RESEARCH PAPER

Artificial Intelligence Readiness and Myopia Control Intervention Preferences Among Indian Eye Care Practitioners: A National Cross-Sectional Survey

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ABSTRACT

Objective: To evaluate myopia control intervention preferences, perceived barriers, and artificial intelligence (AI) readiness among Indian eye care practitioners (ECPs).

Methods: A pre-validated, self-administered, internet-based questionnaire comprising 30 items across four domains—demographics, myopia intervention knowledge and prescribing patterns, perceived barriers, and AI readiness—was distributed to optometrists and ophthalmologists across India between January and April 2026. Content validity was established through expert panel review (S-CVI/Ave = 0.92). Reliability was confirmed via pilot testing (n = 30; Cronbach's $\alpha = 0.87$). Data were analyzed using descriptive statistics, chi-square tests, and binary logistic regression (SPSS v26.0).

Results: Of 412 valid responses from 24 states/UTs, single-vision spectacles remained the most prescribed intervention (67.2%) despite being perceived as the least efficacious (5.2 ± 8.4%), revealing a significant knowledge-practice gap. Low-dose atropine was perceived most efficacious pharmacologically (48.6 ± 22.3%) but prescribed by only 23.1% ($\chi^2 = 34.72$, $p < 0.001$). Regarding AI, 62.1% were aware of AI applications in myopia, but only 28.6% expressed willingness to adopt AI tools. Younger age (<35 years; OR = 2.84), postgraduate qualification (OR = 3.21), and urban practice (OR = 2.16) were significant predictors of AI readiness (all $p < 0.01$). Cost (72.8%), regulatory ambiguity (58.3%), and insufficient training (54.6%) were the top barriers.

Conclusion: Indian ECPs demonstrate awareness of evidence-based myopia control but face a persistent knowledge-practice gap. AI readiness remains limited and is strongly influenced by age, qualification, and practice setting. Integrating AI literacy into myopia management training is essential to bridge this translational gap.

Keywords: Myopia control, artificial intelligence, low-dose atropine, orthokeratology, eye care practitioners, survey, India, AI readiness, knowledge-practice gap.

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INTRODUCTION

Myopia has emerged as the most prevalent refractive error globally, with projections estimating approximately 50% of the world population will be myopic by 2050.[1] In India, the prevalence among school-age children ranges from 6.7% to 36.5%, with an upward trend exacerbated by increased near-work demands and reduced outdoor activity.[2,3]

Each diopter of myopic progression is associated with a 67% increased risk of myopic macular degeneration and significantly elevated risks of retinal detachment and glaucoma.[4] This has driven a paradigm shift from optical correction toward active myopia management—interventions designed to slow axial elongation and refractive progression in children.[5]

The current evidence base supports pharmacological (low-dose atropine 0.01–0.05%), optical (orthokeratology, DIMS/HAL spectacle lenses, MiSight soft contact lenses), and behavioral (increased outdoor time) interventions.[6–9] The IMI 2025 Interventions update further expanded evidence across optical, pharmacological, behavioral, and colored light domains.[9]

Despite this growing evidence, global IMI surveys (2015–2024) have consistently shown that single-vision spectacles remain the most frequently prescribed option worldwide, indicating a persistent translational gap.[10,11] In India, Chaurasiya et al. (2023) surveying 302 optometrists and Naik et al. (2024) surveying 393 optometrists confirmed that while practitioners are aware of emerging strategies, clinical uptake remains poor.[12,13]

Concurrently, artificial intelligence (AI) is transforming myopia care. Applications now include machine learning-based axial length prediction, AI-driven progression risk stratification, and large language model (LLM)-based clinical decision support.[14–16] recent reviews have highlighted AI's potential for personalized myopia management through treatment response prediction and environmental monitoring integration.[17]

Novelty of the Present Study: While previous Indian surveys examined myopia knowledge, attitude, and practice among optometrists,[12,13] no study has assessed AI readiness—the willingness of Indian ECPs to integrate AI tools into myopia management. The present study is the first to simultaneously evaluate myopia intervention preferences and AI readiness within the same cohort, and to identify demographic predictors of AI adoption readiness among Indian eye care practitioners.

The objective was to evaluate myopia control intervention preferences, perceived barriers, and AI readiness among Indian ECPs, and to identify predictors of AI adoption readiness.

MATERIALS AND METHODS

Study Design

This was a descriptive, cross-sectional, web-based survey conducted among eye care practitioners across India between January and April 2026, following CHERRIES guidelines.[18]

Ethical Considerations

The study involved an anonymous, voluntary, internet-based professional opinion survey with no patient data collection. As per ICMR National Ethical Guidelines (2017), anonymous surveys of healthcare professionals that pose no risk are exempt from formal ethics committee review.[19] Informed consent was obtained electronically before participation.

Sample Size

Using Cochran's formula ($Z = 1.96$, $p = 0.50$, $e = 0.05$), the minimum required sample was 385. Anticipating 10% incomplete responses, the target was 425.[20]

Participants and Recruitment

Eligible participants were licensed optometrists and ophthalmologists in clinical practice in India. The survey was distributed via the Optometry Council of India (OCI), Indian Optometric Association (IOA), IACLE India Chapter, state-level optometric societies, and professional messaging groups. A bi-weekly reminder strategy (three reminders over six weeks) maximized response rates.

Survey Instrument

The questionnaire was developed based on: (a) the IMI Global Survey instrument,[10] (b) the Indian KAP surveys by Chaurasiya et al. and Naik et al.,[12,13] and (c) established technology readiness frameworks.[21] The final instrument comprised 30 items across four domains: Demographics (8 items), Myopia Knowledge and Prescribing (10 items), Barriers (4 items), and AI Readiness (8 items). AI readiness was assessed using a 12-item Likert-scale instrument across four dimensions: awareness, perceived usefulness, willingness to adopt, and training needs.

Content Validity

A five-member expert panel (two myopia-specialist optometrists, one pediatric ophthalmologist, one AI researcher, one psychometrician) rated each item for relevance (1–4 scale). Items with I-CVI < 0.78 were revised.[22] The final S-CVI/Ave was 0.92.

Pilot Testing and Reliability

Pilot testing ($n = 30$; 15 optometrists, 15 ophthalmologists from three states, excluded from main study) yielded Cronbach's $\alpha = 0.87$ for the AI readiness subscale. Test-retest reliability at two weeks yielded ICC = 0.84 (95% CI: 0.68–0.93).

Data Collection and Quality Control

The Google Forms survey required mandatory responses. Duplicate submissions were prevented via IP restriction. Responses completed in <3 minutes or with uniform Likert responses (straight-lining) were excluded.

Statistical Analysis

Data were analyzed using IBM SPSS v26.0. Descriptive statistics, chi-square tests, and binary logistic regression were employed. AI readiness was dichotomized as "ready" (≥4 on Likert willingness items) vs. "not ready" (<4). Significance was set at $p < 0.05$.

Bias Minimization

Selection bias was mitigated through multi-channel distribution; response bias through anonymity; social desirability bias by stating no "correct" answers exist; acquiescence bias by including negatively worded items; recall bias by asking about current (not historical) practices.

RESULTS

Response Rate and Demographics

Of 438 responses received, 412 valid responses (94.1% completion rate) from 24 states/UTs were included after excluding 18 incomplete and 8 inattentive responses. The demographic profile is presented in Table 1.

Table 1: Demographic Profile of Respondents (n = 412)

Characteristic	n	%
Age Group		
<30 years	156	37.9
30–40 years	148	35.9
41–50 years	72	17.5
>50 years	36	8.7
Gender		
Male	238	57.8
Female	174	42.2
Professional Qualification		
B.Optom / Diploma Optometry	164	39.8
M.Optom / M.Sc. Optometry	142	34.5
MS / DNB Ophthalmology	78	18.9
Ph.D. / Fellowship	28	6.8
Clinical Experience (years)		
<5	134	32.5
5–10	138	33.5
11–20	96	23.3
>20	44	10.7
Practice Setting		
Private clinic	168	40.8
Hospital	112	27.2
Academic institution	86	20.9
Optical retail	46	11.2
Practice Location		
Metropolitan	178	43.2
Urban	124	30.1
Semi-urban	72	17.5
Rural	38	9.2

The majority were male (57.8%), aged under 40 years (73.8%), with optometric qualifications (74.3%). Mean clinical experience was 9.4 ± 7.2 years.

Myopia Concern and Knowledge

Mean concern level was 7.8 ± 1.9 on the 0–10 scale. Knowledge of complications: retinal detachment (88.3%), myopic macular degeneration (76.2%), glaucoma (62.4%), cataract (41.7%). Mean knowledge score was 3.6 ± 1.2 out of 5.

Intervention Preferences and Knowledge-Practice Gap

Intervention preferences and the knowledge-practice gap are presented in Table 2 and visualized in Figure 1.

Table 2: Myopia Control Intervention Preferences and Knowledge-Practice Gap (n = 412)

Intervention	Perceived Efficacy (mean ±SD %)	Currently Prescribing (%)	K-P Gap*	Efficacy Rank	p-value†
Low-dose atropine	48.6±22.3	23.1	+25.5	1	<0.001
Orthokeratology	44.2±21.8	11.4	+32.8	2	<0.001
DIMS/HAL spectacles	41.8±20.6	18.7	+23.1	3	<0.001
MiSight/ MC soft CL	38.4±23.1	8.3	+30.1	4	<0.001
Combination therapy	52.1±24.7	6.8	+45.3	5††	<0.001

Outdoor time	34.6±18.9	82.4	−47.8	6	<0.001
Single-vision spectacles	5.2±8.4	67.2	−62.0	7	<0.001
RLRL therapy	28.3±26.4	3.2	+25.1	8	<0.001

**K-P Gap = Perceived Efficacy (%) – Prescribing Frequency (%). †Chi-square test. ††Combination therapy ranked highest in perceived efficacy but 7th in prescribing.*

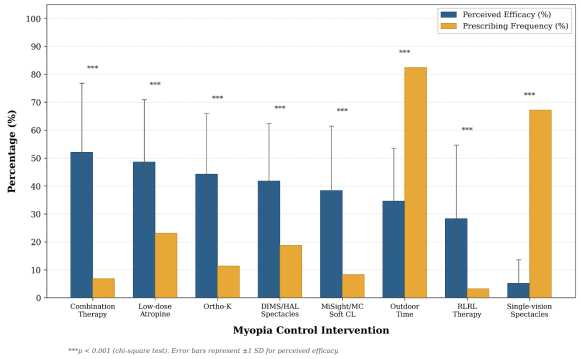

Figure 1: Knowledge-Practice Gap for Myopia Control Interventions Among Indian ECPs (n = 412). Grouped bar chart comparing perceived efficacy (%) versus prescribing frequency (%). Error bars represent ±1 SD. ***p < 0.001.

Combination therapy exhibited the largest knowledge-practice gap (+45.3 percentage points), followed by orthokeratology (+32.8) and MiSight (+30.1). Single-vision spectacles showed a negative gap (−62.0), being massively over-prescribed relative to perceived efficacy. All discrepancies were statistically significant ($p < 0.001$). Only 38.6% routinely measured axial length despite 71.8% agreeing it is essential for monitoring treatment response.

Barriers to Adoption

The top three barriers were: cost to patient (72.8%), lack of regulatory clarity (58.3%), and insufficient training (54.6%), followed by limited product availability (46.2%), inadequate consultation time (38.7%), lack of India-specific guidelines (34.1%), parental non-compliance (28.4%), and medicolegal concerns (16.7%). Barrier rankings are visualized in Figure 2.

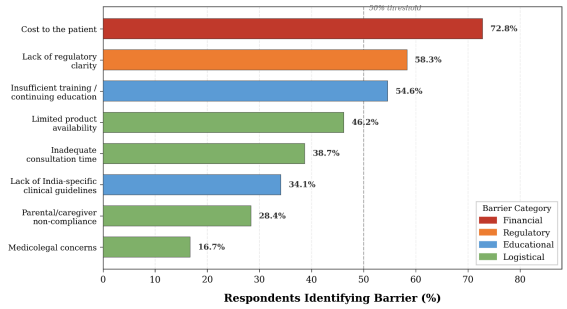

Figure 2: Ranked Barriers to Adoption of Evidence-Based Myopia Control Interventions (n = 412). Horizontal bar chart, color-coded by category: financial (red), regulatory (orange), educational (blue), logistical (green).

AI Readiness

Of 412 respondents, 62.1% were aware of at least one AI application in myopia management. The most recognized were AI-based axial length prediction (48.3%) and AI-assisted retinal imaging (44.7%). Awareness of AI for atropine dosing (12.6%) and wearable-integrated monitoring (18.4%) was considerably lower.

On the AI readiness subscale (range 8–40), the mean score was 24.3 ± 7.8. When dichotomized, 28.6% (n = 118) were classified as "AI-ready." Perceived usefulness of AI for progression prediction scored highest (3.62 ± 1.04), while trust in AI recommendations scored lowest (2.84 ± 1.18). The need for AI training in curricula was strongly endorsed (4.12 ± 0.86; 78.2% agreeing/strongly agreeing).

Binary logistic regression results are presented in Table 3 and AI readiness dimensions are visualized in Figure 3.

Table 3: Binary Logistic Regression – Predictors of AI Readiness (n = 412)

Predictor	B	SE	OR	95% CI	Wald	p
Age <35 years (vs. ≥35)	1.044	0.286	2.84	1.62–4.97	13.32	<0.001
PG qualification (vs. UG)	1.166	0.276	3.21	1.87–5.51	17.84	<0.001

Urban/Metro (vs. other)	0.770	0.244	2.16	1.34–3.48	9.96	0.002
Myopia patients >15/wk	0.682	0.261	1.98	1.19–3.30	6.83	0.009
Academic setting	0.847	0.298	2.33	1.30–4.18	8.08	0.004
Female gender	0.124	0.218	1.13	0.74–1.74	0.32	0.571
Experience >10 years	−0.312	0.267	0.73	0.43–1.24	1.37	0.242

Model: $\chi^2 = 68.42$, $p < 0.001$; Nagelkerke $R^2 = 0.234$; Hosmer-Lemeshow $p = 0.412$. Dependent: AI readiness (ready [≥4] vs. not ready [<4]).

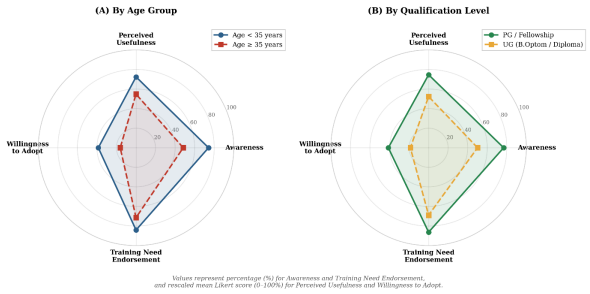

Figure 3: Radar Chart of AI Readiness Dimensions (n = 412). Panel A: By age group (<35 vs. ≥35 years). Panel B: By qualification (PG vs. UG). Four axes: Awareness, Perceived Usefulness, Willingness to Adopt, Training Need Endorsement.

Younger age (<35 years; OR = 2.84), postgraduate qualification (OR = 3.21), urban/metro practice (OR = 2.16), higher patient volume (OR = 1.98), and academic setting (OR = 2.33) were significant independent predictors of AI readiness (all $p < 0.01$). Gender and experience >10 years were not significant.

DISCUSSION

This study is the first to simultaneously assess myopia control intervention preferences and AI readiness among Indian ECPs, providing a dual-dimensional snapshot of the translational landscape in Indian optometric practice. The dominance of single-vision spectacles (67.2% prescribing) despite being perceived as least efficacious (5.2%) is consistent with, but more pronounced than, the global trend reported in the IMI 2024 survey, where single-vision prescribing decreased by 11.1% since 2015 but still dominated practice.[11] Chaurasiya et al. (2023) similarly reported single-vision dominance among Indian optometrists but did not quantify the knowledge-practice gap using paired efficacy-prescribing methodology as employed here.[12] The present study's quantification reveals that combination therapy shows the largest gap (45.3 points), indicating Indian ECPs recognize its superior efficacy but face systemic barriers preventing translation to practice.

Cost ranking as the primary barrier (72.8%) is consistent with the IMI global finding.[11] However, the second-ranked barrier in regulatory ambiguity (58.3%) reflects India-specific challenges: low-dose atropine lacks DCGI approval for myopia control, orthokeratology requires specialized training infrastructure, and DIMS/HAL lenses remain expensive imports.[23] This mirrors findings from Australian and UK surveys where regulatory and training barriers similarly impeded uptake.[24,25] The African survey by Nti et al. (2023) also reported cost and training as dominant barriers, suggesting these are universal challenges amplified in resource-limited settings.[26,27]

The awareness-adoption disconnect in AI readiness (62.1% aware vs. 28.6% willing to adopt, a 33.5-point gap) represents a critical finding. The predictors of AI readiness of younger age, higher qualification, urban setting, and academic practice to align with the diffusion of innovations framework, where early adopters tend to be younger, better educated, and situated in information-rich environments.[28,29] The low trust score for AI recommendations (2.84/5) suggests that explainable AI approaches, such as SHAP-based model interpretability,[30] will be critical for building clinical trust before AI tools can be widely adopted in myopia practice.

The strong endorsement for AI training in curricula (78.2%) is directly actionable. Biswas et al. (2023, 2024) demonstrated that AI-based LLMs can provide clinically relevant myopia information,[15,16] suggesting that AI tools are technologically ready for clinical integration. The present data provide the demand-side evidence that practitioners want this integration.

Strengths and Limitations

Strengths include: (a) the largest Indian myopia management survey sample (n = 412), exceeding Chaurasiya et al. (n = 302) and Naik et al. (n = 393); (b) first simultaneous assessment of myopia preferences and AI readiness; (c) robust psychometric validation (S-CVI/Ave = 0.92, Cronbach's α = 0.87, ICC = 0.84); (d) CHERRIES-compliant reporting; and (e) paired efficacy-prescribing methodology for gap quantification. Limitations include: (a) cross-sectional design precluding causal inference; (b) convenience/snowball sampling potentially over-representing urban, younger, digitally connected practitioners; (c) self-reported data subject to social desirability bias; (d) web-based format excluding practitioners without internet access; and (e) optometric respondent predominance (74.3%) limiting ophthalmologist generalizability.

CONCLUSION

This study establishes three findings with direct implications for Indian optometric practice. First, a quantifiable knowledge-practice gap persists: practitioners recognize the efficacy of atropine, orthokeratology, and combination therapy but prescribe single-vision spectacles in the majority of cases, driven by cost, regulatory, and training barriers. Second, AI readiness is nascent awareness is moderate (62.1%), but willingness to adopt is low (28.6%) and trust in AI recommendations is the weakest dimension. Third, the demographic predictors of AI readiness (younger age, higher qualification, urban practice) identify an early-adopter cohort that can serve as the vanguard for AI-integrated myopia management in India.

Future Implications: (1) The DCGI should expedite regulatory clarity on low-dose atropine for myopia control. (2) Optometry curricula should integrate evidence-based myopia management and AI-assisted decision-making modules, aligned with the outcome-based education framework. (3) AI tools for myopia progression prediction should be developed for Indian populations with emphasis on explainability and multilingual accessibility. (4) A longitudinal repeat survey at 2–3 year intervals, following the IMI model,[11] would track temporal trends in both intervention adoption and AI readiness.

As AI transitions from research to clinical reality in optometry, this study provides the baseline data necessary for evidence-based planning of technology-integrated myopia care pathways in India.

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CONFLICT OF INTEREST

The authors declare no conflict of interest.

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Artificial Intelligence Readiness and Myopia Control Intervention Preferences Among Indian Eye Care Practitioners: A National Cross-Sectional Survey

APPENDIX: SURVEY QUESTIONNAIRE

Title: AI Readiness and Myopia Control Intervention Preferences Among Indian Eye Care Practitioners

Informed Consent: This is an anonymous, voluntary survey for practicing eye care professionals in India. By clicking "I agree," you consent to participate.

DOMAIN I: DEMOGRAPHICS (Q1–Q8)

Q1. Age: (a) <30 (b) 30–40 (c) 41–50 (d) >50
Q2. Gender: (a) Male (b) Female (c) Prefer not to say
Q3. Qualification: (a) Diploma (b) B.Optom (c) M.Optom/M.Sc. (d) MS/DNB (e) Ph.D./Fellowship
Q4. Experience: (a) <5 yrs (b) 5–10 (c) 11–20 (d) >20
Q5. Practice setting: (a) Private clinic (b) Hospital (c) Academic (d) Optical retail
Q6. Location: (a) Metro (b) Urban (c) Semi-urban (d) Rural
Q7. State/UT of practice: [Dropdown]
Q8. Pediatric myopia patients/week: (a) <5 (b) 5–15 (c) 16–30 (d) >30

DOMAIN II: MYOPIA KNOWLEDGE & PRESCRIBING (Q9–Q18)

Q9. Concern level for pediatric myopia (0–10 scale)
Q10. Complications associated with high myopia (select all): (a) Retinal detachment (b) MMD (c) Glaucoma (d) Cataract (e) CNV
Q11. Currently prescribed interventions (select all): (a) SV spectacles (b) Low-dose atropine (c) Ortho-K (d) DIMS/HAL (e) MiSight (f) Outdoor time (g) Combination (h) RLRL (i) Other
Q12. Perceived efficacy of each intervention (0–100% slider per intervention)
Q13. Routine axial length measurement: (a) Always (b) Sometimes (c) Rarely (d) Never (e) No biometer
Q14. Minimum prescribing age for: (a) Atropine (b) Ortho-K (c) MC soft CL (d) Defocus spectacles
Q15. Combination therapy use: (a) Routine (b) Occasional (c) No (d) Unaware
Q16. Primary information source (top 2): (a) Journals (b) CE events (c) Industry (d) Online (e) Social media (f) Colleagues
Q17. Formal myopia CE in last 2 years: (a) Yes (b) No
Q18. Axial length monitoring essential: (Strongly Disagree – Strongly Agree)

DOMAIN III: BARRIERS (Q19–Q22)

Q19. Rank barriers 1–8: Cost, Regulatory, Training, Availability, Time, Guidelines, Compliance, Medicolegal
Q20. Primary atropine concern: (a) No DCGI approval (b) Side effects (c) Rebound (d) Long-term safety (e) Scope
Q21. Ortho-K availability: (a) Easy (b) Available/expensive (c) Limited (d) Unavailable
Q22. Training adequacy: (a) Confident (b) Somewhat (c) Not confident (d) No training

DOMAIN IV: AI READINESS (Q23–Q30)

Q23. AI awareness (Yes/No; if yes, select known applications)
Q24. AI useful for predicting progression (5-point Likert)
Q25. AI useful for intervention selection (5-point Likert)
Q26. Willing to use AI for axial length prediction (5-point Likert)
Q27. Willing to use AI for atropine optimization (5-point Likert)
Q28. Trust in AI recommendations (5-point Likert)
Q29. AI training should be in curriculum (5-point Likert)
Q30. Preferred AI format: (a) Mobile app (b) EMR-integrated (c) Web-based (d) Wearable (e) Not interested