Myopia incidence and progression in early adult life

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Key points

Question: How common is myopia progression and onset during early adulthood?

Findings: In a cohort study of 711 young adults from a general population, significant increase in myopia and axial length in the 8 years were observed by 0.04D/year and 0.02mm/year, respectively. Of the 526 participants without myopia at baseline, myopia incidence from 20- to 28-years old was 14%.

Meaning: There is a high incidence of myopia and prevalence of myopia progression in the third decade of life.

Abstract

Importance: Myopia incidence and progression has been described extensively in children. However, little data exist regarding myopia incidence and progression in early adulthood.

Objective: To describe the 8-year incidence of myopia and change in ocular biometry in young adults, and their association with the known risk factors for childhood myopia .

Design: The Raine Study is a prospective cohort study. Baseline and follow-up eye assessments were conducted in January 2010 to August 2012 and in March 2018 to March 2020.

Setting: Single-centre.

Participants: A total 1,328 participants attended the baseline assessment and 813 attended the follow-up. Refractive information from both visits were available for 701 participants. Participants with keratoconus, previous corneal surgery, or recent orthokeratology wear were excluded.

Exposure: Participants' eyes were examined at ages 20 (baseline) and 28 years.

Main outcome measures: Incidence of myopia and high myopia; change in spherical equivalent (SE) and axial length (AL).

Results: A total of 526 (51% male) and 698 (50% male) participants without myopia or high myopia at baseline were included in the incidence analyses, while 691 participants (49% male) were included in the progression analysis. The 8-year myopia and high myopia incidence were 14.0% (95% confidence interval [CI]=11.5–17.4%) and 0.7% (95%CI=0.3–1.2%). A myopic shift (≥0.50D in at least one eye) occurred in 37.8% of participants. Longitudinal changes in SE (-0.04D/year), AL (+0.02mm/year), lens thickness (+0.02mm/year), and AL-to-corneal-radius ratio (+0.003/year) were statistically significant (all p<0.001). Incident myopia was associated with East Asians (self-reported ethnicity;; odds ratio [OR]=6.1 versus Whites), female sex (OR=1.8), smaller CUVAF area (OR=9.9 per

10mm^2 decrease, indicating less sun exposure), and parental myopia (OR=1.6 per parent) (all p<0.05). Rates of myopia progression and axial elongation was faster in females (estimates= SE: 0.02D/year; AL: 0.007mm/year) and those with parental myopia (estimates= SE: 0.01D/year; AL: 0.005mm/year)(all p≤0.001). Education level was not associated with myopia incidence or progression.

Conclusions and relevance: These findings suggest myopia progression continues for more than one-third of adults during the third decade of life, albeit at lower rates than during childhood. The protective effects of time outdoors against myopia may continue into young adulthood.

Keywords: myopia incidence, myopia progression; the Raine Study; young adults

INTRODUCTION

The global myopia epidemic is well reported[1,2] and the rate of myopia-associated complications is expected to similarly rise as younger generations with high myopia prevalence approach middle and older age.[3,4] Myopia typically develops and progresses fastest during childhood, and it has been reported that myopia stabilizes (defined as change of less than 0.5 diopters [D]) at around age 15 to 16 years.[5,6] However, longitudinal studies involving university students have demonstrated that myopia may progress and even start to develop during young adulthood. In 118 university students for 3 years in Portugal[7] (mean age 21 years at baseline), prevalence of myopia and hyperopia increased by 5% and decreased by 9%, respectively, while mean spherical equivalent decreased by 0.3D. A similar study in Norway[8] found a 3-year myopia incidence of 33% among university students (mean age 21 years at baseline), with mean spherical equivalent decreasing by 0.6D. Similar longitudinal findings were reported in university students in Denmark[9] and the United States.[10,11]

With the modern emphasis on tertiary education, a known risk factor for myopia,[12] myopia may continue to progress or onset during young adulthood. With the rise in indoor jobs in the past century[13] and increase in automation of many manual or outdoor labor occupations,[14] individuals are likely to spend less time outdoors, which could further drive myopia progression during young adulthood,[15-17] even after formal education is completed. However, there are limited data in the literature on myopia development and progression after the age of 21 and often studies have been conducted in select populations.

The aims of this longitudinal study were to (1) describe the 8-year incidence of myopia and high myopia and (2) examine the 8-year within-person change in refractive measures in young adults from a general population. Within both aims, we explored risk factors for myopia development or progression during young adulthood and tested the hypothesis that the three known major risk factors of childhood myopia – higher level of education, lower time spent outdoors, and parental myopia – are also associated with myopia development and progression during young adulthood.

METHODS

Study sample

The Raine Study[18] has followed a cohort of participants since their prenatal periods in 1989-1991, when over 2,900 pregnant women were recruited from the King Edward Memorial Hospital and surrounding obstetric clinics in Perth, Western Australia. An aim of the Raine Study was to develop a long-term cohort to study the effects of early life factors on later health. From these women, 2,868 offspring were born, forming the original study cohort who are now in young adulthood, and have since been undergoing a series of regular medical and health examinations and completion of questionnaires.

At the 20-year follow-up (age 18–22 years), participants underwent their first eye examination as part of the Raine Study.[19] This has allowed us to document the prevalence of refractive error,[15,16,19] keratoconus,[19,20] amblyopia,[21] and strabismus,[21] and profile the normative optical coherence tomography-derived parameters[22-24] in young adults from a general population. Participants were invited to return for the Gen2 28-year follow-up eye examination.

All follow-ups of the Raine Study were conducted in compliance with the Declaration of Helsinki and have been approved by the University of Western Australia's Human Research Ethics Committee. All participants were given a full explanation of the nature of the study and provided informed consent prior to participating in each follow-up.

Eye examination

The 20- and 28-year follow-ups were conducted in 2010–2012 and 2018–2020, respectively, and the full protocols for the eye examinations at both follow-ups have been published.[19,25] In brief, both eye examinations included visual acuity measurement (LogMAR-style charts), conjunctival ultraviolet autofluorescence (CUVAF) photography, ocular biometry (IOLMaster V.5, Carl Zeiss Meditec AG, Jena, Germany), post-mydriatic autorefraction/keratometry (Nidek ARK-510A, NIDEK Co. Ltd, Japan), and lens thickness measurement (Oculus Pentacam, OculusOptikgerate GmbH, Wetzlar, Germany), amongst others. Autorefraction was performed at least 20 minutes after instillation of one drop of tropicamide 1%. CUVAF photography is an objective method of measuring ocular sun exposure and has been shown to have a strong correlation with self-reported time spent outdoors in adults.[26] The same refraction and ocular biometric measurement protocol and instrument models used were used in both follow-ups.

A participant was considered to have myopia or high myopia if either or both eyes had a spherical equivalent of ≤-0.50 or ≤-6.00D, respectively.[27] A refraction shift was defined as a change of 0.50D or more in spherical equivalent in either direction (myopic/hyperopic).

Questionnaire

In a self-administered questionnaire, participants indicated their highest level of education as (1) up to secondary school; (2) vocational qualification (including technical college, vocational training, or other certification courses); (3) Undergraduate degree; or (4) Postgraduate degree. Self-reported parental myopia, ethnicity, and ocular history were also obtained. Ethnicity was categorized as White, East Asian, and others/mixed. East Asians were analysed as its own category in view of the observed high prevalence of myopia in this demographic.[28] Ocular history information included previous surgeries and keratoconus. For participants who had laser refractive surgery, we further asked if they remembered their approximate refraction prior to surgery (e.g., what their contact lens prescription was prior to surgery).

Statistical analysis

For Aim 1 (describing the 8-year incidence of myopia), participants were included in the analysis if they had post-mydriatic refraction data at both follow-ups, and if they had no myopia at the 20-year follow-up (baseline). A similar process was applied to obtain the 8-year incidence of high myopia. Logistics regression was used to explore the risk factors of myopia development, including sex, ethnicity, education, and ocular sun exposure.

To address Aim 2, all participants who had refraction data at both follow-ups were included, regardless of myopia status. Linear mixed-effect models were used with random intercept and slope for participants to account for the within-participant correlation between two eyes.[29] In multivariable analyses, the main effects of sex, ethnicity, highest level of education, CUVAF area (as an objective measure of ocular sun exposure), and parental myopia, as well as interaction effects with age on refractive measures were evaluated.

Participants who wore orthokeratology lenses or had a history of cataract or corneal surgery were removed from the analyses. Participants with keratoconus, defined as having a Belin/Ambrósio enhanced ectasia display score of ≥2.6 in either eye based on Scheimpflug imaging[20] at the 28-year follow-up, were additionally excluded. To maximize the sample size, we included participants who underwent laser refractive surgery between ages 20 and 28 years by adding their self-provided estimated pre-surgical spherical equivalent (if known) to their 28-year refraction data as obtained during the eye examination. However, these participants were removed from analyses with keratometry as the outcome measure. Participants who were not able to provide or recall their estimated refraction data prior to surgery were excluded.

All analyses were conducted using R (v3.6.2; 2019 The R Foundation for Statistical Computing Platform [https://www.r-project.org/]), and the level of significance was set at $p<0.05$. Because of the multiple comparisons in Aim 2, the level of significance was set as $p<0.025$ for Aim 2 with the Bonferroni correction, in consideration of the 2 main refractive outcome measures (spherical equivalent and axial length; this adjustment was not done for Aim 1 as it only had 1 outcome measure).

RESULTS

Of the 1,328 participants with refractive data at baseline (20 years), 342 and 19 participants had myopia and high myopia, giving a prevalence of 25.8% (95% confidence interval [CI]= 23.5–28.2) and 1.4% (95%CI= 0.9–2.2), respectively. Of 783 participants who had refractive data at the 28-year follow-up, 260 and 12 participants had myopia and high myopia (prevalence= 33.2% [95%CI= 30.1–36.7%] and 1.5% [95%CI= 0.9–2.7]).

Among participants who attended the 20-year visit (baseline), there was no significant difference in ethnicity, baseline spherical equivalent, axial length, or CUVAF area between those who returned and did not return for the 28-year follow-up. However, there were more males than females who did not attend the follow-up (no attendance: male 54% vs attended follow-up: male 50%; $p=0.05$).

Eight-year incidence of myopia

After excluding participants who had no refraction data at either follow-up, those with myopia at baseline, keratoconus, or recent use of orthokeratology contact lenses, a total of 516 participants (50.6% males) were included in the myopia incidence analysis (**Figure 1**).

The cumulative 8-year myopia incidence was 14.0% (95%CI= 11.5–17.4%), with 72 participants developing myopia. In univariable logistic regression, myopia incidence was significantly associated with female sex, East Asian ethnicity (relative to White), less sun exposure (as indicated by smaller CUVAF areas), and parental myopia. (**Table 1**). Participants who reported "vocational training" as their highest level of education had lower odds of incident myopia relative to those who reported "up to secondary school". In the multivariable analyses, all these factors, except for education, remained significantly associated with incident myopia.

Eyes with incident myopia had lower spherical equivalent, longer axial lengths, and thinner lens at baseline (20-year) than those that did not become myopic (**Table 2**). There was no significant difference in baseline corneal radius between groups (**Table 2**).

Eight-year incidence of high myopia

There were 683 participants (338 males; 49.5%) available for the high myopia incidence analysis (**Figure 1**). This included 5 participants with prior laser refractive surgery who were able to provide their estimated refraction prior to surgery, either directly obtained from their optometrist (n=1) or the participants recalled their pre-surgery contact lens prescription (n=4).

The incidence of high myopia was 0.7% (95%CI= 0.3–1.2%), with 5 participants progressing to high myopia. None of these participants had a history of laser refractive surgery. **eTable 1** presents the refractive error, parental myopia, highest level of education, and CUVAF area for these 5 participants. Most of these 5 participants had myopia of -5D or worse in at least one eye at the 20-year follow-up and progressed by less than 2.0D in that 8-year period (progression rate of -0.08 to -0.22D/year).

Eight-year change in refractive measures

Of 701 participants who had refractive data at both follow-ups, 6 participants who had keratoconus, 3 who had prior refractive surgery with unknown prescription prior to surgery, and 1 who wore orthokeratology lenses a few days before the eye examination were excluded from the analysis. This left 691 participants available for this analysis. The 5 participants who had prior refractive surgery, but had pre-surgery refraction information, were excluded only from the keratometry analyses.

There were 261 participants (37.8%) who experienced a myopic shift (≥0.50D) in at least one eye over the 8 years, including 361 with a myopic shift in both eyes (**Table 3**). The spherical equivalent in the majority of participants (n=361; 52.2%) remained stable in both eyes (within ±0.50 D) between their 20- and 28-year visits (**Table 3**). As shown in **eTable 2**, the 8-year change in axial length, but not lens thickness or corneal radius, was significantly different between those with a myopic shift compared to those with no refractive change. Myopia progression of ≥0.25D/year (generally the minimum detectable change in refraction) in at least one eye was observed in 19 participants (2.7%).

There was a significant longitudinal change in spherical equivalent, axial length, and lens thickness after correcting for sex, ethnicity, and the major known risk factors of myopia (all $p<0.001$; see **Table 4** for a summary and **eTables 3–6** for the full multivariable analyses outcomes). Corneal radius did not change significantly over time.

The multivariable analyses showed that men had lower spherical equivalents, longer axial lengths, and flatter corneas than women ($p \leq 0.002$; **eTables 3–6**). However, the age × sex interaction results suggested that females had higher rates of spherical equivalent decrease, and axial elongation than males as shown in **Table 4** and **eTables 3–6**.

On average, East Asians had longer axial lengths than White participants (Estimate=-0.6, 0.3mm, and 0.05, respectively; $p \leq 0.019$), as well as higher longitudinal rates of axial elongation and corneal flattening compared to Whites, albeit a small difference of only a

0.014 and 0.008 mm/year, respectively. There was no other significant main or interaction effect of ethnicity (**eTables 3–6**).

Parental myopia was significantly associated with a faster rate of spherical equivalent decrease and axial elongation (estimate=-0.012 D/year and +0.005 mm/year, respectively for each additional parent with myopia; p<0.001).

DISCUSSION

Several reports on myopia incidence and progression in school-age children, especially in East Asia where myopia rates are the highest in the world, have been published. The annual myopia incidence have been reported to range from 7–30% in East Asian children[30-35] and 1–3% in White children,[31,36,37] depending on geographical location and age. For example, in East Asian children aged 6–7 years old at baseline, annual myopia incidence was higher in those living in Singapore, China, or Hong Kong (11-24%)[30,32,34] compared to those in Australia (7%).[31,32] Many studies have also reported that myopia incidence decreases with older age in children.[30,32,38]

Exploration of adult-onset myopia incidence, on the other hand, has been limited. In the 1990s, studies on university students in their late teens or early 20s have reported that the annually myopia incidence was between 2.5% and 13%.[7,8,39] While these estimates on university studies cannot be broadly applied to the general population, they provide evidence that it is common for myopia to start developing after childhood and adolescence.

In our study of young adults from a general population, we found an 8-year incidence of 14% (or 1.8% per year) and that spherical equivalent progressed by -0.04D/year on average, with 38% of participants experiencing a myopia shift of 0.50D or more in at least one eye over 8 years, in contrast to a mean age of myopia stabilization at ~15 years old reported by the Correction of Myopia Evaluation Trial (COMET).[5] With younger generations increasingly pursuing postgraduate education,[40] we may expect more at-risk young adults to develop myopia in their 20s or even early-30s. Even in non-university students or graduates, individuals are likely to start their first full-time occupation in or just prior to their 20s (students are 17-18 years when they leave school), and the rise in indoor occupations will inevitably result in the development or progression of myopia in a substantial proportion of the population.

Indeed, we observed an inverse association of increased sun exposure, as quantified using CUVAF area with incident myopia. Similarly, previous studies[41-45] have noted a protective effect of increased time outdoors against myopia, but findings on whether it reduces myopia progression have been conflicting. The lack of association between ocular sun exposure and refractive measure change may also be partly due to use of sunglasses or hats in some adults, which filters out incident ultraviolet rays and thus protective against enlargement of CUVAF area,[46] while still allowing exposure to higher levels of outdoor lighting.

Additionally, we did not find a statistically significant relationship between highest level of education with rate of change in refractive measures as hypothesized. Instead, unmodifiable factors such as ethnicity, sex, and parental myopia appeared to have stronger associations with the rate of change in refractive measures than environmental factors.

Women were more likely than to develop myopia and had greater temporal changes in myopia measures between 20 and 28 years old. Longitudinal studies on school-age children in East and South Asia have similarly reported higher myopia incidence[30,34,38] and faster myopia progression[32,39] in girls compared to boys. Likewise, the COMET reported that myopia progressed faster in girls than in boys, in terms of spherical equivalent but not axial length.[47] In previous studies involving children, the differential effect of sex on myopia progression and axial elongation may be influenced by pubertal growth spurts,[48] but this is unlikely to be a factor in our young adult sample. Instead, this difference between young men and women may reflect the modern societal push for higher education in girls and women, as reflected by the increasing proportion of women with higher education than men,[49] and a tendency for women to work in indoor-based occupations in Australia.[49] However, the associations between female sex and myopia progression were significant even after correcting for education and CUVAF area. Moreover, higher level of education was not significantly associated with myopia incidence or progression. It is possible that some other lifestyle habits, biological, or hormonal factors may mediate this age and sex interaction effect during young adulthood, and this should be explored in further studies.

Over the 8 years, there were crystalline lens thickening and axial elongation in this sample. The latter is particularly concerning as it is strongly believed that longer axial length increases the risk of myopia-related complications.[50] Fricke et al.[4] estimated that more than 55 million people (0.6% of the world population) will be visually impaired from myopic macular degeneration alone, including 18 million who will be blind, in the year 2050 if we do not implement interventions to slow myopia progression. Similarly, Cheung et al.[3] predicts a retinal detachment epidemic as a consequence of a surge in prevalence of high myopia. Myopia management strategies targeting control of axial elongation should therefore be considered in young adults exhibiting myopia progression.

A main strength of the current study is the large sample of community-based young adults, rather than recruiting participants from universities or myopic cohorts, as has been done in previous studies on young adults.[7,8,11,51,52] The Raine Study participants has also been shown to be generally representative of the Western Australian population of the same age.[53] However, our findings may not be generalizable to recent immigrants of Western Australia, which may comprise a higher proportion of East Asians than the current Australia-born cohort. We were also unable to ascertain whether there was a differential rate of change within the follow-up period, for example, if progression was faster during the early 20s than mid–late 20s.

Nonetheless, our findings provide evidence that myopia can start to develop and continue to progress during young adulthood, albeit at slower rates than during childhood. The eye continues to elongate axially in some participants during young adulthood, which may contribute to the increased risk of myopia-related complications as these young adults reach middle and older age. Our findings highlight the need for research into myopia control methods in young adults in addition to those currently being researched in children.

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Figure legends

Figure 1. Sample size for incidence analysis (Aim 1). *[a] Fewer participants attended the 28-year follow-up partly because data collection had to cease early because of the COVID-19 pandemic. Includes 5 with history of laser refractive surgery but known refractive error prior to surgery*

Table 1. Risk factors associated with incident myopia between 20- and 28-years

	All participants (n= 516)	Developed myopia (n= 72)	Did not develop myopia (n= 444)	Univariable analyses		Multivariable analysis[a]	
				OR (95%CI)	p-value	OR (95%CI)	p-value
Sex (n, %)							
• Males	261 (50.6%)	26 (36.1%)	235 (90.0%)	Ref	-	Ref	-
• Female	255 (49.4%)	46 (63.9%)	209 (82.0%)	1.99 (1.19–3.33)	0.009	1.81 (1.02–3.22)	0.04
Ethnicity[b] (n, %)							
• White	458 (88.8%)	60 (83.3%)	398 (89.6%)	Ref	-	Ref	-
• East Asians	6 (1.2%)	3 (4.2%)	3 (6.8%)	6.63 (1.31–33.63)	0.02	6.13 (1.06 to 35.25)	0.04
• Other/mixed	52 (10.1%)	9 (12.5%)	43 (9.7%)	1.39 (0.64–2.99)	0.40	1.45 (0.65 to 3.26)	0.55
Parental myopia[b] (n, %)							
• None	373 (72.3%)	40 (55.6%)	333 (75.0%)	Ref	-	Ref	-
• 1 parent myopic	102 (19.8%)	24 (33.3%)	78 (17.6%)		0.001		0.05
• Both parents	30 (5.8%)	7 (9.7%)	23 (5.2%)	1.86 (1.28–2.70)[d]		1.57 (1.03–2.38)[d]	
myopic	9 (1.7%)	2 (1.4%)	10 (2.3%)				
• No response							
Highest education[b] (n, %)							
• Up to secondary school	96 (18.6%)	17 (23.6%)	79 (17.9%)	Ref	-	Ref	-
• Vocational training	158 (30.6%)	14 (19.4%)	144 (32.4%)	0.45 (0.21–0.96)	0.04	0.57 (0.13–1.02)	0.22
• Undergraduate degree	168 (32.3%)	25 (34.7%)	143 (32.2%)	0.81 (0.41–1.60) 1.12 (0.52–2.43)	0.55	0.64 (0.31–1.32)	0.44
• Postgraduate degree	77 (14.9%)	15 (20.8%)	62 (14.0%)	-	0.77	1.00 (0.44–2.25)	0.80
• No response	18 (3.3%)	1 (1.4%)	16 (3.6%)		-	-	-

CUVAF area (median and IQR; per $10mm^2$ increase)[d]	40.7 [21.6 to 64.5]	34.0 [14.8 to 52.7]	42.8 [23.3 to 65.4]	9.87 (9.78–9.97)	0.009	9.86 (9.76–9.97)	0.009

[a] *Includes all variables in the table;* [b]*self-reported;* [c] *expressed as median and interquartile range, multivariable analysis generated in a separate model in place of time spent outdoor;* [d] *odds ratio with each additional parent with myopia; CI= confidence interval; CUVAF= conjunctival ultraviolet autofluorescence; IQR= interquartile range.*

Table 2. Baseline (20-year) ocular measures according to incident myopia

Measure	**Developed myopia (n= 122 eyes)**	**Did not develop myopia (n= 925 eyes)**	**Group difference statistical outcome[a]**	
			F-statistic	**P-value**
Spherical equivalent (D)	Median= +0.00 [IQR= -0.13 to +0.25]	Median= +0.50 [IQR= +0.25 to +0.75]	$F_{1,514}$= 50.2	< 0.001
Axial length (mm)	Median= 23.52 [IQR= 23.10 to 23.88	Median= 23.30 [IQR= 22.81 to 23.79]	$F_{1,512}$= 7.2	0.007
Central corneal radius (mm)	Median= 7.72 [IQR= 7.55 to 7.85]	Median= 7.74 [IQR= 7.57 to 7.92]	$F_{1,512}$= 2.0	0.16
Lens thickness (mm)	Median= 3.46 [IQR= 3.33 to 3.58]	Median= 3.51 [IQR= 3.38 to 3.64]	$F_{1,474}$= 5.0	0.03

[a] *Group difference analyzed using linear mixed-effect models to account for the within-subject correlation between two eyes and adjustment for sex and ethnicity.*

IQR= interquartile range

Table 3. Refraction shift over 8 years (total n= 691 participants)

Refractive shift[#]		Left eye		
		Myopic shift	**No change**	**Hyperopic shift**
Right eye	**Myopic shift**	152 (22.0%)	56 (8.1%)	0
	No change	53 (7.6%)	361 (52.2%)	45 (6.5%)
	Hyperopic shift	0	10 (1.4%)	14 (2.0%)

Myopic/hyperopic shift defined as a change in refraction of ±0.50 D or more

Table 4. Estimated annual change in myopia-related parameters for all participants, men, and women

Measure (change/year)	Estimate (97.5%CI)[a]	Statistical outcome[a]	
		F-statistic	p-value
All participants			
Spherical equivalent (D)	-0.041 [-0.055 to -0.027]	$F_{1,1972}$= 27.6	< 0.001
Axial length (mm)	0.020 [0.014 to 0.025]	$F_{1,1962}$= 87.3	< 0.001
Corneal radius (mm)	0.000 [-0.002 to 0.002]	$F_{1,1965}$= 18.5	0.91
Lens thickness (mm)	0.020 [0.017 to 0.024]	$F_{1,1819}$= 170.7	<0.001
Men			
Spherical equivalent (D)	-0.018 [-0.036 to 0.001]	$F_{1,959}$= 17.7	0.030
Axial length (mm)	0.010 [0.004 to 0.016]	$F_{1,956}$= 53.1	<0.001
Corneal radius (mm)	-0.001 [-0.003 to 0.002]	$F_{1,956}$= 1.3	0.50
Lens thickness (mm)	0.019 [0.015 to 0.022]	$F_{1,887}$= 160.2	<0.001
Women			
Spherical equivalent (D)	-0.044 [-0.063 to -0.025]	$F_{1,1005}$= 6.1	<0.001
Axial length (mm)	0.022 [0.015 to 0.030]	$F_{1,999}$= 9.1	<0.001
Corneal radius (mm)	0.000 [-0.002 to 0.002]	$F_{1,1001}$= 0.3	0.97
Lens thickness (mm)	0.021 [0.016 to 0.026]	$F_{1,924}$= 10.0	<0.001

[a] *Corrected for ethnicity, conjunctival autofluorescence area, education, parental myopia, and sex (where appropriate). CI= confidence interval.* [a] *97.5%CI shown for significance at p≤ 0.025 (with the Bonferroni correction for the 2 main outcome measures [spherical equivalent and axial length; 0.05/2]).*