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Public Health Strategies for Early Myopia Detection and Intervention in Schools in the United States

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Abstract: ***Myopia is becoming a growing concern among school-aged children in the United States, posing risks to academic performance, social development, and long-term visual health. This narrative review examines myopia prevalence, emphasizing the role of school-based screening and intervention programs. It discusses current public health strategies, including technology-driven screening, mobile clinics, and educational campaigns. Despite these advancements, financial limitations, workforce shortages, and unequal access remain significant barriers. The review recommends standardizing screening protocols, expanding funding, integrating myopia education in school curricula, and fostering community partnerships. A collaborative approach involving policymakers, educators, and eye care professionals is essential to ensure equitable access to myopia care for all children.***

Keywords: Myopia, school vision screening, public health intervention, childhood eye care, visual health education

1. Introduction

Myopia, also known as nearsightedness, is a rapidly growing public health problem both in other countries and here in the United States. Myopia among U.S. adults aged 12 to 54 increased from 25% in the early 1970s to 41.6% in the 2000s (Vitale et al., 2009). More recently, research shows pediatric myopia rates are rising, mostly among urban populations and with significant disparities by ethnicity and socioeconomic status (French et al., 2023). Those trends coincide with global projections that nearly half of the world's population (roughly 4.8 billion people) could be myopic by 2050 (Holden et al., 2016)

An increasing burden of myopia threatens the public health with uncorrected refractive errors being the leading cause of visual impairment in children whose vision problems impair their academic performance, social engagement and quality of life (Fricke et al., 2018) Beyond refractive correction, high myopia causes other complications which can lead to blindness such as retinal detachment, glaucoma and myopic maculopathy, which increase long-term healthcare costs and disability (Saw et al., 2019)

Early detection and management of childhood myopia is possible with school-based interventions because schools provide an organized and consistent setting for vision screening programs, outdoor activities and eye health education for children, parents, and teachers. School-based programs are effective in early detection of visual impairment and in improving spectacle compliance and visual outcomes in underserved communities (He et al., 2023).

This review examines public health strategies for early myopia detection and intervention in school settings in the US and abroad and highlights its successes and challenges and present ways to overcome them. Through the collection of global evidence, stakeholders including policymakers and eye care professionals will be informed on best practices in tackling the rising myopia epidemic.

2. Public Health Strategies for Early Myopia Detection and Intervention in Schools

As myopia prevalence increases in school age children, public health models that are focused on early detection, intervention and education are needed. Schools at the best and easiest place to implement myopia detection and control measures and strategies because it is where children and families are most involved. This section discusses key public health strategies for myopia detection and intervention in U.S. Schools.

2.1. Vision Screening Programs

Vision screening programs in schools play an essential role in myopia detection because it can identify children who may be at risk. There are various types of vision screening programs, and they differ in terms of who does the screening:

a) Teacher-Led Screening: In some school districts, teachers are trained to perform basic vision screening with Snellen charts. Such an approach is inexpensive and readily available but less sensitive to early or mild myopia and other visual impairments (Huang et al., 2020)
b) Optometrist-Led Screening: Screening by trained optometrists or ophthalmologists catches myopia and other refractive errors more accurately and earlier. Such screenings typically use more complex methods like retinoscopy and autorefractors but also require more resources (Zhao et al., 2019)
c) Mobile Clinics: Mobile eye clinics bring vision care to schools in underserved areas that have limited access to eye care. They have all the tools and are staffed by optometrists or ophthalmologists who do on-site screenings and referrals. Studies show mobile vision care services can reach children who otherwise would not have access to eye care services (Sherwin et al., 2021).

2.2 Health Education and Awareness Campaigns

Myopia prevention and early intervention can be promoted through Health Education and Awareness Campaigns that encourage early solutions. Such campaigns target students, teachers and parents educating them and helping them to

recognize myopia and other refractive errors early. For students, campaigns encourage them to adhere to healthy vision habits such as less screen time and more outdoor time. For teachers, it trains them on how to observe and spot signs of visual problems in the classroom and refer children for professional eye exams. Parents are taught about the importance of early eye exams and how myopia is caused by genetics and lifestyle (Saw et al., 2020). Studies show that educating students about myopia risks and encouraging them by providing opportunities to be outside increase their engagement in preventive behaviours such as being outside more and cutting screen time (Chia et al., 2020).

Including vision health as part of the school health curriculum can be a helpful way to make sure that every child participates further making myopia prevention a part of a child's education experience. This approach may involve talking about eye health, the dangers of prolonged screen time and the benefits of being outside. Vision health education in school curricula normalizes eye care conversations for better long-term outcomes (Wang et al., 2021).

2.3 Use of Technology and innovations

Integration of technology such as photoscreeners which are non-invasive, automated devices that detect myopia and other refractive errors in children without a full eye exam. They have been shown to work in large-scale screenings and in schools (Sherwin et al., 2021). Another technology-based solution for remote eye exams is tele-optometry, especially in rural or underserved areas. Schools can offer virtual consultations with optometrists through tele-optometry so that the child does not have to travel far, thereby reducing travel time for eye care services and improve access to timely interventions (Huang et al., 2020)

2.4 Lighting and Classroom Ergonomics

Classroom lighting and ergonomics also help prevent myopia from getting worse. Proper lighting from outdoor natural light or evenly distributed artificial light can reduce eye strain. Also, ergonomic seating arrangements and frequent breaks from close-up work may reduce myopia progression risk (Friedman et al., 2021).

2.5 Refractive Correction Provision On-Site

Some schools have programs where refractive correction like glasses is given on-site. They make sure kids with glasses are getting them promptly so they can avoid barriers to care and improve educational outcomes. Prescription use compliance and academic performance have been found to improve with on-site glasses distribution (Wang et al., 2021).

2.6 Atropine Therapy and Orthokeratology

In children, atropine eye drops, and orthokeratology (overnight contact lenses) are two most common methods to slow myopia progression. But these therapies are often expensive, unavailable or not accessible to parents. Schools can adopt initiatives that are aimed at educating parents about these treatments options and refer them to eye care professionals (Chia et al., 2020).

2.7 Outdoor Activity Promotion

Promoting outdoor activity in schools is one of the cheapest ways to slow down myopia progression. Outdoor play and structured physical education should be included in the curriculum to encourage children to spend more time in natural light which protects against myopia development (Liu et al., 2020)

3. Barriers to Implementation

Although school-based myopia detection and intervention programs have some merits, but they may not be widely adopted because of certain barriers which they currently face. These barriers exist in the financial, logistical, social and cultural applications and must be addressed if we are to be successful in managing myopia in school age children.

3.1 Financial and Resource Limitations

Expenses for the initial setup and for running ongoing operations are among the biggest barriers to myopia detection and intervention programs in schools. The cost of high-quality vision screenings in schools often limits the scope and reach of these school-based vision screening programs especially in low-income districts that don't have enough resources (Zhao et al., 2021)

3.2 Lack of Awareness and Education

According to Saw et al., many school staff and parents are unaware of myopia or do not understand its impact on academic performance and overall health of children (Saw et al., 2020). Teachers especially might be undertrained to recognize myopia signs and to recommend appropriate professional eye care. Also, some parents do not think about eye exams for their children because they do not understand the role of early intervention in halting myopia's progression (Friedman et al., 2021).

3.3 Socioeconomic and Geographic Disparities

Access to eye care is greatly influenced by socioeconomic status and geographic location. In many cases, families in lower income brackets are not able to afford eye exams, glasses or specialized treatment for myopia even after screenings in schools indicate they need correction. A study by Zhao et al., showed that children from lower socioeconomic backgrounds are less likely to receive follow-up care after screening which affects how effective these school screening programs are (Zhao et al., 2021).

Other problems stem from geographic barriers in rural and remote areas. While some schools provide vision screenings, some children in less-served regions may not have easy access to eye care professionals for follow-up assessments or corrective treatments. According to Liu et al, children in rural areas often have difficulty getting optometry services because providers are scarce, care facilities are far away and transport is not available (Liu et al., 2020)

3.4 Policy and Systemic Barriers

Inconsistent policies between states and school districts prevent standardization of myopia detection programs. No nationwide law mandates school-based myopia screening, and age and frequency of vision screenings vary widely by region. This lack of consistency causes gaps in care and makes a uniform strategy difficult to implement nationally. Chia et al, pointed out that those fragmented policies regarding myopia screening and intervention often led to missed opportunities for early diagnosis and treatment (Chia et al., 2021). Also, in some schools, other health problems like immunization or mental well being may take precedence over vision care when budgets are tight. In this competition for resources, myopia screening and intervention may be cut off or not funded.

3.5 Cultural and Behavioral Resistance

In some communities there is a stigma about glasses which may make children not want to wear them because of peer pressure or societal perceptions. Friedman et al, found out that some children in some cultures resist corrective eyewear, which in turn reduces the success of these screening programs and early interventions (Friedman et al., 2021).

3.6 Legal Concerns

Legal issues also apply to school-based myopia screening and interventions. Some schools have trouble getting parental consent for screenings or corrective treatments because of concerns of data privacy, parental rights or cultural sensitivities. Zhao et al. In some jurisdictions, schools must meet legal requirements regarding parental consent and data protection which may delay or even prevent implementation of screening programs in those jurisdictions (Zhao et al., 2021)

4. Recommendations

With myopia becoming more common among school-age children in the US, comprehensive, evidence-based strategies must be developed for early detection and intervention. The following recommendations are designed with the aim to strengthen school-based myopia programs.

4.1 Standardizing Vision Screening Protocols Nationwide

Lack of uniformity in Vision Screening Protocols across states and school districts is one of the biggest barriers to myopia management. Having no standardized criteria for age of first screening, frequency of screenings and diagnostic tools results in poorer quality and accessibility of eye care. In 2021 Chia et al., called for nationwide guidelines requiring that all children be screened at appropriate ages and intervals to detect myopia early in at-risk populations. (Chia et al., 2021)

Standardized screening protocols would also enable cross region data comparisons and allow more robust evaluations of program effectiveness. Zhao et al, stated that in the long run, standardized approaches in urban and rural settings would ensure that children from all backgrounds are screened and followed up appropriately (Zhao et al., 2021).

4.2 Expanding Funding and Workforce Capacity

Funding and Workforce Needs are also major barriers to school-based vision screening programs. Li et al, said many schools especially low-income ones lack the money to buy diagnostic equipment and staff to conduct screenings. (Li et al., 2021) For this reason more federal and state money is needed to expand myopia detection in underserved communities.

Also, we need to train more optometrists, ophthalmologists and school nurses to do screenings and follow-up care. Sherwin et al., also recommended funding to cover the cost of equipment as well as training to increase the number of professionals who can provide school vision care. (Sherwin et al., 2021)

4.3 Incorporating Myopia Education into School Health Curricula

Early detection and prevention of Myopia must be taught in School Health Curricula. Friedman et al., argued that Educating students and teachers about myopia risks and how it may affect academic performance and quality of life can help schools become more proactive in eye health (Friedman et al., 2021). Early education about the benefits of outdoor activity and screen time management may also reduce myopia progression risk factors such as prolonged near work and insufficient time outdoors.

In addition to the eye health benefit, general health education curricula might encourage other behaviors like spending more time outdoors, which has been shown to reduce myopia risk. Saw et al, also stressed that initiatives may also empower parents with information about how to support children's vision health at home (Saw et al., 2020).

4.4 Longitudinal Data Collection and Program Evaluation

Continuous Data Collection and Program Evaluation are necessary for monitoring school-based myopia detection and intervention programs. Longitudinal data would help researchers and policy makers understand myopia trends, different interventions and long-term results of early detection strategies. Liu et al in 2020 called for robust systems of data collection and analysis to evaluate vision screening programs in myopia control and eye health in school age children. (Liu et al., 2020)

Regular program evaluation would also reveal barriers to implementation and allow real-time changes in care quality to be made. Zhao et al, recommended such evaluations at the local, state and national levels to ensure that programs are changing to meet new needs and that the best interventions are scaled up in different regions (Zhao et al., 2021)

5. Innovative and Emerging Approaches

With myopia growing globally new and emerging strategies need to be developed for its early detection, intervention and management especially in school age children.

5.1 Integrating AI and Machine Learning in Screening

AI and ML technologies are rapidly changing vision care especially myopia detection. AI-powered screening tools like photo-screeners are getting more sophisticated, making it able to detect myopia faster and more accurately in children. These image-based technologies pick up refractive errors very precisely and often faster than with traditional methods. AI-based screening systems can shorten the time to vision assessment and make large-scale school-based screenings more feasible and less resource-intensive (Zhao et al., 2021). Also, AI and ML algorithms can improve their diagnostic accuracy by analyzing large datasets. Li et al, using large amounts of visual and demographic data, demonstrated that machine learning algorithms can predict myopia onset in children very well. Therefore, by incorporating such technologies into school screening programs, schools could identify at-risk children earlier to provide timely interventions (Li et al., 2021).

5.2. Mobile Vision Clinics and Telehealth

In rural or low-income areas where eye care services are scarce, Mobile Vision Clinics and Telehealth are making eyecare and screening more accessible to those underserved populations. Myopia in children who otherwise would not have screening is being detected by mobile vision clinics equipped with diagnostic tools, according to Friedman et al. (2021). Sherwin et al, stated that telehealth has helped get eye care to people when there are not enough optometrists in a community (Sherwin et al., 2021). In school-based screening programs, tele-optometry can be added without parents or children having to travel long distances to see an eye care professional.

6. Conclusion

The myopia epidemic affecting school-age children in the United States is a public health emergency that requires immediate action and targeted interventions. Early detection and intervention for myopia in school age children is critical to limiting the public health problem. School-based vision screening programs together with other public health interventions can help identify children that are at risk for early myopia and implement corrective measures. If we correct myopia earlier, we can limit severe visual impairment potential, improve academic performance and improve the quality of life for affected children. The importance of these interventions cannot be overstated and policymakers, educators and eye care professionals need to work together for a just, fair and equitable myopia management system. Schools need funding for screening programs and vision care must be expanded especially for the poor. School curricula should include eye health education so children are aware and have better vision habits. Eye care professionals especially optometrists can help with the expertise, screenings and referrals.

Our united actions can all help to reduce myopia in both school-aged children and the society at large; therefore, we need everyone to step up and contribute to fix this so that every child can grow up with healthy vision.

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Author Profile

Nnamdi Okore received a Doctor of Optometry degree from the Prestigious Abia State University in 2017, gradating as the Doctor with the highest-grade point average receiving numerous awards from the optometry regulatory body in the country, the Institution and subsequently offered automatic full-time employment as a Lecturer in the same institution where he worked until 2022. In 2022, he relocated to Canada and worked with TLC Laser Eye Center from 2022 -2025 specializing in myopia control and treatment and refractive surgery. He has also been involved in public health campaigns, raising awareness and implementing strategies to combat diabetic retinopathy and solving global health challenges particularly in underserved population and low resources areas. In 2025, he met all requirements for Licensure in the State of New York through the State University of New York, Education Department.