Introduction: Exposure to traffic-related air pollution (TRAP) and Sickle Cell Anaemia (SCA) are both associated with cognitive difficulties in children. As there are few longitudinal studies in SCA and none on the effect of long-term exposure to TRAP on change in intelligence quotient (IQ) data, we report data from the East London cohort studied from 1991-2003.

Method: SCA participants without stroke (n=37: HbSS=30, HbSC=6, HbSThalassaemia=1; median age=8.17, 3.85-15.67 years) underwent Wechsler Intelligence scales at Time 1 (1992-1993) and Time 2 (1998-2002) with an interim of 5.79-10.21 years (median interim=9.22 years). Sibling controls (n=15; median age=8.50. 4.08-14.4 years) also underwent Wechsler Intelligence scales at Time 1 (1992-1994) and Time 2 (2001-2002) with an interim of 8.09-9.99 years (median interim=9.23 years). Brain MRI at Time 2 identified silent cerebral infarcts (SCI) in SCA participants. As a proxy for long-term exposure to TRAP, residential proximity to major roads, primary routes (A1) and A roads (A2), was measured using straight-line distance, in line with previous studies . ANCOVA was performed, adjusting for sex, genotype, age at Time 1, Time 1 to 2 interim, and presence (SCI+) or absence of SCI (SCI-).

Results:

SCA Participants: Mean change in full-scale IQ (FSIQ) from Time 1 to 2 was 2.73 points. Those who lived ≤175m from A1 had a decrease in FSIQ of 8.57 points (95% CI: -15.272, -1.871; p=0.04; n=7) in comparison to an improvement of 5.36 points (95% CI: 0.018, 10.709; n=19) in those living 176-500m from A1 and 5.37 points (95% CI: 1.301, 9.436; n=11) in those living 501-2,000m from A1. This decline with increasing proximity to A1 was also observed as a trend for verbal IQ. Participants living closest to A1 also had a significant decline in performance IQ (PIQ) (mean change= -11.43; 95% CI: -17.208, -5.649; p=0.004). Age at Time 1 was an independent predictor of IQ but sex, genotype, interim and presence of SCI were not. No change in IQ with distance from A2 was observed. SCI+ participants had lower IQ scores than SCI- participants. Presence of SCI, however, was not an independent predictor of change in IQ from Time 1 to 2.

Controls: IQ scores at Time 1 were higher in controls than SCA participants, significantly so for FSIQ (mean=94.73, 95% CI: 88.903, 100.564, p=0.03) and PIQ (mean=97.87, 95% CI: 91.511, 104.222, p=0.04) (*Figure 3*). Sex and age were not independent predictors of IQ at Time 1. Mean change in FSIQ from Time 1 to 2 was 7.93 points, 10.6 points for VIQ and 2 points for PIQ. No decline in IQ scores with increasing proximity to major roads was observed (FSIQ: p=0.42, VIQ: p=0.85, PIQ: p=0.13). Age at Time 1 was an independent predictor of change in FSIQ and PIQ but not of change in VIQ. Sex and interim period were not independent predictors of change in IQ.

Discussion: IQ of SCA participants was lower than that of the sibling controls, in line with already published findings. IQ scores of SCA participants also decreased over time with increasing proximity to A1. Although only seven SCA participants lived ≤175m from A1, a limitation of this study, those children demonstrated a significant decline in FSIQ and PIQ; a trend not observed in sibling controls. Those living in close proximity to A1 have greater exposure to neurotoxic TRAP, although other influencing factors on cognitive decline, such as exposure to tobacco smoke, noise pollution and socioeconomic factors must also be considered.