

Foreword

The Significance of Hyperopic Reserve Monitoring and Its Value for Myopia Prevention and Control

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Myopia represents a critical public health challenge with far-reaching implications for future development, as global prevalence is projected to reach 49.8% by 2050 (1–2). The Chinese government has implemented comprehensive policies and proactive measures (3–6) to accelerate prevention efforts through systematic interventions. Traditional monitoring approaches have focused primarily on vision screening and diopter examination following myopia onset, thereby lacking early warning systems for tracking hyperopic reserve depletion. Commissioned by the National Disease Control and Prevention Bureau, our team has spearheaded a landmark large-scale monitoring project on hyperopic reserves among children and adolescents since 2020, encompassing ten provincial-level administrative divisions (PLADs; including Beijing, Liaoning, Zhejiang, Henan, Chongqing, Shaanxi, Guangdong, Shanxi, Hunan, and Shandong). Through a multistage cluster sampling design at each site, students from senior kindergarten through high school were systematically selected, with 67,260 individuals initially surveyed. This initiative represents a transformative measure that emerged in direct response to the developmental requirements of the new era. The hyperopic reserve monitoring framework comprises two integrated components: comprehensive questionnaire surveys and detailed ophthalmic examinations. Emphasis is strategically placed on hyperopic reserve assessment rather than conventional diopter examination alone, with cycloplegic refraction methods employed to determine visual acuity status, yielding substantially more accurate results. This advancement signifies that China's myopia prevention and control efforts are transitioning toward a more scientific, precise, and forward-looking paradigm.

This special issue presents five pivotal studies that collectively advance our understanding of hyperopic reserve monitoring. Gao et al. comprehensively investigated axial length (AL), corneal radius (CR), and AL/CR ratios in children and adolescents from ten provinces and municipalities, analyzing the distribution patterns of each refractive parameter and their relationships with refractive status while evaluating the monitoring effectiveness of each parameter for refractive development (7). Luo et al. characterized different percentiles of spherical equivalent (SE) following cycloplegic refraction across children and adolescents aged 5–18 years throughout ten provinces and cities in China (8). Zhang et al. examined the association between screen exposure and insufficient hyperopic reserve in Chinese children aged 6–12 years, highlighting significant regional heterogeneity (9). Liu et al. explored the application of machine learning models to predict cycloplegic spherical equivalent in children and adolescents using non-cycloplegic measurements and ocular biometric parameters (10). These investigations collectively illuminate the critical importance of hyperopic reserve for myopia prevention and control while underscoring the substantial value of the hyperopic reserve detection initiative across ten provinces and municipalities. Specifically, this monitoring program demonstrates several prominent contributions to the field.

Addressing Critical Gaps: A Strategic Transformation from “Reactive Treatment” to “Proactive Prevention”

Hyperopic reserve represents the physiological hyperopia (11) naturally present during ocular development in children and adolescents — functioning as a protective “buffer zone” that mitigates myopia risk. This reserve undergoes gradual depletion as the eye matures (12). When hyperopic reserve is consumed too rapidly before achieving emmetropia, myopia onset becomes imminent or has already occurred (13). Traditional, myopia monitoring has predominantly been implemented following vision deterioration or myopia development, resulting in delayed intervention opportunities. For the first time, this groundbreaking initiative has established a comprehensive, large-scale monitoring system for hyperopic reserves in preschool and school-aged children across

ten PLADs in China, addressing a fundamental gap in preventive eye care. This achievement marks a paradigm shift in myopia prevention and control, advancing beyond outcome-based indicators such as “myopia presence” and “myopia severity” toward predictive early warning metrics, including “myopia occurrence probability.” By repositioning the prevention and control checkpoint earlier in the developmental timeline, this approach fundamentally transforms myopia management from passive response strategies to proactive prevention methodologies.

Establishing Evidence-Based Standards: Constructing the Foundation for Scientific Assessment and Precision Intervention

One of the fundamental contributions of this monitoring initiative, which encompasses ten provinces and municipalities with substantial sample sizes and robust regional representation, lies in its capacity to establish the first comprehensive “reference range” for hyperopic reserve among Chinese children and adolescents. The hyperopic reserve reference range enables identification of early changes preceding myopia onset, facilitating early detection and warning systems while enabling precise prevention and control with advanced checkpoint positioning. These values demonstrate variation according to age, geographic region, and environmental factors. Previously, the absence of authoritative national baseline data created significant challenges for physicians, educational institutions, and parents in accurately determining whether an individual child’s hyperopic reserve values were within normal parameters or depleting at concerning rates. The subsequent phase of this research will provide scientifically validated evaluation standards based on the growth and developmental characteristics of Chinese children for nationwide implementation. The establishment of these standards encompasses several key components:

Scientific assessment foundation: Enables primary medical institutions and school health professionals to accurately evaluate myopia risk levels using standardized benchmarks.

Precision intervention support: High-risk children — those demonstrating hyperopic reserve significantly below age-appropriate standards or experiencing rapid depletion — can be identified early, enabling targeted interventions including increased outdoor activities, visual habit modifications, and optical strategies to prevent or delay myopia onset.

Policy development guidance: Provides essential data to support the standardization of myopia risk screening processes and the evaluation of prevention effectiveness. Assists national and local authorities in formulating more refined prevention and control policies.

Empowering Grassroots Implementation: Strengthening Early Myopia Risk Identification Capabilities

The analysis of large-scale hyperopic reserve monitoring data and the establishment of evidence-based standards must ultimately serve grassroots clinical practice. This study significantly enhances early warning capabilities for myopia prevention and control at the community level. Following standard implementation, several key improvements will be realized:

Community hospitals and school clinics: By incorporating hyperopic reserve assessments into routine physical examinations — using standardized values preliminarily calculated through non-mydratic computerized refraction — these facilities can identify high-risk children early and promptly notify parents of concerning findings.

Parents and teachers: Armed with standardized hyperopic reserve reference values, they can proactively monitor children’s visual development, emphasizing outdoor activities and limiting excessive near-work activities, rather than waiting for vision deterioration to occur.

Coordinated prevention efforts: Risk identification based on unified standards facilitates more effective communication and collaboration among families, schools, and medical institutions, creating a comprehensive network to safeguard children’s visual health.

Highlighting Transformation: Advancing the National Myopia Prevention Strategy

The launch and advancement of hyperopic reserve monitoring across ten provinces and municipalities represents

a transformative milestone in China's national commitment to myopia prevention. This groundbreaking initiative demonstrates:

Enhanced investment: Unprecedented funding and comprehensive project support for foundational research and critical monitoring efforts in myopia prevention.

Strategic advancement: The prevention and control paradigm has evolved from merely “managing myopia severity” to “preventing myopia onset,” emphasizing early intervention and proactive source management.

Evidence-based leadership: Leveraging specialized institutions within the disease control system to conduct large-scale epidemiological investigations and drive policy decisions through rigorous scientific data ensures a standardized, evidence-based framework for myopia prevention and control in the contemporary era.

The hyperopic reserve monitoring initiative among children and adolescents across ten provinces and municipalities represents pioneering work in China's myopia prevention and control field. This comprehensive effort not only addresses critical data gaps but also substantially advances the prevention and control timeline. The next phase will establish China's indigenous hyperopic reserve assessment standards, with reference ranges stratified by age (6–18 years, with discrete age groups) and region (province/city) to accommodate developmental variations among children across different geographical areas. This framework will provide a robust foundation for early myopia risk identification, precise intervention strategies, and evidence-based prevention and control measures nationwide. This work exemplifies the accelerating transformation of pediatric and adolescent myopia prevention and control toward more scientific, precise, and efficient methodologies. Beyond representing a technological breakthrough, this initiative serves as a pivotal milestone in the comprehensive implementation of the national myopia prevention and control strategy, facilitating the paradigm shift from “treating existing conditions” to “preventing disease onset.” It will undoubtedly strengthen frontline defenses, securing improved visual health outcomes for millions of children and adolescents throughout the country.

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