, the majority of focus group members were faculty at one academic institution. This was an intentional choice in design aligned with the study's dual objective of informing strategic planning for the Department of Ophthalmology and Visual Sciences at the institution. Nevertheless, a broader demographic of leaders and stakeholders nationally, particularly those in organizations such as the NEI, NIH, and FDA would have enriched the discussion, as well as increased gender diversity. Additionally, given the study's dual objective regarding strategic planning, a five-year timeline was selected for developing these scenarios instead of a ten- or twenty-year outlook. As stated previously, future scenarios become increasingly more difficult to project at more distant timepoints, given added uncertainties and unseen variables. Had a ten- or twenty-year outlook been utilized, it is possible that experts may have identified different key drivers altogether, and that the subsequent scenarios encompassed a much wider range of difference between the aspirational and bleak states. Finally, while group consensus was achieved, logistical constraints precluded multiple iterations of review by KOLs.

Conclusion and future perspectives

In this study, we have executed the first documented scenario planning process in the field of ophthalmology and visual science by utilizing a modified Delphi technique to develop expert-derived, consensus-driven future scenarios. We found that the drivers most likely to impact the field are research funding, health policy and financial reform, physician shortages, artificial intelligence, and an aging population. We have also depicted aspirational states for these drivers and have identified opportunities to change the current trajectory through efforts such as the implementation of preventive, population-based, holistic care; optimization of the workforce; collaboration between industry, government and academic entities; and enhanced advocacy for research. The charge for leadership is to use these scenarios as a guide for what is possible and what is at stake, and begin strategically planning toward these aspirational futures without delay.

Declarations

Ethics approval and consent to participate

All research and data collection were conducted in accordance with the Declaration of Helsinki and exemption from the University of Michigan Institutional Review Board (HUM00278530).

Competing interests

None to declare.

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Appendix A: Institutional faculty survey

We are looking to learn more about the potential drivers that will affect vision care and research in the next 5 years for our departmental strategic planning. Please consider how these potential drivers could impact us in a conventional, aspirational, and bleak scenario.

Conventional scenario: A most likely or expected future if current trends continue.
Aspirational scenario: An optimistic or highly desirable future where positive trends dominate.
Bleak scenario: A pessimistic or high-risk future where negative trends dominate.

1. What do you think are the biggest healthcare drivers for the next 5 years? Please select up to 5.
    - Personalized/precision medicine
    - Aging population
    - Preventative care
    - Value-based care
    - Health policy and reform
    - AI in Healthcare
    - Telehealth and virtual/hybrid care
    - Health data security and privacy
    - Research funding
    - Physician shortages
    - Other: ____________
2. For one of the healthcare drivers above that you are most interested in or experienced with, please describe your vision of a conventional future, aspirational future, and bleak future.
3. If you have additional thoughts about conventional, aspirational, or bleak futures for any of the other healthcare drivers listed, please state them here:
4. Would you be willing to participate in a focus group to discuss these potential healthcare drivers? If so, please provide your name.
5. Are there any thought leaders with respect to these healthcare drivers that you would nominate to participate in a focus group for developing future scenarios? If so, please provide their name.

Appendix B: Focus group guide

AI in healthcare/Health data security and privacy

1. How will healthcare look in 5 years from now with AI integrated into everyday care?
2. As AI advances, how do you think our control over personal health data will change? What are your expectations on how health data should be protected?

Health policy, financial reform, and value-based care

3. How will the state of health policy and financial reform impact healthcare in the next 5 years?
4. How can organizations adapt to protect against dramatic shifts in healthcare policy? What proactive changes can be made to increase resilience?

Physician shortages

5. Do you envision healthcare worker and physician shortages affecting healthcare in the next 5 years? If so, how?
6. How can organizations prepare for these shortages now? What can be done to address shortages structurally? What is the root cause of these shortages?

Aging population

7. How will the aging population increase healthcare demand? In what way will infrastructure and healthcare providers/systems be stressed?
8. What can organizations do now in anticipation for an increasingly aged population? Where are increased resources and attention required? How will the way we operate be changed in the next 5 years?

Research funding

9. What are the biggest challenges in securing funding now and that you envision for the next 5 years?
10. What actions can an organization take to help safeguard and protect its research and researchers from changes in funding?