

Latent Growth Modelling of Refractive Error Development in White Children & Young Adults

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INTRODUCTION

- Population-based prospective data on children's eye growth and refractive error development are rare^{1,2} and no such data exist for white UK based children.
- Growth data are often used from control arms of myopia treatment trials where participants are already myopic and therefore cannot provide predictive data prior to the onset of myopia.³
- Examining growth patterns can be used to profile refractive risk and provide a basis to identify potential myopes prior to onset and stratify emerging myopes according to how fast their myopia is likely to progress. With the emergence of anti-myopia interventions such as low dose atropine, multi-focal contact lenses and lifestyle advice, such data could be used to target treatments to the most appropriate patients.

PURPOSE

- This prospective, observational study modelled the developmental trajectory of spherical equivalent refractive error (SER) and axial length (AL) in a white population of children and young adults. The number of homogenous classes were examined.

METHODS

- The Northern Ireland Childhood Errors of Refraction (NICER) Study used stratified, random cluster sampling to recruit a representative sample of white children aged 6-7 years ('younger cohort' n=392) and 12-13 years ('older cohort' n=661) between 2006-2008.
- Cycloplegic autorefraction (Shin-Nippon NVision-K 5001 Fig.1A) and axial length (IOLMaster v3 Fig. 1B) were assessed at baseline and prospectively at 3, 6 and 9 years after the baseline measure.
- Participants and their parents/guardians completed questionnaires probing family history of myopia, physical activity, time spent doing near work and whether the participant was breastfed.
- Latent growth modelling of SER and AL was conducted using Mplus v7.4.
- The fit of six models (one- to six-class) were used to determine the best fit model for both the younger and older cohorts of children.
- Predictive variables for the emergent classes were explored for the younger cohort (odds ratios and confidence intervals, CI) to determine if certain characteristics could be used to predict those who were emergent myopes.

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METHODS

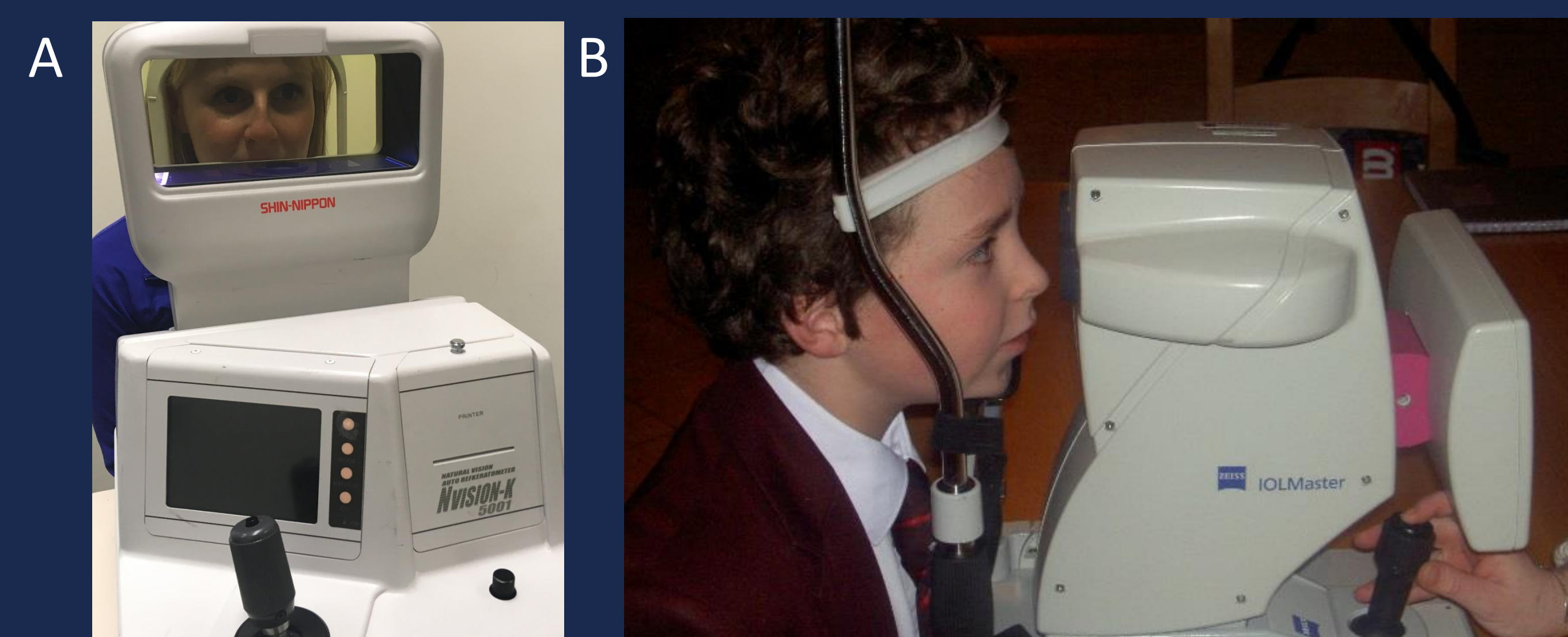


Figure 1 (A) Shin Nippon Nvision-K 5001 and (B) IOLMaster v3

RESULTS

- Younger cohort (6-16 years)
- A four-class solution was the best fit for SER with classes labelled as 'Persistent Emmetropes-PEMM', Persistent Moderate Hyperopes-PMHYP', 'Persistent High Hyperopes-PHHYP' and 'Emerging Myopes-EMYO'. A two-class solution was the best fit for AL (Figures 2 A & B).

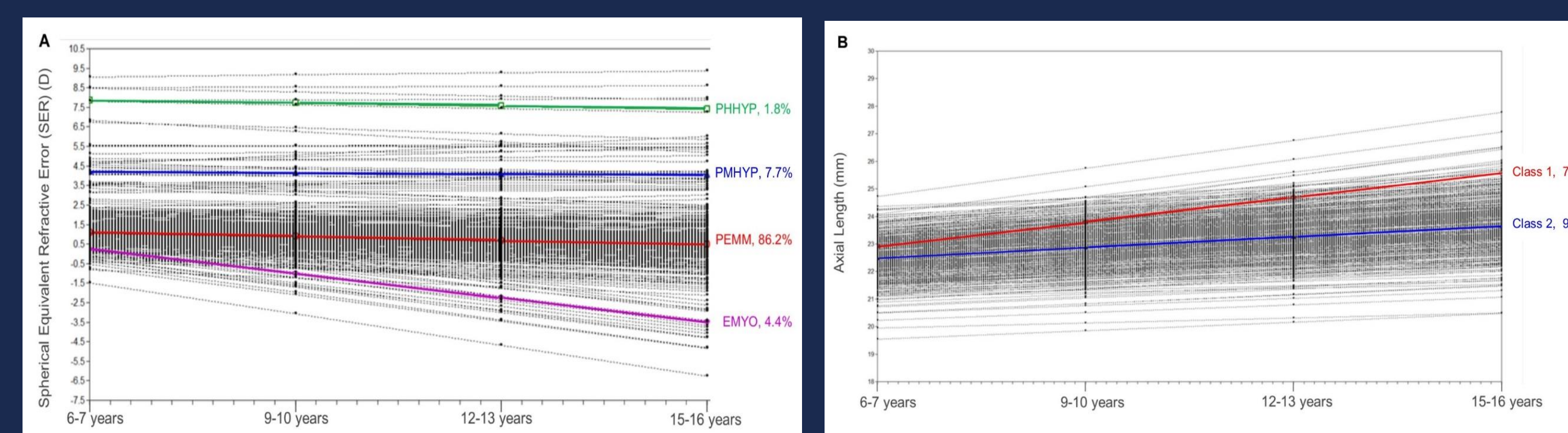


Figure 2 SER (A) & AL (B) growth models, 6-16 years

- Older cohort (12-22 years)
- A five-class solution fitted best for SER with classes labelled as 'PHHYP', 'PMHYP', 'PEMM', Low Progressing Myopes-LPMYO' and 'Moderate Progressing Myopes MPMYO'. A four-class solution was the best fit for AL (Figures 3 A & B).

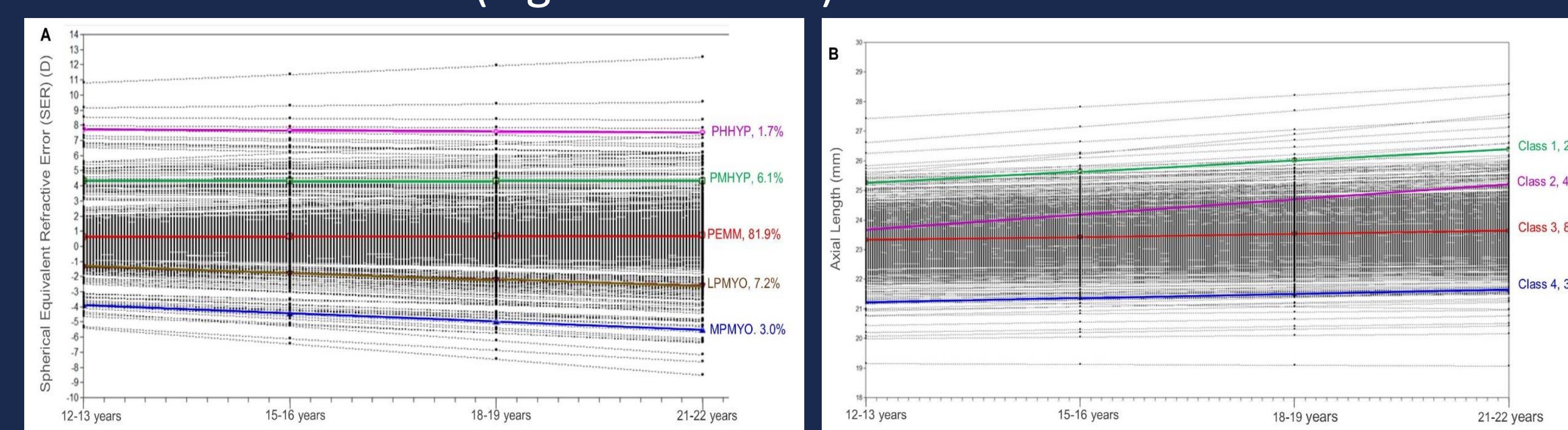


Figure 3 SER (A) & AL (B) growth models, 12-22 years

RESULTS

PREDICTIVE VARIABLES FOR EMERGENT MYOPES	ODDS RATIO (95% CI)
GENDER male 1, female 0	0.37 (0.11 to 1.23) p=0.105
SOCIOECONOMIC STATUS quintiles 1 to 5, 1=low, 5= high	1.18 (0.81 to 1.74) p=0.393
AT LEAST ONE PARENT MYOPIC yes 1, no 0	6.28 (1.01 to 38.93) p=0.048 *
PHYSICAL ACTIVITY sedentary 1, light activity 2, regular activity up to 3hrs/week 3, regular activity >3hrs/week 4	0.47 (0.19 to 1.19) p=0.113
TIME SPENT DOING NEARWORK average hrs/week	0.76 (0.36 to 1.61) p=0.471
BMI per unit increase	1.00 (0.74 to 1.36) p=0.982
BREASTFED yes 1, no 0	1.03 (0.47 to 2.28) p=0.933
AXIAL LENGTH AT BASELINE per mm increase	2.50 (1.05 to 5.87) p=0.038 *

Table 1. Logistic regression analysis on the predictive variables associated with being classed within 'Emerging Myopes' compared to 'Persistent Emmetropes' within the younger cohort (6-16 years).

CONCLUSIONS

- Four distinct classes of refractive development were evident from childhood to teenage years and five distinct classes from teenage years to adulthood.
- The two-class solution for AL growth in children 6-16 years (compared to the four-class for SER) suggests other ocular components, such as lens shape are important determinants of SER alongside AL at this age.
- Parental history of myopia and longer AL at 6-7 years are risk factors for emergent myopia in childhood.
- There was no 'Emerging Myopes' class for the 12-22 years, reinforcing evidence that myopia onset is occurring at a younger age.⁴
- These population-based data are a useful addition to other refractive growth models and can be used to identify, at an early stage, white children who may benefit from myopia intervention.

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