

Age-Related Changes in Refractive Errors: A Study on the Shift from Myopia to Hypermetropia

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Received Date: March 13, 2025; **Accepted date:** March 24, 2025; **Published date:** April 07, 2025

Citation: Anindya Saha, Arpana Sharma, Merina Limboo, Anamika Tamang, Sheetal Prasad, et al, (2025), Age-Related Changes in Refractive Errors: A Study on the Shift from Myopia to Hypermetropia, *Clinical Research and Studies*, 4(2); DOI:10.31579/2835-2882/079

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Abstract

Refractive errors, including myopia (nearsightedness) and hypermetropia (farsightedness), change with age due to the decline in accommodation. This study analyzes survey data to assess how myopia is more prevalent in younger individuals (10–30 years), while hypermetropia becomes increasingly common after 30 years. A Gaussian distribution model illustrates that myopia peaks in early adulthood before stabilizing, whereas hypermetropia follows an upward trend with aging. These findings highlight the importance of regular eye examinations and early corrective measures to manage age-related vision deterioration.

Key words: myopia; hypermetropia; presbyopia; age-related distal vision; accommodation; refractive errors

Introduction

Refractive errors are among the most common vision problems affecting people across different age groups. Myopia is widely observed in younger individuals, primarily due to increase near work, digital screen exposure, and reduced outdoor activities. Conversely, hypermetropia and presbyopia become more noticeable with age due to the weakening of the eye's focusing ability.

Accommodation, the process that enables the eye to adjust focus for near objects, gradually declines as the crystalline lens stiffens and ciliary muscle function diminishes. This physiological shift leads to an increase in hypermetropia and presbyopia. Understanding the prevalence and progression of these refractive errors can aid in early detection and management strategies, emphasizing the importance of routine eye care.

Approach

This study surveyed 199 participants from different age groups, collecting data on their vision status, history of spectacle use, and other ocular conditions. The study primarily focused on three refractive errors:

- **Myopia (Nearsightedness):** Blurred distance vision, commonly seen in younger individuals.
- **Hypermetropia (Farsightedness):** Difficulty focusing on near objects, becoming more prominent with aging.

- **Presbyopia:** Age-related loss of accommodation, affecting individuals over 40 years.

Statistical analysis, including mean, median, and standard deviation, was conducted to evaluate the prevalence of these conditions across age groups. Gaussian distribution models were used to illustrate trends in myopia and hypermetropia.

Findings

The survey results demonstrated clear age-related patterns in refractive errors:

- **Myopia:** Observed in 28.5% of participants, mainly among individuals aged 10–30 years. The prevalence peaked in the mid-20s and stabilized thereafter.
- **Hypermetropia:** Found in 12% of participants, predominantly in individuals aged 30–50 years. A steady increase in cases was observed with age.
- **Presbyopia:** Present in 18.5% of participants, with a sharp rise after 40 years.
- **Cataracts:** Detected in 1% of participants, primarily in older individuals.

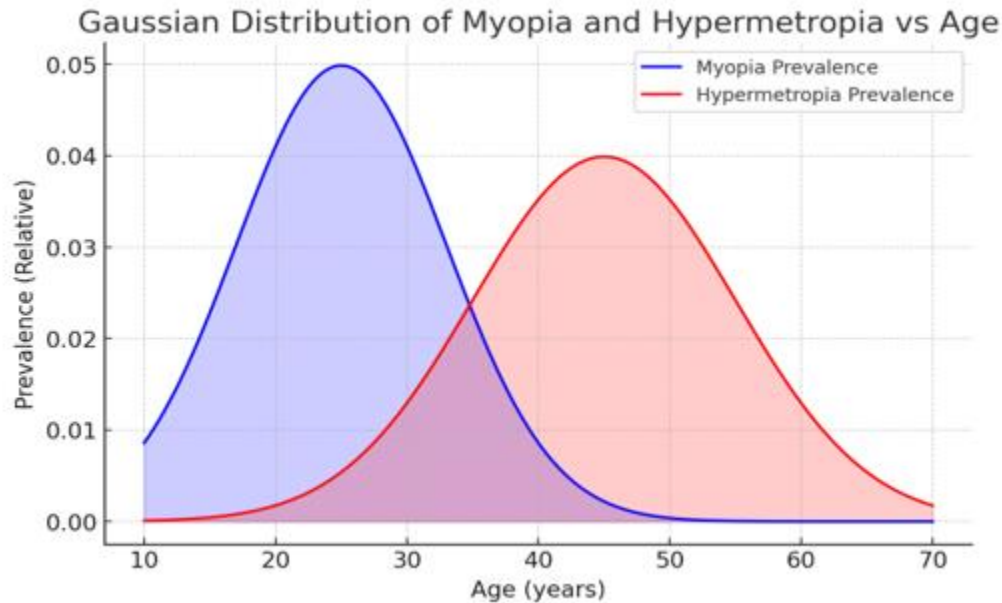
Graphical analysis confirmed that myopia is dominant among younger individuals, hypermetropia becomes more frequent in middle age, and presbyopia increases significantly after 40 years.

Discussion

The findings confirm that myopia is more common in younger individuals, which is often linked to increased near work such as studying, reading, and prolonged screen time. However, as people age, their accommodative ability declines, leading to an increase in hypermetropia and presbyopia.

This shift occurs due to the gradual hardening of the crystalline lens and weakening of the ciliary muscles, making it difficult for the eye to adjust focus for near objects. As accommodation decreases, latent hypermetropia becomes more pronounced, necessitating corrective lenses.

Interestingly, individuals with mild myopia may experience a temporary advantage as presbyopia progresses, since their natural near focus can compensate for the loss of accommodation. However, emmetropic and hyperopic individuals experience greater difficulty focusing on near objects as they age, requiring reading glasses or bifocals sooner.



Conclusion

The present study highlights the natural progression of refractive errors with age. Myopia is predominantly seen in younger individuals due to lifestyle habits, whereas hypermetropia and presbyopia increase with aging due to reduced accommodation. Routine eye check-ups are essential for detecting

and correcting refractive errors at an early stage. Timely intervention, such as prescribing appropriate corrective lenses, can help maintain optimal vision and prevent further deterioration. Public awareness campaigns and regular vision screenings should be encouraged to promote proactive eye care, especially among aging populations.

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