

# Increasing myopia and associations with deprivation and rural/urban environments in children aged 3.5-5.5 years in Scotland

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**Purpose:** Scotland, UK's second largest country, has a comprehensive children's vision screening programme at age 3.5-5.5 years. Children registered with a General Medical Practitioner are offered screening, taken up by ~85% (40,000-50,000 annually). Orthoptists deliver screening, including presenting vision, cover test, and other orthoptic tests. Screening failures are referred for eye examinations, including cycloplegic refraction. Primary aim: report refractive error data from these eye examinations (5,000-7,000 annually) for three years pre-pandemic and two years post-pandemic. Secondary aims: investigate correlations between myopia and socio-economic deprivation and urban/rural dwellings.

**Methods:** Right eye data from 10 Health Boards (HB) are reported. Frequency distributions for all refractions were plotted for spherical equivalent refraction (SER) for five school years: 2013-14, 2014-15, 2015-16, 2020-21, 2021-22. Distributions of SER across these five years were compared (ANOVA). Possible linear trends in proportions of myopia were investigated (regression analysis). Population proportions within each quintile of a deprivation index and proportions living in different dwelling types are known for each HB. Associations were investigated between these two variables and proportions of children in each HB who failed screening and were subsequently found to have myopia.

**Results:** Refractive error frequency distributions revealed a myopic shift in SER over the five years. Median SER (interquartile range) was, in 2013-14, +1.25D (+0.50 to +2.63); 2014-15, +1.38D (+0.38 to +2.50); 2015-16, +1.38D (+0.50 to +2.63); 2020-21, +1.13D (+0.25 to +2.25); 2021-22, +1.25D (+0.37 to +2.25). There was a statistically significant overall difference between years (Kruskal-Wallis,  $H=98.30$ ,  $p<0.0005$ ); pairwise comparisons showed statistically significant differences ( $p<0.0005$ ) between each of the first three years and each of the last two years, but non-significant differences ( $p>0.66$ ) in pairwise comparisons of each of the first three years and of the last two years. The proportion of children who failed screening criteria for presenting visual acuity, subsequently attended for eye examination, and were myopic ( $\leq -0.50D$ ) was <8% annually from 2013-16, but increased to 12% in 2020-21 and 11% in 2021-22. There was a linear trend for an increasing proportion of children with myopia ( $r^2=0.94$ ,  $p=0.006$ ).

Correlations between the proportion of children in each HB who were myopes and fell within each deprivation index quintile were low ( $r^2<0.33$ ). There was a high positive correlation ( $r^2 = 0.83$ ,

p=0.002) between the proportion of children in each HB who were myopes and the proportion of dwellings that were flats/apartments (which reflect each Board's urban/rural demographic), and negative correlations for all other dwelling types.

**Conclusions:** In this predominantly Caucasian population, proportions of children with myopia have increased post-COVID. A strong association exists between living in flats/apartments and myopia, but no strong correlation with a deprivation index.