Comparison of Myopia Prevalence Among Hostel and Day Scholar School Students in Kanpur, Uttar Pradesh

Running Title: *Myopia Prevalence: Hostel vs Day Scholars students*

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Abstract

Background: The global rise in myopia prevalence among school-aged children has prompted significant interest in identifying modifiable environmental and behavioural determinants of refractive error. Factors including prolonged engagement in near-vision tasks, excessive digital screen exposure, and inadequate participation in outdoor activities have been consistently associated with myopia onset and progression.

Objective: This study aimed to compare the prevalence of myopia between residential hostel students and non-residential day scholar students aged 12 to 18 years attending schools in Kanpur, Uttar Pradesh, and to examine the relationship between lifestyle habits and myopia occurrence.

Methods: A cross-sectional observational study was conducted among 900 school students, comprising 500 hostel students and 400 day scholars. Demographic and lifestyle data were gathered using a structured questionnaire. Refractive status was evaluated through visual acuity assessment and refraction. Myopia was defined as a spherical equivalent refractive error of −0.50 diopters or more.

Results: The prevalence of myopia was 13.8% among hostel students and 18.0% among day scholars. Day scholars recorded a mean daily screen time of 2.5 hours versus 0.5 hours for hostel students, and they engaged in 1.1 hours of outdoor activity daily compared to 2.2 hours among hostel counterparts.

Conclusion: Day scholar students demonstrated a higher prevalence of myopia, which was associated with greater screen exposure and reduced outdoor participation. Findings support the implementation of structured outdoor activity programs and responsible digital device policies in school settings.

Keywords

Myopia; Hostel Students; Day Scholars; Screen Time; Outdoor Activity; School Children; Refractive Error; Visual Health; Kanpur; Uttar Pradesh

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Introduction

Myopia, widely referred to as nearsightedness, is a refractive condition in which the focal point of parallel light rays falls anterior to the retina under relaxed accommodation, resulting in impaired distance vision. It ranks among the most frequently occurring ocular disorders in the paediatric and adolescent age groups and has been recognised as a growing public health challenge globally. Beyond its functional impact on vision, myopia is associated with a range of serious ocular complications, including retinal detachment, myopic maculopathy, open-angle glaucoma, and posterior subcapsular cataract. The cumulative burden of these complications has substantial implications for quality of life, educational attainment, and national healthcare expenditure (Morgan, Ohno-Matsui and Saw, 2012).

Epidemiological trends indicate a marked escalation in myopia prevalence across both high-income and low-to-middle-income countries over the past several decades. Global projections estimate that approximately one in three individuals is currently affected by myopia, and this proportion is anticipated to approach half the world's population by the year 2050 (Holden et al., 2016). The parallel rise in high myopia, defined as a spherical equivalent of −6.00 diopters or worse, has amplified concerns regarding preventable blindness and associated ocular morbidity in future generations.

While genetic predisposition has long been acknowledged as a contributory factor, accumulating evidence points to environmental and behavioural determinants as primary drivers of the contemporary myopia epidemic. Rapid shifts in lifestyle patterns accompanying urbanisation and

educational intensification have substantially altered the visual environment of children and adolescents. Prolonged near-work activities, including reading, writing, and the use of electronic devices, have been implicated in increased accommodative demand and consequent axial elongation of the eyeball (Pan, Ramamurthy and Saw, 2012). Concurrently, the pervasive availability of smartphones, tablets, personal computers, and television has accelerated digital screen engagement among younger populations.

Outdoor activity has received considerable scientific attention as a potential protective factor against myopia development. The hypothesis that exposure to higher ambient light intensities outdoors stimulates retinal dopamine release, thereby regulating ocular axial growth, has gained traction through both experimental and epidemiological research. Rose et al. (2008) reported that children with greater outdoor exposure exhibited a meaningfully lower prevalence of myopia compared to peers with restricted outdoor time. Subsequently, He et al. (2015) demonstrated through a randomised clinical trial that incorporating additional outdoor time within school hours significantly curtailed the incidence of new myopia cases. A comprehensive systematic review and meta-analysis by Xiong et al. (2017) corroborated these findings, concluding that outdoor exposure confers a protective effect against both the onset and progression of myopia.

Within the Indian context, myopia prevalence among school-going children has risen steadily, with a more pronounced trend observed in urban populations (Agarwal et al., 2020). Saxena et al. (2022) identified limited outdoor participation as a significant risk factor in North Indian school children. Despite growing evidence of lifestyle-related influences on refractive error, comparative investigations between students residing in structured residential settings and those attending schools as day scholars remain sparse, particularly in the Uttar Pradesh region.

Hostel students in residential schools typically adhere to regulated daily timetables that include defined study periods, mandatory recreational activities, and restricted individual screen usage. In contrast, day scholars enjoy greater autonomy in organising their after-school hours, which may lead to higher levels of recreational screen use and diminished outdoor engagement. These differential lifestyle patterns present a unique opportunity to examine how living arrangements and associated habits influence myopia prevalence within a comparable educational cohort.

The present study was therefore undertaken with the dual objectives of comparing myopia prevalence between hostel and day scholar students aged 12 to 18 years in Kanpur, Uttar Pradesh, and of examining the association between lifestyle variables, including screen time, outdoor activity duration, and near-work load, with the occurrence of myopia. The findings are intended to inform the development of targeted preventive interventions and school-based awareness programmes aimed at mitigating the growing burden of childhood myopia.

Materials and Methods

Study Design

A cross-sectional observational study was carried out among school-going students in Kanpur, Uttar Pradesh, India. Data were collected over a defined period following the receipt of institutional ethical clearance and written informed consent from the parents or guardians of all participating students.

Study Population

The target population comprised students aged between 12 and 18 years who were enrolled in either residential schools (providing on-campus hostel accommodation) or non-residential schools (attended as day scholars).

Study Groups

Group A – Hostel Students: Students enrolled at Jawahar Navodaya Vidyalaya, residing in on-campus hostel facilities with regulated daily schedules.
Group B – Day Scholar Students: Students attending non-residential schools in the Kanpur region without boarding accommodation.

Sample Size

A total of 900 students were included in the study: 500 hostel students (Group A) and 400 day scholar students (Group B).

Inclusion Criteria

- Students aged 12 to 18 years at the time of screening.
- Students enrolled in either a residential hostel school or a non-residential day scholar school.
- Students with or without a documented prior history of myopia.
- Students presenting with a refractive error of −0.50 diopters or greater on objective and/or subjective refraction.

Exclusion Criteria

- History of intraocular or ocular surface surgery, including laser-assisted refractive procedures, cataract surgery, or surgical correction of strabismus.
- Presence of amblyopia, keratoconus, or any structural retinal disorder.

- Systemic diseases known to affect visual function, including diabetes mellitus and autoimmune conditions.
- Neurological disorders such as epilepsy or migraine with visual aura.
- Long-term use of corticosteroids or other medications with documented ocular side effects.

Data Collection and Assessment Procedures

Demographic details and lifestyle information were gathered using a structured, pre-validated questionnaire administered by trained research personnel. The questionnaire captured information on daily screen time (inclusive of mobile phone, television, tablet, and computer use), duration of outdoor activity, near-work load (reading, writing, and study hours per day), and parental history of refractive error.

Distance visual acuity was measured using a standard Snellen chart at a testing distance of six metres under standardised illumination conditions. Students who demonstrated a best-corrected visual acuity below 6/6 in either eye, or who reported symptoms consistent with distance blur, were subjected to detailed ophthalmic evaluation. Objective refraction was performed using an auto-refractometer, followed by subjective refinement of the refraction to arrive at the best-corrected spherical equivalent.

Myopia was defined according to established clinical criteria as a spherical equivalent refractive error of −0.50 diopters or greater in one or both eyes, consistent with the International Myopia Institute classification guidelines (Flitcroft et al., 2019).

Statistical Analysis

Data were entered into a Microsoft Excel spreadsheet and analysed using appropriate descriptive statistical methods. Prevalence rates were expressed as percentages. Differences in lifestyle variables between the two groups were assessed and presented as group means. A chi-square test was applied to evaluate the statistical significance of the difference in myopia prevalence between hostel and day scholar students, with a p-value of less than 0.05 considered statistically significant.

Observation and Results

Of the 900 students screened, 141 were diagnosed with myopia, yielding an overall prevalence of 15.7%. Among hostel students, 69 out of 500 met the diagnostic criteria for myopia, representing a prevalence of 13.8%. In contrast, 72 out of 400 day scholar students were found to be myopic, corresponding to a prevalence of 18.0%. The difference in prevalence between the two groups was statistically significant ($p < 0.05$), with day scholars demonstrating a 4.2 percentage point higher prevalence of myopia compared to hostel students.

With respect to lifestyle parameters, day scholar students reported a mean daily screen time of 2.5 hours, which was substantially greater than the 0.5 hours recorded among hostel students. Regarding outdoor activity, hostel students spent a mean of 2.2 hours daily engaged in outdoor pursuits, compared to only 1.1 hours among day scholars. Near-work duration, encompassing academic study and related reading or writing activities, was higher in day scholars at 8.5 hours per day, in contrast to 7.8 hours per day among hostel students.

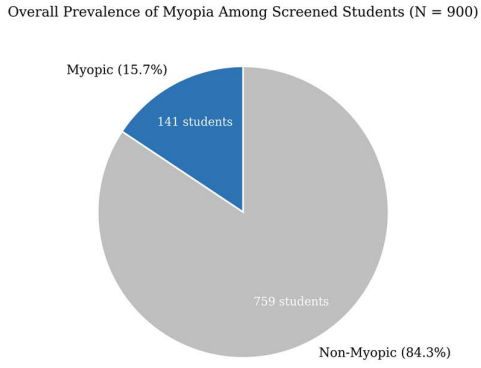

Figure 1: Overall Prevalence of Myopia Among Screened Students (N = 900)

Table 1 presents a comparative summary of myopia prevalence and associated lifestyle parameters between the two study groups.

Table 1: Comparison of Myopia Prevalence and Lifestyle Parameters Between Hostel and Day Scholar Students

Parameter	Hostel Students (Group A)	Day Scholar Students (Group B)	Finding / Unit
Total Students Screened (N)	500	400	Count
Myopic Cases (n)	69	72	Count
Myopia Prevalence (%)	13.8%	18.0%	4.2% higher in Day Scholars

Parameter	Hostel Students (Group A)	Day Scholar Students (Group B)	Finding / Unit
Diagnostic Criterion	≤ −0.50 D Spherical Equivalent	≤ −0.50 D Spherical Equivalent	Clinical Standard
Mean Daily Screen Time	0.5 hours	2.5 hours	Hours/day (Major Risk Factor)
Mean Daily Outdoor Activity	2.2 hours	1.1 hours	Hours/day (Protective Factor)
Mean Daily Near Work	7.8 hours	8.5 hours	Hours/day (Near Work Load)
Observed Association	Lower prevalence: high outdoor exposure, low screen time	Higher prevalence: low outdoor exposure, high screen time	Environmental Correlation

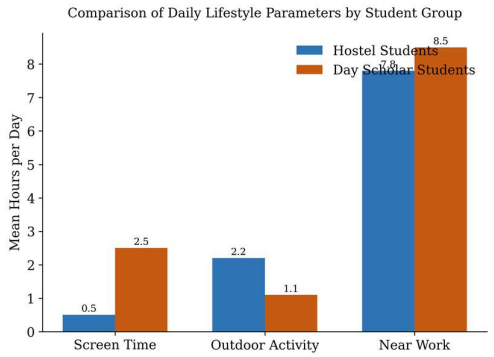

Figure 2: Comparison of Daily Lifestyle Parameters by Student Group

Discussion

The results of the present study reveal a higher prevalence of myopia among day scholar students relative to their hostel-resident counterparts. This differential finding is consistent with the hypothesis that structured living environments, which restrict prolonged screen use and promote regular outdoor engagement, may attenuate the risk of myopia development in school-aged children. The observed association between reduced screen time, greater outdoor activity, and lower myopia prevalence among hostel students aligns with the substantial body of literature examining lifestyle influences on refractive error development.

One plausible mechanism underlying the lower myopia prevalence observed among hostel students is the influence of regulated daily schedules characteristic of residential schools. Institutional timetables in such settings typically incorporate mandatory physical activity and outdoor recreation periods, limit individual access to digital devices outside designated hours, and structure academic study within defined intervals. This regulated environment may serve to limit the cumulative near-work burden and reduce continuous accommodation demand, thereby reducing stimuli for axial elongation. Simultaneously, the regular outdoor exposure afforded by structured recreational periods may facilitate the protective neurochemical effects of high-intensity natural light, specifically through the promotion of retinal dopamine secretion, which has been shown to retard axial eye growth in experimental models.

The protective role of outdoor activity in myopia prevention has been well-established through epidemiological and interventional research. Rose et al. (2008) observed that children with greater participation in outdoor activities demonstrated a significantly lower risk of myopia compared to peers with limited outdoor time, independent of near-work load. Importantly, He et al. (2015) provided robust experimental evidence through a randomised clinical trial, demonstrating that the addition of structured outdoor periods during school hours significantly reduced new myopia onset among Chinese schoolchildren over a three-year follow-up period. The findings of the present study corroborate these observations, as hostel students who spent nearly twice as much time outdoors daily exhibited a meaningfully lower myopia prevalence than day scholars.

The significantly greater screen time reported by day scholar students in this study is particularly noteworthy. With a mean daily screen exposure of 2.5 hours compared to 0.5 hours among hostel students, day scholars were exposed to substantially higher levels of near-vision digital tasks. Digital device use places the visual system under continuous accommodative demand at short viewing distances and in low-luminance conditions, which may collectively contribute to or accelerate axial elongation. Huang et al. (2020) identified increased digital screen exposure as an independent risk factor for myopia progression in school-aged children, while Jonas et al. (2021) highlighted the

cumulative interaction between near work and reduced outdoor exposure in driving myopia incidence.

The higher near-work duration among day scholars (8.5 hours per day versus 7.8 hours among hostel students) likely reflects the additional academic and tuition commitments that non-residential students undertake after school hours. The combination of extended near-work with high screen time and reduced outdoor activity may create a compounding risk environment that predisposes day scholars to a higher myopia burden. This cumulative exposure model is supported by findings from French et al. (2013) and Jones et al. (2007), who identified near-work intensity and limited outdoor time as additive contributors to incident myopia in longitudinal cohort studies.

The findings carry particular relevance in the context of the post-pandemic educational landscape, wherein online learning modalities and home-based digital engagement have substantially increased among children. Multiple recent reports have documented a surge in myopia incidence and progression during periods of prolonged school closure and home confinement. The present results reinforce the imperative of prioritising outdoor activity and limiting recreational screen exposure as cornerstones of myopia prevention policy.

From a public health standpoint, high myopia is associated with a significantly elevated lifetime risk of sight-threatening complications, including rhegmatogenous retinal detachment, myopic macular degeneration, primary open-angle glaucoma, and complicated cataract (Sankaridurg et al., 2021). Early preventive interventions targeting modifiable risk factors are therefore of critical importance. Schools, parents, ophthalmologists, and health policymakers must collaborate to develop and implement evidence-based programmes that encourage outdoor participation, establish reasonable limits on recreational screen time, and promote awareness of myopia risk among school communities.

Conclusion

The present cross-sectional study conducted among school students in Kanpur, Uttar Pradesh, demonstrates a statistically significant difference in myopia prevalence between hostel-resident and day scholar students. A higher prevalence of myopia was identified among day scholars, which was associated with greater daily screen time and reduced outdoor activity compared to their hostel counterparts. These findings underscore the important role of lifestyle and environmental factors in determining myopia risk among school-aged children.

Structured residential environments, characterised by regulated screen use and mandatory outdoor activity, appear to confer a degree of protection against myopia development. Educational institutions, healthcare providers, and parents should collaborate to implement practical interventions, including minimum daily outdoor activity targets, structured screen-time restrictions, and vision health education programmes, to reduce the growing burden of myopia in the school-going population. Longitudinal research in this area would further strengthen causal inferences and guide the development of evidence-based preventive strategies.

Limitations

The present study is limited by its cross-sectional design, which precludes the establishment of causal relationships between lifestyle exposures and myopia prevalence. Additionally, lifestyle data were obtained through self-reported questionnaires, which may be subject to recall bias or social desirability effects. Future longitudinal studies with objective measurement of outdoor light exposure and screen time, conducted across larger and more geographically diverse populations, would strengthen the evidence base for causality and support the refinement of preventive guidelines.

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Author Contributions

Pooja Nishad: Conceptualisation of the study, development of the research protocol, primary manuscript writing, literature review, data collection, participant recruitment, and administration of the structured questionnaire. Ms Nishad also contributed to the drafting, critical revision, and preparation of the final manuscript for submission.

Dr. Anitha Arvind: Supervision and academic mentorship throughout the study, guidance in study design and methodology, oversight of data collection procedures, and critical intellectual review of the manuscript. Dr. Arvind also contributed to the writing and editing of the final draft, ensuring academic rigour and scholarly integrity of the work.

Mitesh Yadav: Statistical analysis and interpretation of clinical and epidemiological data, including computation of myopia prevalence rates, group-wise comparison of lifestyle parameters, and application of appropriate inferential statistical tests. Mr. Yadav also provided expert optometric clinical input and contributed to the critical appraisal of the results and their contextualisation within existing ophthalmic literature.

Data Availability Statement

The datasets generated and analysed during the current study are available from the corresponding author on reasonable request.

Conflict of Interest

The authors declare that there are no financial, personal, or professional conflicts of interest that could have influenced the design, conduct, reporting, or interpretation of the findings presented in this study.

References

Agarwal, D., Saxena, R., Gupta, V., Mani, K., Dhiman, R., Bhardwaj, A. and Vashist, P. (2020) 'Prevalence of myopia in Indian school children: Meta-analysis of last four decades', PLOS ONE, 15(10), p. e0240750. Available at: https://doi.org/10.1371/journal.pone.0240750.

Dolgin, E. (2015) 'The myopia boom', Nature, 519(7543), pp. 276–278. Available at: https://doi.org/10.1038/519276a.

Flitcroft, D.I., He, M., Jonas, J.B., Jong, M., Naidoo, K., Ohno-Matsui, K., Rahi, J., Resnikoff, S., Vitale, S. and Yannuzzi, L. (2019) 'IMI – Defining and classifying myopia: A proposed set of standards for clinical and epidemiologic studies', Investigative Ophthalmology and Visual Science, 60(3), pp. M20–M30. Available at: https://doi.org/10.1167/iovs.18-25957.

French, A.N., Morgan, I.G., Mitchell, P. and Rose, K.A. (2013) 'Risk factors for incident myopia in Australian schoolchildren: The Sydney Adolescent Vascular and Eye Study', Ophthalmology, 120(10), pp. 2100–2108. Available at: https://doi.org/10.1016/j.ophtha.2013.02.035.

Guggenheim, J.A., Northstone, K., McMahon, G., Ness, A.R., Deere, K., Mattocks, C., Pourcain, B.S. and Williams, C. (2012) 'Time outdoors and physical activity as predictors of incident myopia in childhood: A prospective cohort study', Investigative Ophthalmology and Visual Science, 53(6), pp. 2856–2865. Available at: https://doi.org/10.1167/iovs.11-9091.

He, M., Xiang, F., Zeng, Y., Mai, J., Chen, Q., Zhang, J., Smith, W., Rose, K. and Morgan, I.G. (2015) 'Effect of time spent outdoors at school on the development of myopia among children in China: A randomised clinical trial', JAMA, 314(11), pp. 1142–1148. Available at: https://doi.org/10.1001/jama.2015.10803.

Holden, B.A., Fricke, T.R., Wilson, D.A., Jong, M., Naidoo, K.S., Sankaridurg, P., Wong, T.Y., Naduvilath, T.J. and Resnikoff, S. (2016) 'Global prevalence of myopia and high myopia and temporal trends from 2000 through 2050', Ophthalmology, 123(5), pp. 1036–1042. Available at: https://doi.org/10.1016/j.ophtha.2016.01.006.

Huang, P.C., Hsiao, Y.C., Tsai, C.Y., Tsai, D.C., Chen, C.W., Hsu, C.C., Huang, S.C., Lin, M.H. and Liou, Y.M. (2020) 'Protective behaviours of near work and time outdoors in myopia prevalence and progression in myopic children: A 2-year prospective population study', British Journal of Ophthalmology, 104(7), pp. 956–961. Available at: https://doi.org/10.1136/bjophthalmol-2019-314101.

Jonas, J.B., Ang, M., Cho, P., Guggenheim, J.A., Flitcroft, D.I., Lin, L.L.K., Sankaridurg, P., Saw, S.M. and Tideman, J.W.L. (2021) 'IMI prevention of myopia and its progression', Investigative Ophthalmology and Visual Science, 62(5), p. 6. Available at: https://doi.org/10.1167/iovs.62.5.6.

Jones, L.A., Sinnott, L.T., Mutti, D.O., Mitchell, G.L., Moeschberger, M.L. and Zadnik, K. (2007) 'Parental history of myopia, sports and outdoor activities, and future myopia', Investigative Ophthalmology and Visual Science, 48(8), pp. 3524–3532. Available at: https://doi.org/10.1167/iovs.06-1118.

Morgan, I.G., Ohno-Matsui, K. and Saw, S.M. (2012) 'Myopia', The Lancet, 379(9827), pp. 1739–1748. Available at: https://doi.org/10.1016/S0140-6736(12)60272-4.

Pan, C.W., Ramamurthy, D. and Saw, S.M. (2012) 'Worldwide prevalence and risk factors for myopia', Ophthalmic and Physiological Optics, 32(1), pp. 3–16. Available at:

https://doi.org/10.1111/j.1475-1313.2011.00884.x.

Rose, K.A., Morgan, I.G., Ip, J., Kifley, A., Huynh, S., Smith, W. and Mitchell, P. (2008) 'Outdoor activity reduces the prevalence of myopia in children', Ophthalmology, 115(8), pp. 1279–1285. Available at: https://doi.org/10.1016/j.ophtha.2007.12.019.

Sankaridurg, P., Tahhan, N., Kandel, H., Naduvilath, T., Zou, H., Frick, K.D., Lamoureux, E. and Resnikoff, S. (2021) 'IMI impact of myopia', Investigative Ophthalmology and Visual Science, 62(5), p. 2. Available at: https://doi.org/10.1167/iovs.62.5.2.

Saw, S.M., Katz, J., Schein, O.D., Chew, S.J. and Chan, T.K. (1996) 'Epidemiology of myopia', Epidemiologic Reviews, 18(2), pp. 175–187. Available at: https://doi.org/10.1093/oxfordjournals.epirev.a017924.

Saxena, R., Gupta, V., Prasad, P., Bhardwaj, A. and Vashist, P. (2022) 'Prevalence of myopia and its risk factors in rural school children in North India: The North India Myopia Rural Study (NIM-R Study)', Eye, 36(10), pp. 2000–2005. Available at: https://doi.org/10.1038/s41433-021-01797-3.

Tideman, J.W.L., Polling, J.R., Vingerling, J.R., Jaddoe, V.W.V., Williams, C., Guggenheim, J.A. and Klaver, C.C.W. (2018) 'Environmental risk factors can reduce axial length elongation and myopia incidence in 6- to 9-year-old children', Ophthalmology, 126(1), pp. 127–136. Available at: https://doi.org/10.1016/j.ophtha.2018.06.029.

Wadhwani, M., Vashist, P., Singh, S.S., Gupta, V., Gupta, N. and Saxena, R. (2022) 'Myopia prevalence in a population-based childhood visual impairment study in North India (CHVI-2)', Indian Journal of Ophthalmology, 70(3), pp. 939–943. Available at: https://doi.org/10.4103/ijo.IJO_974_21.

Wu, P.C., Tsai, C.L., Wu, H.L., Yang, Y.H. and Kuo, H.K. (2013) 'Outdoor activity during class recess reduces myopia onset and progression in school children', Ophthalmology, 120(5), pp. 1080–1085. Available at: https://doi.org/10.1016/j.ophtha.2012.11.009.

Xiong, S., Sankaridurg, P., Naduvilath, T., Zang, J., Zou, H., Zhu, J., Lv, M., He, X. and Xu, X. (2017) 'Time spent in outdoor activities in relation to myopia prevention and control: A systematic review and meta-analysis', Acta Ophthalmologica, 95(6), pp. 551–566. Available at: https://doi.org/10.1111/aos.13403.