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Parental attitudes to myopia: a key agent of change for myopia control?

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Abstract

Purpose: With the increasing prevalence in myopia there is growing interest in active myopia prevention. This study aims to increase our understanding of parental attitudes to myopia development and control, as a means to inform future health planning and policy. It evaluates, for the first time, the attitude of parents to myopia and its associated risks, as well as assessing the exposure of Irish children to environmental factors that may influence their risk profile for myopia development.

Methods: Parents of 8–13 year old children in eight participating schools completed a questionnaire designed to assess their knowledge of and attitudes towards myopia and its risk factors. A structured diary was also used to capture daily activities of children in relation to myopia risk factors.

Results: Of 329 parents, just 46% considered that myopia presented a health risk to their children, while an identical number (46%) regarded it as an optical inconvenience. Myopia was also, but less frequently, considered an expense (31% of parents), a cosmetic inconvenience (14% of parents) and, by some, as a sign of intelligence (4% of parents) 76% of parents recognised the potential of digital technology to impact the eye, particularly as a cause of eyestrain and need for spectacles. Only 14% of parents expressed concern should their child be diagnosed with myopia. Compared to non myopic parents, myopic parents viewed myopia as more of an optical inconvenience ($p < 0.001$), an expense ($p < 0.005$) and a cosmetic inconvenience ($p < 0.001$). There was a trend for myopic parents to limit screen time use in their household more than non-myopic parents ($p = 0.05$). Parents who considered myopia a health risk sought to limit screen time more than parents who did not regard myopia as a health risk to their child ($p = 0.01$). Children spent significantly longer performing indoor proximal tasks (255 min) compared to time spent outdoors (180 min; $p < 0.0001$) daily. Older ($p = 0.001$), urban ($p = 0.0005$) myopic (=0.04) children spent significantly more time at digital screens compared to younger non-myopic children from a rural background.

Conclusion: Parental attitudes to myopia were typically nonchalant in relation to health risk. This is of particular concern given the impact parents have on children's behaviour and choices with respect to such risk factors, demonstrating an acute need for societal sensitisation to the public health importance of myopia.

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Introduction

Myopia is predicted to affect a staggering 2.5 billion people worldwide by 2020,[1] and is set to double again to almost 5 billion by 2050.[2] In East and Southeast Asia, the prevalence of myopia has doubled in the past 30 years.[3] Similar extraordinary increases in prevalence have affected Western society, with myopia prevalence doubling over a similar time period to almost 50% among school-leavers in the USA,[4] and over 50% in parts of Europe,[5] including the UK.[6] Children are becoming more myopic at a younger age,[7,8] with the degree of myopia continuing to increase in magnitude over time.[9,10]

The public health implications of a continued increase in myopia prevalence and magnitude include a range of adverse societal, economic, educational and quality of life impacts. Epidemiological studies indicate that myopia is second only to age as a risk factor for many of the major eye diseases (glaucoma/cataract/retinal detachment),[11] and is the primary risk factor in myopic maculopathy.[12] The increasing prevalence and magnitude of myopia is associated with a dose-dependent increased risk of such conditions, and is therefore, already adversely influencing societal vulnerability to eye disease.[8,11] Myopic maculopathy is a leading cause of blindness in Asia[13] and has been consistently shown as a major cause of blindness among the working age population across Europe.[14–18] Should the myopia pandemic continue unabated, current estimates indicate that a seven-fold increase in the number of people who will suffer vision loss and blindness is possible from 2000 to 2050.[2] The above concerns all point to the urgent need for targeted interventions that (1) reduce the risk of developing myopia in the first instance, and (2) slow or halt the progression of myopia once diagnosed.

While the causes of myopia are both genetic and environmental, the recent and precipitous changes in myopia prevalence are thought to primarily reflect changing environmental influences.[19] In Singapore, both the prevalence and degree of myopia correlate with the time spent in full time education.[20] In Inuit populations with little genetic heterogeneity, the incidence of myopia has rapidly increased in line with acculturation and formal schooling over as few as two generations.[19,21] Jewish Orthodox male students in intense schooling involving sustained near vision were more likely to be myopic than girls from the same families who had a more normal educational upbringing.[22] Studies have also demonstrated positive associations between myopia and continuous reading or longer periods of close work,[23,24] and with reading more books per week.[25] Likewise it has been postulated that the increased use of personal electronic devices, continuous hours at a screen or the proximity of the screen to the face may influence myopic refractive error, even though myopia was a significant issue and was rising prior to the widespread adoption of smart phones or tablets. However the rapid and widespread adoption of such technology certainly merits research into its possible impact on visual development in children.

Recent studies have, therefore, focused on investigating myopia development and technology usage,[26–28] particularly computer and mobile phone usage, which have evolved rapidly over the past 10 years,[29] with electronic visual display technology now at the forefront in many schools and workplaces. Today's children are growing up in a world saturated with technology that demands proximal attention and competes for the leisure time available to children, with the average American youth now spending one-third of each day engaged in some form of electronic media.[30] Although not all studies are consistent in demonstrating a near-work myopia relationship,[24] it is conceivable that extensive exposure to screens might represent a risk factor for the development or progression of myopia and may have contributed to the recent rapid rise in the prevalence of myopia, especially in younger age cohorts.

This increased risk may relate to increased levels of proximal attention, altered patterns of near work such as the very short viewing distances associated with mobile phones, adverse influences on time spent outdoors or some combination of each of these factors. These potential contributions have yet to be fully elucidated and it is, therefore, essential to understand the influence of our contemporary environment on myopia onset and progression.

Time spent outdoors is also considered an important factor in relation to risk of incident myopia.[31–34] Modern society's increased emphasis on education,[35] the lack of green spaces due to urbanisation[2] and the extensive use of technology and smart devices[36] are all thought to detract from quality time spent outdoors, and comprise key drivers of this unprecedented myopia boom.

Although there is no established 'cure' for myopia, there is now a growing body of evidence demonstrating that myopia risk can be managed and myopia progression controlled. Interventions to increase time spent outdoors have, for example, proven to be effective in terms of reducing the risk of myopia development.[37,38] A range of optical and pharmacological treatments have now been shown to have the capacity to significantly reduce myopia progression, both in terms of refraction and axial growth.[39] Despite this evidence, very few practitioners are actively offering such treatment.[40]

Slow acceptance that myopia is a treatable condition,[41] concerns about the safety, cost and the availability of myopia control interventions are perceived barriers to myopia control practice.[40] The lack of uptake of available treatment

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options by practitioners confirms the need for stakeholder sensitisation regarding public health policy and clinical practice reform for myopia control.

There is a scarcity of published literature that probes the attitudes of individuals to myopia and its control. A structured search of MEDLINE, EMBASE, Google Scholar, Scopus, the World Health Organization International Clinical Trials Registry Platform, and ClinicalTrials.gov databases during the preparatory stages of this study revealed only two research papers and one survey that explored the awareness and attitudes of stakeholders toward myopia and myopia control. The limited research that exists, however, suggests that there is a lack of understanding of myopia, its risk factors and myopia control techniques among eye care practitioners, parents, teachers and students.[40,42,43] The importance of creating awareness around the causes of myopia and benefits of myopia control cannot be underestimated.[44] Parents can play an integral role given their particular influence on the lifestyle choices of children. The success of any strategy that requires behavioural modification or acceptance of new treatment regimens for children will likely depend on parental awareness of the condition and on their acceptance of the proposed interventions as a necessary treatment option.

From a myopia perspective, there are interesting parallels to be drawn to the emergent problem of childhood obesity. Obesity reflects a condition whose cause is rooted in a rapidly evolving pattern of lifestyle choices and environmental risk exposures. Health policy for childhood obesity management reflects the concept that childhood obesity 'needs to be tackled where it starts -at home'.[45] The most effective interventions are those which target parents as key mediators of change in child eating and physical activity behaviours.[46] Such family-based approaches recognise parents as integral targets of the intervention and include strategies to influence various aspects of parenting, including the environments to which children are exposed, parenting styles and practices and how child behaviour can mirror parental habits,[47] all of which would seem just as critical in relation to future myopia risk management strategies.[48] Promoting awareness of myopia, its causes and treatment options will help to motivate parents (and all other stakeholders) to actively prevent and treat myopia rather than just to passively alleviate the symptoms it creates.

This prospective study aims, therefore, to increase our understanding of the importance of the parental role in myopia development and control as a means to inform future health planning and policy. It evaluates, for the first time, the attitude of parents to myopia and its associated risks, as well as assessing the exposure of Irish children to environmental factors that may influence their risk profile for myopia development.

Methods

About 1190 school children aged between 8–13 years were invited to participate in the study. This included students from three urban and five rural schools in the Republic of Ireland, contacted through the study investigator and the Dublin Institute of Technology Access and Civic Engagement Office. Involvement in the study required completion of three key tasks; a parental questionnaire, a student daily activities diary, and a parental diary of child activities. Information regarding parental and children's refraction was obtained as part of the parental questionnaire. A talk was delivered to each class informing children and teachers about the research, and any questions were answered. All eligible students were then provided with an information leaflet, copies of the structured questionnaire and activity diaries and invited to discuss participation in the study with their parents. Questionnaires, diaries and consent forms were collected by the study investigator 1 week after distribution. Schools were contacted the day before the study investigator's return, to remind students to return their surveys.

An initial draft questionnaire for parents was constructed and subsequently analysed by an external reviewer with expertise in questionnaire design. The questionnaire was evaluated and optimised to ensure question construction did not contain leading, confusing or double-barrelled questions. The questionnaire contained 15 questions. This included three open-ended questions with a free-text box for parents to express their opinions in relation to myopia, their understanding of the consequences of myopia and their thoughts on the potential impact of technological devices on their child's eyes. Tick-box questions were used to explore parent's perceptions of myopia (e.g. as a health risk vs as an expense), and parents could tick all that applied to them. Tick box questions were also used to determine whether parents limited their child's screen usage, to record the type of outdoor activities, the child's ethnicity and whether the parents and/or child wore glasses for myopia. Both parents' and child's spectacle prescriptions (if any) were requested, as well as the age the child was first prescribed glasses, where relevant. If the parent had laser refractive surgery, the pre-surgery prescription was obtained where possible.

Parent and child diaries were designed to quantify the amount of time spent participating in activities that can influence myopic refractive error, based on previous literature.[3,23,38] Participating children were tasked to complete the structured diary each night for 1 week to quantify time spent each day reading, writing, watching television, doing their homework, on screens (phone/computer/tablet) and playing video games. The amount of time spent outside and the type of outdoor activity was recorded. Children

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also documented their time of sleep and wakening for 1 week. Parents were required to maintain a similar record of child activity, and document the average amount of time per weekday and weekend day their child spent outdoors, on screens, reading, writing and performing other near tasks such as artwork or reading music. Parents and children were instructed to complete their respective diaries independently of each other. To prevent shared views from within a family only one parent and child from each family were invited to participate in the study.

Diaries and questionnaires were anonymous; participants were assured that all individual results would be kept strictly confidential. Participation in the study was voluntary. A passive consent form, which required parents to sign and return the form if they did not wish their child to participate,[49] was distributed with the questionnaire for parents. The study was approved by the Research Ethics Committee at Dublin Institute of Technology. All data was collected in early Summer (May) of 2016. The data collected was analysed on the statistical package for social sciences (IBM SPSS Statistics for Windows, Version 22.0, www.ibm.com) and R version 3.2.2. in RStudio (www.rstudio.com). The Kolmogorov–Smirnov Test for normality determined the data we analysed was not normally distributed. Non- parametric tests were used where appropriate and the median and confidence intervals were reported throughout. A log transformation was also used to normalise certain data to facilitate further parametric analysis. The results were analysed using descriptive statistics and inferential statistics including a three-way ANOVA (using log transformed data), Mann–Whitney U test and chi-square tests of independence. A statistical significance level of $p < 0.05$ was adopted throughout the analysis.

Results

Demographics

Eight primary schools were approached and agreed to facilitate the conduct of the study, including five rural and three urban based schools. Rural was defined as settlements with a total population of 4000 or less. All rural schools were mixed gender schools. Urban schools consisted of one mixed gender school, one all-boys school and one all-girls school. Details pertaining to the flow of participants in the study are detailed in *Figure 1*. In all, 361 families participated in the study, although there was some minor loss of data on specific questions due to incomplete response. These included 246 urban and 114 rural based participants.

About 185 children were in fifth and sixth class (11–13 year olds) and 143 children were third and fourth class students (8–10 year olds). 45 children who participated in the study were myopic according to parental responses and prescriptions provided. The remainder of the children were either emmetropic or hyperopic or had undiagnosed refractive error (which may have included some undiagnosed myopes). The age (median) at which myopic participants were first prescribed glasses was 7 years, 95% CI [4, 10]. The median myopic prescription was −2.75 D, 95% CI [−0.25, −5.25] in the right eye and −3.00 D, 95% CI [−0.50, −5.50] in the left eye. Of the 45 myopic children, 25 were from an urban setting and the remaining 20 were attending a school in a rural area. 14 myopes were from the 8–10 year old age group and 31 of the myopic children were from the older 11–13 year old cohort. *Table* 1 outlines baseline characteristics of the study population.

Parental attitudes to myopia

Of 329 parents, just 46% considered that myopia presented a health risk to their children, while an identical number (46%) regarded it as an optical inconvenience that could be corrected with glasses, contact lenses or laser refractive surgery. Myopia was also, but less frequently, considered an expense (31% of parents) a cosmetic inconvenience (14% of parents) and, by some, as a sign of intelligence (4% of parents; see *Figure 2*). Parents who considered myopia a health risk sought to limit screen time more than parents who did not regard myopia as a health risk to their child χ^2 (2, N = 324) = 9.56, p = 0.01. However, a Mann–Whitney test indicated there were no significant difference in child lifestyle habits between children whose parents considered myopia a health risk compared to parents who did not consider myopia a health risk to their child (reading/writing U = 9106 p = 0.32, screen time U = 9987 p = 0.12, proximal indoor activities U = 11 229 p = 0.39 outdoors U = 11 665 p = 0.34).

Only 14% of parents (52/361) expressed concern should their child be diagnosed with myopia, 63 parents had no concern should their child require spectacles, 27 parents said glasses would be an inconvenience but not a concern, 21 parents had not thought of myopia affecting their child and nine parents thought their child was myopic but have never brought them to have an eye examination. The remaining parents did not specify their thoughts on myopia (see *Figure 3*).

Despite the finding that most parents did not consider myopia as a health risk, a large majority of parents (76%) did recognise the potential of digital technology to impact the eye, particularly as a cause of eyestrain and need for spectacles (see *Figure 4*). Most parents (78%) indicated that they sought to limit time using screens. Yet only 18 of 327 parents recognised any long-term risk from increased use of technology. Parents considered genetic predisposition and the use of technology as the two main causal factors for myopia.

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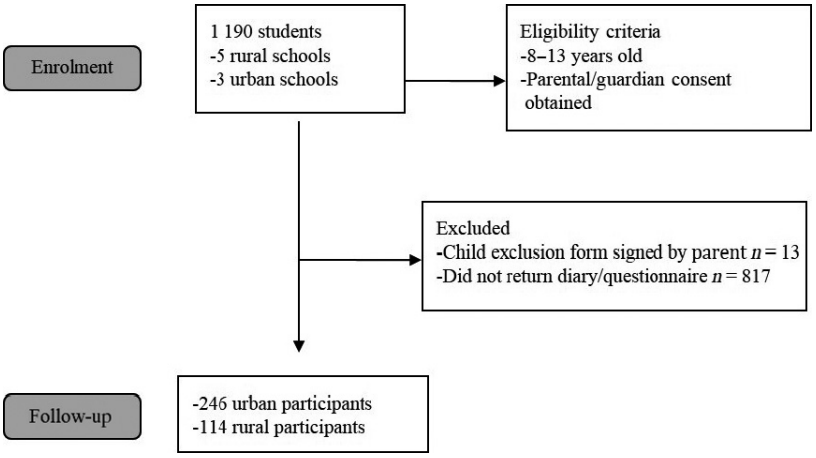


Figure 1. Flow of participants through the study.

Table 1. Participant baseline characteristics

Age	Location	Myopic parent	Myopic child
8–10 years n = 143	Urban n = 246	One Parent n = 126	Yes n = 45
11–13 years n = 185	Rural n = 114	Both Parents n = 41	No n = 306
Missing n = 33	Missing n = 1	Missing n = 19	Missing n = 10

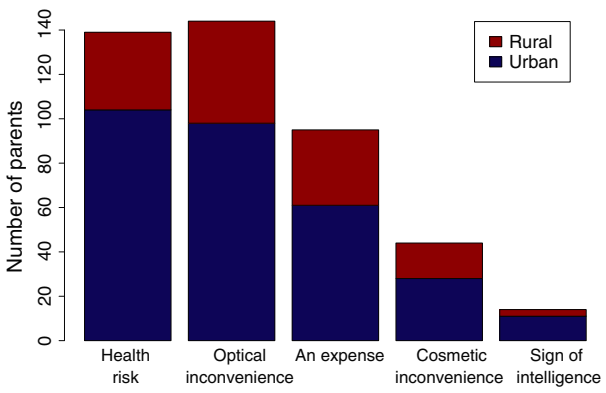


Figure 2. Parental opinion of myopia as identified in tick box responses to the question "Do you see shortsightednes as: (tick all that apply)".

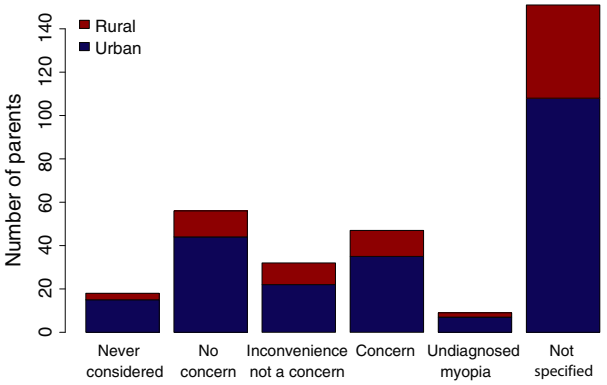


Figure 3. Parental free text responses to the question "What do you think about the possibility that your child is, or may become, short-sighted?".

Relationship between attitudes and family myopia status

A chi-square test of independence was performed to examine the relationship between family myopia status and attitudes toward myopia. Compared to non-myopic parents, myopic parents viewed myopia as more of an optical inconvenience χ^2 (2, N = 308) = 16.08, p = 0.0003 (*Figure 5* left), an expense χ^2 (2, N = 308) = 11.91, p = 0.0025 (*Figure 5* middle) and a cosmetic inconvenience χ^2 (2, N = 308) = 20.51, $p < 0.0001$ (*Figure 5* right). Myopic parents limited screen time use in their household more than non-myopic parents, although this result was borderline significant χ^2 (2, N = 303) = 5.95, p = 0.05. There was no significant difference in perceptions of health risk associated with myopia between myopic and non-myopic parents χ^2 (2, N = 308) = 4.04, p = 0.13.

A chi-square test of independence confirmed there was no significant difference in attitudes toward myopia between urban and rural parents (optical inconvenience p = 0.46, cosmetic inconvenience p = 0.27, expense p = 0.08, intelligence p = 0.33, health Risk p = 0.41).

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Daily activities of children

Parents recorded their children as spending twice as much time on digital devices on weekend days compared to weekdays. Children spent a daily total of 255 min on average participating in proximal tasks at home and in school, equating to 41% more time spent on proximal tasks relative to outdoors. Parental assessment of their children's activities is represented in *Table* 2.

Proximal indoor activities

A three-way ANOVA run on a sample of 287 participants revealed older [$F(1, 279) = 6.31$, MSE = 3.10, $p = 0.01$], myopic children [$F(1, 279) = 5.57$, MSE = 2.74, $p = 0.02$] from an urban area [$F(1, 279) = 6.66$, MSE = 3.27, $p = 0.01$] spent significantly more time participating in proximal indoor activities compared to younger non-myopic children. There were no significant interactions.

Screen time

A three-way ANOVA on a sample of 278 participants revealed older [$F(1, 270) = 10.80$, MSE = 7.034, $p = 0.001$], myopic children [$F(1, 270) = 3.89$, MSE = 2.53, $p = 0.04$] from an urban background [$F(1, 270) = 12.27$, MSE = 8.00, $p < 0.001$] spent significantly more time using digital screens compared to younger non-myopic urban based children. There were no significant interactions.

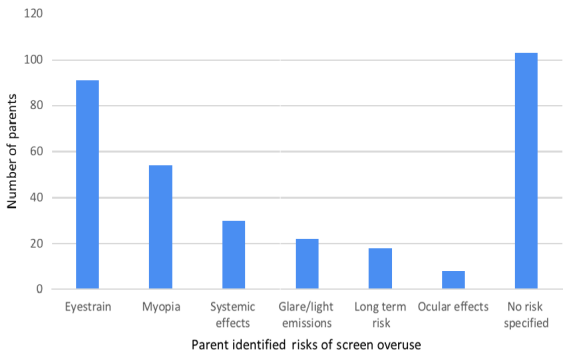


Figure 4. Ocular risks identified by parents in free-text responses to the question "what do you think are the potential risks/effects (of digital technology) on the eyes".

Outdoor activity

A three-way ANOVA run on a sample of 293 participants revealed no significant effect of age, [$F(1, 284) = 0.09$, MSE = 0.03, $p = 0.76$], or refractive status [$F(1, 284) = 1.94$, MSE = 0.63 $p = 0.17$] on the amount of outdoor activity, although location was borderline significant [$F(1, 284) = 3.76$, MSE = 1.21, $p = 0.05$]. There were no significant interactions.

The diary responses revealed a discordance between child and parent recorded activities, with parents assigning more time to all tasks relative to children. However the findings are similar irrespective of which data are used: older, myopic children from an urban background spent less time outside, and more time participating in indoor activities and on screens compared to younger non myopes from a rural area.

Discussion

This study advances our knowledge in relation to myopia, particularly in relation to parental attitudes and understanding of the condition. Parental understanding of the causes of myopia was limited. Perhaps the most salient findings to emerge from this study include the lack of recognition of the health risks for eye disease and vision loss associated with myopia and the lack of parental concern associated with a diagnosis of myopia in a child. This extends previous research which has highlighted that parents are motivated to avoid ocular damage to their child's eyes from myopia, but have a lack of information and understanding as to how this can be achieved.[43] Even though the majority of parents in our study reported that they limited their child's screen-time, children spent over 14 h week^{-1} on average at a screen. Given that the study

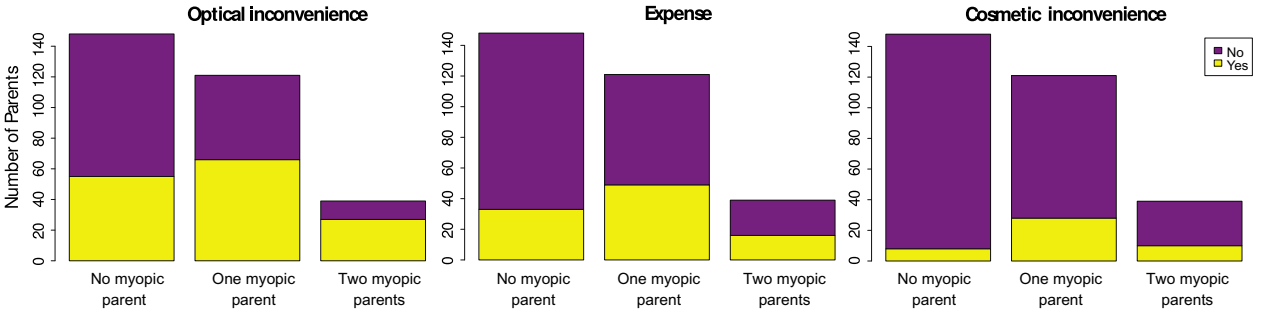


Figure 5. Relationship between attitudes and family myopia status for Optical Inconvenience (left), Expense (middle) and Cosmetic Inconvenience (right).

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Table 2. Parental diary recordings (median and confidence intervals) of the daily time (min) for older vs younger children, urban vs rural based children and myopic vs non myopic children

	Age			Location			Refractive Status		
	8–10 years	11–13 years	*p**	Urban	Rural	*p**	Myopes	Non Myopes	*p**
Proximal Indoor activities	231 min (127, 334)	278 min (165, 411)	0.01	270 min (154, 392)	240 min (139, 361)	0.01	341 min (233, 429)	244 min (142, 368)	0.02
Screens	77 min (52, 137)	111 min (73, 186)	0.001	99 min (74, 172)	77 min (47, 154)	0.0005	135 min (78, 196)	90 min (60, 158)	0.04
Outdoors	180 min (134, 246)	180 min (120, 266)	0.76	166 min (124, 249)	193 min (139, 261)	0.05	177 min (103, 129)	193 min (139, 261)	0.17

*Three-way ANOVA analysis, *p* values relate to log transformed data.

was conducted at a time of year with plenty of opportunity for quality time to be spent outdoors, this suggests that strict limits were not enforced. Additionally, even though some parents did consider myopia as a health risk, their children's level of myopia risk exposure was no different from those of children whose parents did not consider myopia as a health risk. Given the dominant influence parents have on their child's lifestyle choices, these findings confirm that public education about myopia and its risk factors is important in order to close this critical knowledge gap and to generate a shift in the attitude and behaviours of individuals at risk of myopia. From a public health policy perspective, successful realisation of any strategy to control the development of myopia and associated disease will depend heavily on the informed participation of parents.

This study has also explored Irish children's current daily lifestyle habits for the first time, and quantified the level of exposure of different groups to driving factors associated with incident and progressive myopia. Our findings corroborate and extend previous research and demonstrate clearly that child exposure to risk factors known to influence the development of myopia are associated with increasing age, urbanisation and existing myopia.

Non-myopic children spent an additional 2 h week^{-1} on average outdoors relative to myopes. This supports the results of the Avon Longitudinal Study of Parents and Children (ALSPAC) study where the weekly average difference was just over 3 h.[32] The difference in the amount of time urban based children spent outdoors relative to rural children was almost identical in this study to that identified in Guo *et al.*'s study, who found that primary school children from the urban region of Beijing spent an additional 1 h day^{-1} outdoors compared to children in rural Beijing.[50]

Urbanisation is thought to be linked to increasing prevalence of myopia due to a lack of green spaces, less time outdoors and changes in lifestyle in more densely populated areas.[23,51] It has been predicted that by the year 2050, 75% of the Irish population and over 80% of the European population will live in urban areas.[52,53] Given our finding that urban based children spend less time outdoors relative to rural children, these urbanisation trends will necessitate a comprehensive strategy to avoid a continuation and exacerbation of the observed pattern of increasing prevalence of myopia in cities compared to rural areas.[54] The lack of awareness expressed by parents in this study illustrates clearly that the strategy will need to engage parents directly so they can play a prominent role in reversing the indoors to outdoors activity time balance.

Older children in our study also spent more time using visual displays than younger children. The threefold variance in mobile phone usage between older and younger children is notable. This transition is not unexpected as

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older children are more likely to have a phone but the young age range of our primary school participant cohort makes this considerable increase particularly interesting. The closer working distance of a mobile phone compared to a computer screen or a book places greater visual demands on the ocular system,[55] which is important given that closer reading distances and continuous reading have been identified in some studies as risk factors for myopia.[20,24] These findings compliment previous observations that increasing age is accompanied by a decline in time spent outdoors coupled with increased computer use.[56–59] It has been reported, for example, that the average UK teen and adult spends more time using media and technology than they do sleeping.[60] The continuous technological revolution and our sudden reliance on technology at home, work, in schools, our cars and in almost every aspect of our lives may be a significant factor in the sudden rise in myopia in many countries, especially among children who are becoming myopic at a younger age.[7,8] It could also be argued that increased use of technology and devices competes with other more protective activities such as time outdoors,[61] thereby potentially exerting both a direct and indirect influence on myopia development and progression and also making it more difficult to tackle the current pandemic.[62]

Although our cohort of myopic children was relatively small in number ($n = 45$), they spent significantly more time indoors participating in proximal tasks and at screens compared to non-myopes. This supports the observation in other studies that increased amounts of close work contribute to a higher prevalence and severity of myopia.[23,25,63] Saw *et al.*[54] reported that among 8–9 year old children, myopes performed more total near work activities (2.7 ± 0.7 h day^{-1}) than non-myopes (2.3 ± 1 h day^{-1}) daily($p = 0.0027$), which mirrors our finding that myopic children spent an additional 20 min day^{-1} on proximal screens compared to non myopes.

The primary approach to myopia management in children currently prioritises the alleviation of its defining symptom of blurred distance vision. Practitioners, patients and parents generally consider the condition effectively managed through the simple correction of the refractive error, typically using spectacles. The essentially universal parental acceptance of this simple and convenient corrective device means that compliance with the treatment is high, even in young children, and the symptoms of myopia are therefore very successfully managed.[64] Perhaps of more importance is the lack of any significant burden on parents associated with this form of treatment, beyond of course, the occasional need for reminders to wear the spectacles, repair or replacement of broken spectacles and return for future eye examinations. The interventions required to prevent and control the spread of myopia are likely to be substantially more burdensome to parents. Convincing children to give up their smartphone in favour of outdoors activities might not be easy. There will also be added costs to parents, both in terms of time and finances. Optical and pharmacologic interventions will require investment above and beyond the usual costs of spectacles (which will still be required). The burden of care will also increase, requiring more eye care visits, more time to adopt the intervention (e.g. insert eye drops or contact lenses), to manage any complications that arise and to manage any child acceptance issues. The critical role of parents in the acceptance and efficacy of such new treatments is evidenced in other existing public health domains such as, for example the low uptake on the HPV vaccination due to parental resistance from misrepresentation of the benefits of the vaccine.[65] Therefore, the arguments in favour of myopia control will need to be comprehensively and clearly made to parents and children alike to ensure the strategies are broadly accepted and successfully implemented.

Limitations

Time spent participating in daily activities was self-reported by participants at the end of each day. The diary responses revealed a discordance between child and parent recorded activities, with parents assigning statistically significantly more time to all tasks relative to children. The accuracy of this approach is difficult to gauge but is likely to provide a better estimate than a general questionnaire approach. The fact that the statistical conclusions are identical, however, irrespective of whether child or adult diary entries are used, provides reassurance as to the robustness of our findings.

It must be taken into consideration that time spent participating in activities such as reading and outdoors will depend on weather, hours of daylight and school holidays. Our study was conducted in May when there is an average of 16 h daylight in Dublin, Ireland, compared to less than 8 h in December.[66] Thus even though children were participating in proximal school and homework tasks in the current study, as it was a warmer summer month at the end of the school year, it was more likely that children spent an increased amount of time outdoors on the week they recorded their dairies, compared to if the study was carried out over winter months.[67] This study also recorded children's daily activities for 1 week only. A study stretching over a longer time span or a corresponding study completed at several time points across the year including winter time and during school holidays would be advantageous, as time spent participating in various activities will likely vary depending on weather, daylight hours and the academic calendar. Parental attitudes, however, are unlikely to have been affected by such seasonal factors. The attitudes of other stakeholders such as

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children themselves, teachers and clinicians were not explored herein, but are also important in considering future myopia control strategies.

All children participating in the study were under 13 years of age. Further investigation into the daily activities of older students would establish if progression into older childhood further increases exposure to myopia risk factors at a time when parental influence can become less significant,[68] as one would anticipate that teenagers might spend more time engaged in indoors proximal tasks, particularly in the use of electronic displays for social media.

Study participation rate was 30%, which we consider an acceptable survey response rate. Numerous studies have highlighted the difficultly in achieving high participation rates in school based studies.[69–71] Reasons for lower participation may include the young age cohort of children and their lack of understanding of the task as well as the importance of the study, non consent from parents (in which case they most likely did not return the questionnaire and consent form to the school), a lack of direct contact and engagement with parents and a lack of repeat follow up reminders and visits to schools to collect completed diaries and questionnaires.

One concern of potential bias was whether myopic parents would be more motivated to participate and complete our study. 30% of parents in our study were myopic, which is comparable to the prevalence of myopia in 30–59 year old adults (36%) in the E^3 Consortium,[72] suggesting that selection bias is not a significant concern.

Conclusion

Parental attitudes to myopia were typically nonchalant in relation to health risk. The role of parents in the acceptance of any interventional treatments, either pharmacological or optical, needs to be recognised. The knowledge gap identified amongst parents in this study will need to be addressed as part of the process of implementation of any therapies for myopia progression. Parents' views of the dominant risk factors for myopia were also at odds with the literature. This is of particular concern given the impact parents have on children's behaviour and choices with respect to such risk factors, demonstrating an acute need for societal sensitisation to the public health importance of myopia.

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Disclosure

The authors report no conflicts of interest and have no proprietary interest in any of the materials mentioned in this article.

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