Abstract

Children from disadvantaged backgrounds are at an increased risk of being killed or seriously injured (KSI) in a road collision compared to their peers from less disadvantaged areas. However, understanding of the risk of being KSI in a road collision across childhood, gender, level of deprivation, exposure, and mode of transport is not routinely investigated. The present research therefore compared the number of 4 to 10 year-olds and 11 to 15 year-olds KSI road casualties during 2016 across deprivation quintiles and gender to gain a greater understanding of road traffic injury risk across childhood. Using police reported data for England in 2016 the number of children KSI as pedestrians, cyclists and car occupants was examined per 100,000 of the population. Children 4 – 10 years-old and 11 – 15 years-old residing in the most deprived areas were nearly three times more likely to be KSI as pedestrians than their peers in the least deprived areas. The inequality in injury risk as cyclists and car occupant's increased for males as they progressed towards adolescence. This relationship remained even when exposure to the roads was taken into account. Differential patterns of risk are therefore apparent across childhood as well as gender and transport mode, with those in the most deprived areas facing the greatest risk of being KSI on the roads.

Keywords: Road traffic injury, deprivation, child injury

Deprivation and Road Traffic Injury Comparisons for 4 to 10 and 11 to 15 year-olds

Road traffic injuries are disproportionately experienced by some groups more than others. Children, for example, are at a greater risk of pedestrian injury than any other age group (Ward, 1994), with road traffic injuries being the second leading cause of death in children 5 to 14 years-old (Peden et al., 2008). This likely reflects their developmental stage and lack of experience with the traffic environment (Wittink, 2001). Individuals who live in the most deprived areas are also at greater risk of road traffic injury (Christie, 1995; Feleke, Scholes, Wardlaw, & Mindell, 2017; Graham, MacMillan, Murray, & Reid, 2005), with children residing in the most deprived areas being particularly at risk (Graham et al., 2005; Kendrick, 1993). Children from the most disadvantaged backgrounds are five times more likely to be killed on the roads as pedestrians than their peers from the highest socio-economic groups (Edwards et al., 2006). Place, as well as individual, disadvantage may be adversely affecting health outcomes (Macintyre, Maciver, & Sooman, 2009; Sloggett & Joshi, 1994).

Children from deprived backgrounds may be at increased risk of road traffic injury due to a range of social and economic factors. The factors include: lack of money to buy appropriate safety equipment, lack of safe places to play, limited ability of family to supervise children, access to information and services, and children's own attitudes towards road safety and risk taking behaviours (Towner, 2005; Christie 1995). Environmental factors such as living on a long straight 'rat run' road with a high volume of traffic travelling at speed has also been found to increase the risk of road traffic injury in children from deprived backgrounds (Christie, 1995). Although these risk factors are likely to interact to increase the risk of road casualty risk, environmental factors are thought to be central predictors of casualty risk (Christie, 1995).

Despite this pattern of increased road traffic injury risk for children from disadvantaged backgrounds being apparent for several decades (Feleke et al., 2017; Graham et al., 2005; Roberts & Power, 1996), limited attention has been directed towards understanding patterns of risk during different stages of childhood, deprivation levels, and modes of transport. Most prior research has considered children as under 15 or 17 years-of-age. During childhood, children make significant advances in their cognitive abilities and self-regulation (Flavell, 1992; Rueda, Posner, & Rothbart, 2005), gain more experience in the traffic environment and are typically exposed to road safety education (Dragutinovic & Twisk, 2006), they become more independent in navigating the traffic environment (Pfeffer & Tabibi, 2016), and their exposure and typical modes of transport change (DfT, 2017a). Patterns of risk may consequently change across childhood and considering only broad age ranges may mean important trends in road traffic injury risk in childhood are missed.

In line with this, evidence has indicated that the link between deprivation and road traffic injury may be more prominent for younger children. A study of hospital admissions between 1992 and 1997 found that the number and severity of injuries increased with increasing socio-economic deprivation and that this was most prominent for children between 0 and 4 years-old and specifically for pedestrian injuries (Hippisley-Cox et al., 2002). Gender differences in risk of road traffic injury across childhood have also received limited attention. Males under 11 years-old have been found to be at a greater risk than females (Christie, 1995). Socioeconomic differences in road injury risk have been found to remain after taking into account gender, though injury rate for males varied more by social class than for females (Hasselberg, Laflamme, & RingbäckWeitoft, 2001). In contrast, other studies have failed to find evidence of a gender difference in children under 16 years-old (Adams, 2005). The study by Adams et al. (2005) revealed that the odds ratio for pedestrian injuries was 2.69 for males from the most deprived backgrounds and 2.40 for females (Adams et al., 2005). Added to this, a study of a cohort of children 11 to 16 years-of-age found evidence of equalisation in pedestrian injuries for males and females with increased age (West & Sweeting, 2004), suggesting that the marked inequalities in pedestrian injuries evident in childhood may decrease in adolescence.

Understanding the relationship between deprivation and road traffic injury in childhood is further hindered by the limited research exploring this relationship across different modes of transport. Current evidence suggests that children are most at risk as pedestrians. In 2016, 38% of child road casualties in the UK were pedestrians (DfT, 2017b). In a study of 255 children who received fatal injuries, the majority (*n* = 175) were pedestrians, followed by cyclists (*n* = 35) and car occupants (*n* = 25) (Sharples, Storey, Aynsley-Green , & Eyre, 1990). Added to this, the study found that injury was significantly related to social deprivation, with most injuries occurring to children residing in deprived areas and who were playing unsupervised near their homes. Social inequalities in road traffic injuries were more prominent for pedestrians than cyclists, which may reflect the fact that young cyclists are more able to venture outside their own potentially dangerous neighbourhood (Laflamme & Diderichsen, 2000). However, other studies have indicated that there is a high risk for young cyclists as well as pedestrians. Compared to children (0 – 15 years-old) whose parents were in the highest socioeconomic class, those in the lowest socioeconomic class were 27.5 times more likely to be killed as cyclists, 20.6 times more likely to be killed as pedestrians, and 5.5 times more likely to be killed as car occupants (Edwards, Green, Lachowycz, Grundy, & Roberts, 2008). In this study, children were categorised as being between birth and 15 years-old. Children vary dramatically in their development between these ages and consequently the risk of road traffic injury may vary according to the age of the child.

In addition to the age of the child, exposure to the road is a further factor that may influence the road traffic risk of children. Children typically do not travel far from their home (Villanueva et al., 2012). Research has suggested that most 10 to 12 year-olds walk between 250 and 1600 metres (Harten & Olds, 2004; McDonald & Aalborg, 2009), resulting in a range of between 400 and 1600 meters around children's homes (Hooper, 2012). However, exposure may vary across IMD quintiles. For example, the majority of households that do not own a car are concentrated in the most deprived communities (NHTS, 2001). In order to gain a more accurate picture of road traffic injury risk across modes of transport and deprivation it is therefore also important to take into account exposure.

The aim of the present research was to compare the number of 4 to 10 year-olds and 11 to 15 year-olds killed or seriously injured (KSI) in road traffic collisions as pedestrians, cyclists and car occupants during 2016 in England across deprivation quintiles and gender to gain a greater understanding of road traffic injury risk across childhood. The number of children KSI between 4 and 10 and 11 and 15 years of age was considered after taking into account the population for each age group in order to control for population differences in the number of children across IMD quintiles. Further, exposure to the roads was also considered to control for the amount of time children spend on the roads.

Method

Participants and Data

Road traffic casualty data was extracted from the STATS 19 data for 2016. STATS19 includes police reported data on road casualties in Great Britain from 2005 onwards. The dataset includes details of incidents on public roads that involve a human casualty that were reported to the police and subsequently recorded using the STATS19 form. Details relating to the date, time, and location of the collision as well as a summary of all reported vehicles and pedestrians involved in the road traffic collision and the total number of casualties by severity are reported. Figures relating to fatalities on the road refer to persons killed immediately or who died within 30 days of the incident. STATS 19 data on casualty age, gender, severity of injury, transport type, and Index of Multiple Deprivation (IMD) decile was selected. The IMD is the English Indices of Deprivation which measures relative levels of deprivation across seven domains: Income Deprivation; Employment Deprivation; Health Deprivation and Disability; Education, Skills and Training Deprivation; Crime; Barriers to Housing and Services; and Living Environment Deprivation (Department for Communities and Local Government, 2015). IMD is measured for 32,844 small, stable geographic areas or neighbourhoods (known as Lower-layer Super Output Areas, in England). The IMD decile is automatically added to police reported data based on the full postcode of the place of residence of the casualty. This dataset is publicly available online. Casualty IMD deciles were converted into quintiles in the present research due to low numbers of cases in each decile, where 1 represented the most deprived.

Population estimates were obtained from the Office for National Statistics (ONS) Deaths and Population by Sex, Age, and IMD Decile, England and Wales, 2001 – 2016 Dataset. Estimates of population for 4 to 10 and 11 to 15 year-olds for IMD quintiles in England were calculated. Exposure estimates were obtained from the National Travel Survey data from the Department for Transport Statistics. The National Travel Survey involves interviews and 7-day self-reported travel diaries. The travel diaries collect information on journey start and end times, purpose, and mode of transport. Based on data from 2014 to 2016, the average number of miles per year travelled by 4 to 10 and 11 to 15 year-olds per IMD quintile as pedestrians, cyclists, and car/van occupants were calculated.

Analysis

The number of KSIs for children 4 to 10 years-old and 11 to 15 year-old was summed by IMD quintile and transport mode as well as gender. These were then divided by the population rates for that age cohort and IMD quintile to provide rates of the number of children

KSI in a road collision per hundred thousand of the population. Exposure based KSI rates were then calculated by taking the rate of KSI per 100,000 of the population for 4 – 10 and 11 – 15 year-olds and dividing it by the average miles travelled per year for the appropriate age group and mode of transport. This was done for each IMD quintile.

Results

In total 1341 cases who were between 4 and 15 years of age (*n 4 – 10 years* = 538; *n 11 – 15 years* = 803) and whose casualty severity was recorded as fatal or serious (KSI) for England were identified. Only cases who were KSI as pedestrians, cyclists or car occupants were selected due to small numbers of child KSIs in the other categories (e.g. van occupant, bus or coach passenger, or motorcyclist). Casualty statistics for 4 to 10 and 11 to 15 year-olds are reported in Table 1. Across both age groups the greatest proportion of casualties were pedestrians. Males were the most vulnerable as pedestrians and cyclists for younger and older age groups. However, across both age groups the number of children KSI as a car occupant were similar.

Deprivation and Mode of Transport

The rate of KSIs per 100,000 of the population across mode of transport and IMD quintiles for 4-10 and 11-15 year-olds is presented in Figure 1. A greater proportion of children KSI resided in the most deprived areas across all modes of transport.

4 – 10 years-olds: Young children residing in the most deprived neighbourhoods were 2.89 times more likely to be KSI as a pedestrian than young children in the least deprived neighbourhoods (12.89 vs. 4.44). Further, young children residing in the most deprived neighbourhoods were 6.47 times more likely to be KSI as a cyclist (2.20 vs. 0.34). The rates of children KSI as car occupants were similar across the most and least deprived quintiles (2.45 and 2.28). The rates of children KSI as cyclists and car occupants were though relatively small.

11 – 15 year-olds: Older children residing in the most deprived neighbourhoods were 2.90 times more likely to be KSI as a pedestrian compared to their peers residing in the least deprived neighbourhoods (25.30 vs. 8.72). Older children residing in the most deprived area were 4.35 times more likely to be KSI as a car occupant (9.12 and 4.93) and 1.85 times more likely to be KSI as cyclists compared to their peers in the least deprived neighbourhoods (5.74 and 1.32). The rates of children KSI as cyclists and car occupants were though relatively small.

Deprivation, Mode of Transport and Gender

The rate of KSIs per 100,000 of the population across mode of transport and IMD quintiles for 4 to10 year-old males and females is presented in Figure 2 and for 11 to15 year-olds males and females is presented in Figure 3. Generally, the greatest proportion of road traffic casualties were males residing in the most deprived areas across both ages groups. Though inspection of the graphs indicated that the relationships between road traffic injury and deprivation across modes of transport were not always linear. This may reflect the small number of KSIs in these populations, but whether these relationships were linear or not was not tested.

4 – 10 years-olds: In the most deprived IMD quintile, a greater proportion of males than females were KSI as pedestrians than cyclists. This gender difference reduced with decreasing levels of deprivation. Males in the most deprived IMD quintile were 2.37 times more likely to be KSI as pedestrians than females, whereas males in the least deprived IMD quintile were 1.83 times more likely to be KSI than females. Males in the most deprived IMD quintile were 5.26 times more likely to be KSI as cyclists than females, whereas males in the least deprived quintile were 1.43 times more likely to be KSI than females. For car occupants, a greater proportion of females were KSI than males (apart from for IMD quintile 2). This gender difference showed little reduction across IMD quintiles. Females in the most deprived quintile were 1.3 times more likely than males to be KSI as car occupants

11 – 15 year-olds: Gender differences were greater for 11 to 15 year-olds compared to for 4 to 10 year-olds. For pedestrians residing in the most deprived IMD quintile, males were 1.43 times more likely to be KSI. In contrast, rates of pedestrian KSI were similar for males and females in the least deprived IMD quintile. A greater proportion of males compared to females were KSI as cyclists across IMD quintiles. For instance, males in the most deprived quintile were 10.94 times more likely to be KSI than females as cyclists and males in the least deprived quintile were 8.56 times more likely to be KSI than females. For car occupants, males were 1.38 times more likely to be KSI than females in the most deprived quintile. However, in the least deprived quintile females were 3.16 times more likely to be KSI as car occupants.

Exposure, Deprivation and Mode of Transport

The average number of miles travelled per year across mode of transports and IMD quintile for 4 – 10 and 11 – 15 year-olds is presented in Table 2. There was a trend for the number of miles per year as a pedestrian to increase with increasing levels of multiple deprivation and for the average numbers of miles per year as a cyclist and car occupant to decrease with increasing levels of deprivation. The rate of children KSI per 100,000 population by exposure across mode of transport and IMD quintile for 4 – 10 and 11 – 15 year-olds are presented in Figure 4.

When exposure was taken into account, children residing in the most deprived communities were still at the greatest risk for road traffic injuries across all modes of transport. A greater proportion of children 11 to 15 years-old were likely to be KSI across modes of transport compared to children between 4 and 10 years-old in the least deprived IMD quintile.

However, this age disparity reduced with decreasing levels of deprivation for pedestrian and car occupant KSIs. In the least deprived quintile there was little difference between the proportion of younger and older children KSI as pedestrians and car occupants. For cyclists, a greater proportion of 11 to 15 year-old children were KSI compared to 4 to 10 year-old children across IMD quintiles. Graphs indicated that the relationships between road traffic injury and deprivation across modes of transport were not always linear. This may be due to the small number of KSIs in these populations, but whether these relationships were linear or not was not tested.

4 – 10 year-olds. Although the rates were small, after taking into account deprivation, population size and exposure to the roads, a higher rate of children residing in the most deprived areas were KSI than children in the least deprived areas. Children were most likely to be KSI as cyclists. Children in the most deprived areas were 8.5 times more likely to be KSI as cyclists, twice as likely to be injured as pedestrians and as car occupants.

11 – 15 year-olds. Even though a greater proportion of children were KSI as cyclists, the greatest difference in risk between most and least deprived was as car occupants. Children in the most deprived areas were 13.33 times more likely to be injured as car occupants than children in the least deprived quintile. Children in the most deprived areas were three times more likely to be injured as pedestrians and 2.6 times more likely to be injured as cyclists than children in the least deprived quintile.

Discussion

The proportion of children killed or seriously injured in road traffic collisions were compared across younger (4-10 years-old) and older (11-15 years-old) age groups, deprivation level, mode of transport and gender. The present research revealed that decades after initial work highlighted the increased risk of road traffic injury for individuals from deprived backgrounds (Christie, 1995), this socio-economic inequality remains, especially for pedestrians. The results indicated that for both younger and older children, those residing in the most deprived areas were at the greatest risk of road traffic injury across all modes of transport. In particular males residing in the most deprived areas were the most vulnerable. This research indicated that although the number of children killed or seriously injured as pedestrians increases across childhood, the increased risk for those living in deprived areas remains relatively stable at nearly three times greater. The social inequality in road traffic injury risk, although reduced, remained after exposure was taken into account. When exposure was taken into account the risk of pedestrian casualty was 2.03 times greater in the most deprived compared to the least deprived area for 4 – 10 year olds, and 2.75 times for 11 – 15 year-olds. This finding contradicts prior studies which have suggested that the link between deprivation and pedestrian injury is greatest for younger children (Hippisley-Cox et al., 2002). Initiatives developed over the past decade or so may have successfully reduced the risk of road traffic injury for children, especially young children, but children from deprived communities may still be at increased risk compared to those residing in more affluent communities.

The findings exploring child KSI rate per 100,000 of the population indicated that a social inequality gradient emerged in later childhood for cycling and car occupant casualties. However, when average number of miles cycled per year were taken into account the risk of cycling injury is substantially greater for 4 – 10 year-olds compared to 11 – 15 year-olds. The average number of miles cycled per year is higher for older children and children from less deprived areas, meaning younger children residing in deprived areas may be less experienced at cycling. This limited exposure to cycling may mean that they have a poorer understanding of safe cycling practice and are therefore at a greater risk of being killed or seriously injured.

The environment may also be a factor. The National Travel Survey (2016) revealed that 83% of 5 – 10 year-olds compared to 71% of 11 – 16 year-olds owned bikes. Further, children residing in deprived areas are more likely to play in the street and less likely to play in parks because they are poorly maintained and a venue for alcohol and drug abuse. (Christie et al, 2010). Young children living in the most deprived areas may therefore be more likely to ride their bikes in unsafe places, such as built up streets than in safe places like parks. This coupled with their limited experience may place children at greater risk of being KSI as a cyclist.

The risk of casualty as a car occupant in deprived areas was greater for older children living in the most deprived areas compared to those living in the least deprived areas (4.27 times greater). This social inequality was magnified when exposure was taken into account, with older children in the most deprived areas being 12.67 times more likely to be injured as a car occupant compared to those residing in the least deprived neighbourhoods. This may reflect the fact that 11 to 15 year-olds are more likely to travel in cars (DfT, 2017a; McDonald, 2006). Risky driving behaviour is common in the presence of male adolescent passengers. Adolescent drivers travelled at faster speeds and allowed shorter headways in the presence of male adolescent passengers (Simons-Morton, Lerner, & Singer, 2005), this may place male car occupants at a greater risk for road traffic injury than female car occupants. This highlights the need for research into road traffic injury to examine different age categories of childhood, rather than considering broad age ranges such as 0 to 17, as well as the importance of considering mode of transport. Differential patterns of risk across childhood and transport mode are apparent.

In line with prior studies that have supported a gender difference in road traffic injury (Christie, 1995), males were typically at a greater risk across different modes of transport and across deprivation levels than females (apart from as car occupants for 4 to 10 year-olds). The greater risk for males may reflect more risk taking and competitive behaviour. For example, males more frequently report playing in the streets than females (Christie, 1995). Added to this, males may be given more licence to travel independently compared to females, meaning males may receive less adult supervision in the traffic environment than females (Hillman, Adams, & Whitelegg, 1990). Further, in support of prior research which found that gender differences lessened with age (West & Sweeting, 2004), the difference in risk of pedestrian injury between males and females attenuated between 4-10 and 11-15 years-of-age, especially for children residing in the more socio-economically advantaged areas.

In contrast, gender differences for cycling casualties appear to increase across childhood, with the gender disparity much greater for males between 11 and 15 years-of age than between 4 and 10 years-of-age. Although 83% of 5 to 10 year-olds own bikes, compared to 71% of 11 to 16 year-olds (DfT, 2017a), there may be differences in the cycle patterns of younger and older children. Older children may be more likely to cycle independently and may be more likely to cycle on the roads and consequently may be exposed to greater risk. Males under 16 years old have also been found to make on average 22 cycle trips per year compared to around 10 for females. Added to this, there is a steep socio-economic gradient for males 11 to 15 years-old, but not for females. Environmental factors characteristic of deprived areas (e.g. more traffic, parked cars on the streets) may place males, who are cycling more frequently, at greater risk than females, who are cycling less frequently.

The relationship between deprivation and car occupant injury risk is not so straightforward. It appears that females are at a greater risk for injury as a car occupants between 4 and 10 years-old, but males are at a greater risk between 11 and 15 years-old. The influence of deprivation appears to be greater on the relationship between gender and road traffic injury between 11 and 15 years-old compared to between 4 and 10 years-old. This may reflect the way adolescent males and females are travelling in cars. Compared to females, adolescent males may more often travel in cars with adolescent male peers who may be more likely to engage in risk taking behaviour when driving and are at an increased risk of a road traffic collision (Williams, 2003). The pattern of risk for males and females may therefore vary across childhood and adolescence in line with changing travel habits.

The social inequalities in road traffic injury, although reduced from the estimate originally published in the Black Report in 1980 (Townsend & Davidson, 1982), still remain, suggesting current approaches to reducing this inequality appear to be having a limited effect. The reasons for this inequality are likely multifaceted and involve a combination of individual, social, and environmental factors (Christie, 1995). Current monitoring of road casualties (STATS 19) does not routinely collect deprivation data and focuses on variables that result in understanding collisions in terms of active human errors, such as the child failing to properly look before crossing. Little attention has been given to latent environmental conditions, like lack of safe play areas, factors which represent significant risk in deprived areas (Christie, 1995). A novel approach to addressing this issue may be required. One suggestion to tackle this inequality is to view road safety through a health perspective lens (Christie, 2017). In the field of public health, social-economic inequalities are more routinely monitored and the social, economic and environmental factors that shape behaviour and health are addressed.

Health inequalities related to road traffic injuries are an important public health issue and as such a key role of public health is to reduce such inequalities (Public Health England, 2016). A public health perspective also offers a systemic view of health inequalities understanding the social, economic, and environmental factors that shape people's behaviour (Dahlgren and Whitehead 1991). There are also co-benefits of integrating road safety and public health, such as encouraging active travel (walking and cycling) and improving health and well-being. Through integrating road safety and public health activities efforts can be made to promote healthy transport and increase physical activity (Vernon, 2014). A public health lens may therefore enable greater understanding of the impact of traffic on people's behaviour and barriers to active travel. Indeed, reducing obesity (which is most prevalent amongst the most deprived) and promoting active travel are the focus of many government policies (Christie, 2017). However, these policies will only be successful in improving public health if they are delivered with in an environmental context in which people feel safe. In line with this, the Mayor of London's 2018 Transport Strategy proposes to adopt a healthy streets, healthy people policy to reduce road casualties (https://tfl.gov.uk/corporate/about-tfl/how-we-work/planning-for-the-future/the-mayors-transport-strategy). The Healthy Streets Initiative (https://healthystreets.com/) incorporates factors relevant to road safety when designing street environments, such as feeling safe and safe places to cross.

Limitations

The present research provided insight into a neglected area, the link between deprivation and road traffic injury across different age groups, genders and transport modes during childhood. However, the present findings should be understood in terms of certain limitations. Firstly, data were only examined for 2016 in England. This provided an exploratory snapshot of the relationship between deprivation and road traffic injury across childhood, but meant trends could not be examined. This approach was chosen as STATS19 data started categorising road traffic casualties by IMD index from 2015, meaning data categorising casualties by deprivation, mode of transport, and age for previous years was not available. Future research monitoring these trends over time may provide greater insight into the link between deprivation and road traffic injury risk for children and including the rest of Great Britain. Secondly, the IMD index provides a measure of the deprivation level of the area in which the casualty lives. This therefore takes into account environmental, but not individual disadvantage (the so called ecological fallacy). Further research should be undertaken to explore the ways different types of disadvantage influence road traffic injury risk. Third, the present research is limited in that collision location and cause were not taken into account. To increase understanding of the social inequality of road traffic risk future research should seek to identify where road casualties are taking place across the range of IMD index levels (e.g. crossing, street) as well as the cause of the collision (e.g. driver speed, child not looking). Finally, alternative approaches could also be used to examine this issue. For instance, coroners' records could be used to explore road traffic injuries and may provide a more socio-ecological view.

Conclusion

Overall the present findings indicate that although reduced from earlier estimates (Townsend & Davidson, 1982), the social inequalities in road traffic injury for child pedestrians residing in the most deprived areas still remains, even after exposure is taken into account. Further, the inequality in injury risk as cyclists and car occupant's increases for males as they progress towards adolescence. Differential patterns of risk are therefore apparent across childhood as well as gender and transport mode. Thus, the current research underscores the importance of breaking down road traffic injury trends for different age groups across childhood as well as mode of transport and gender. Identifying those most at risk means that more targeted intervention work can be carried out in order to reach those that are most vulnerable. However, the issue of why some young people living in deprived areas are most at risk is still poorly understood. Greater research attention needs to be directed toward identifying the causal mechanisms that increase the risk of road traffic injury in those who live in the most deprived areas. A potential fruitful avenue may be to look at this issue through a health perspective lens (Christie, 2017).

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Table 1. Number of KSIs in England during 2016 across quintiles of deprivation

	Pedestrian	Cyclist	Car Occupant	Total
4 – 10 years-old	354 (66%)	59 (11%)	125 (23%)	538
Male	242 (68%)	46 (78%)	61 (49%)	349
Female	112 (32%)	13 (22%)	64 (51%)	189
1 = Most deprived	152 (73%)	26 (13%)	29 (14%)	207
2	82 (65%)	13 (10%)	31 (25%)	126
3	44 (55%)	9 (11%)	27 (34%)	80
4	37 (59%)	8 (13%)	18 (28%)	63
5 = Least deprived	39 (63%)	3 (5%)	20 (32%)	62
11 – 15 years-old	493 (61%)	205 (26%)	105 (13%)	803
Male	281 (57%)	187 (91%)	58 (55%)	526
Female	212 (43%)	18 (9%)	47 (45%)	277
1 = Most deprived	172 (63%)	62 (23%)	39 (14%)	273
2	110 (63%)	44 (25%)	21(12%)	175

3	94 (65%)	31 (22%)	19 (13%)	144
4	64 (53%)	38 (32%)	18 (15%)	120
5 = Least deprived	53 (58%)	30 (33%)	8 (9%)	91

Note. Percentages represent the percentage of children KSI for each age group and each IMD quintile.

Table 2. Average number of miles travelled per year across mode of transport for 4 – 10 and 11 – 15 year-olds by IMD quintile

	Walking	Cycling	Car
4 – 10 year-olds			
1 = Most deprived	188	12	2010
2	181	21	2507
3	160	12	3891
4	149	15	4067
5 = Least deprived	133	16	4742
11 – 15 year-olds			
1 = Most deprived	269	33	1410
2	266	38	2114
3	242	36	3084
4	202	38	3598
5 = Least deprived	257	49	4100

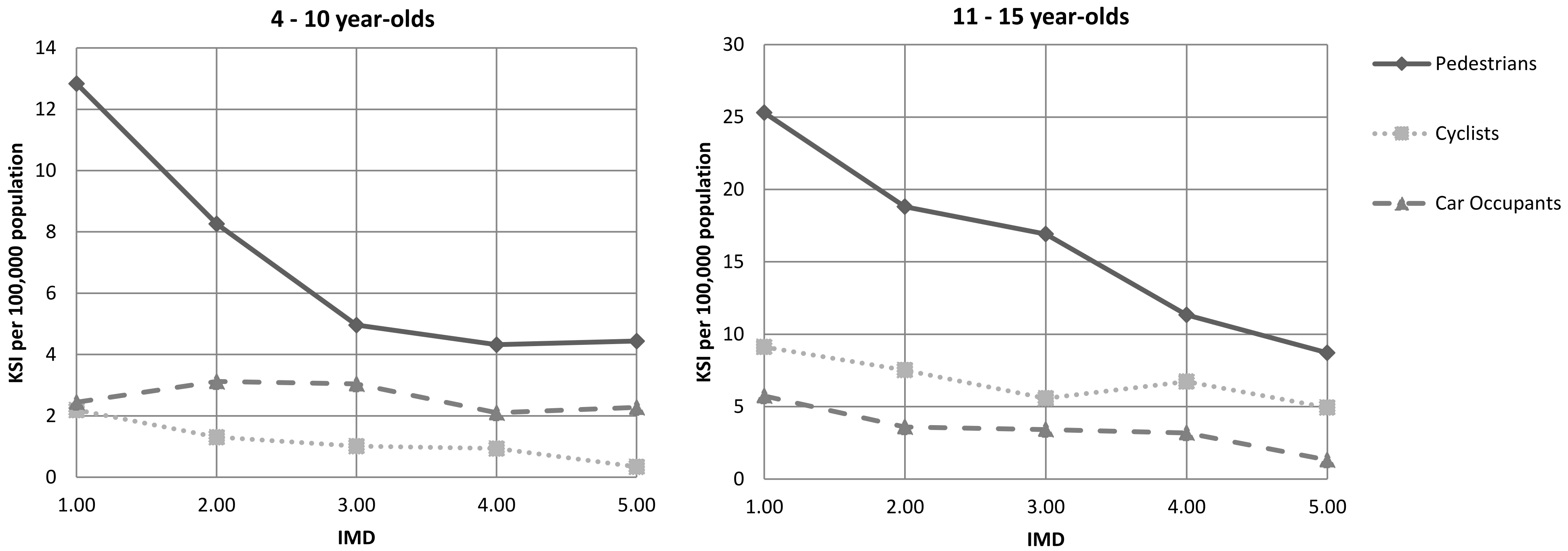

Figure 1. KSIs per 100,000 population across IMD quintiles for 4-10 and 11-15 year-olds in England during 2016.

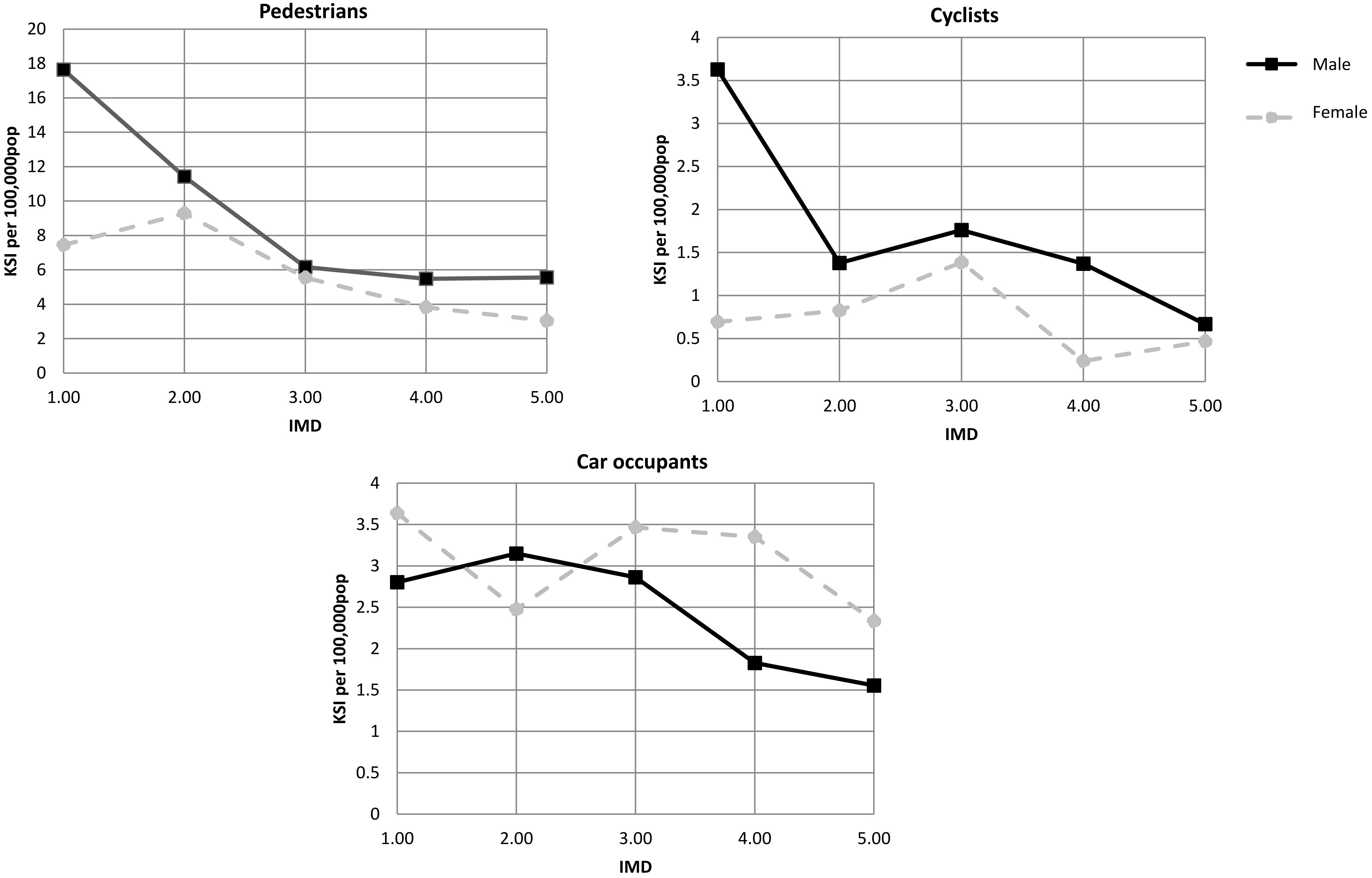

Figure 2. KSIs per 100,000 population across IMD quintiles for males and females 4 – 10 years-old in England during 2016.

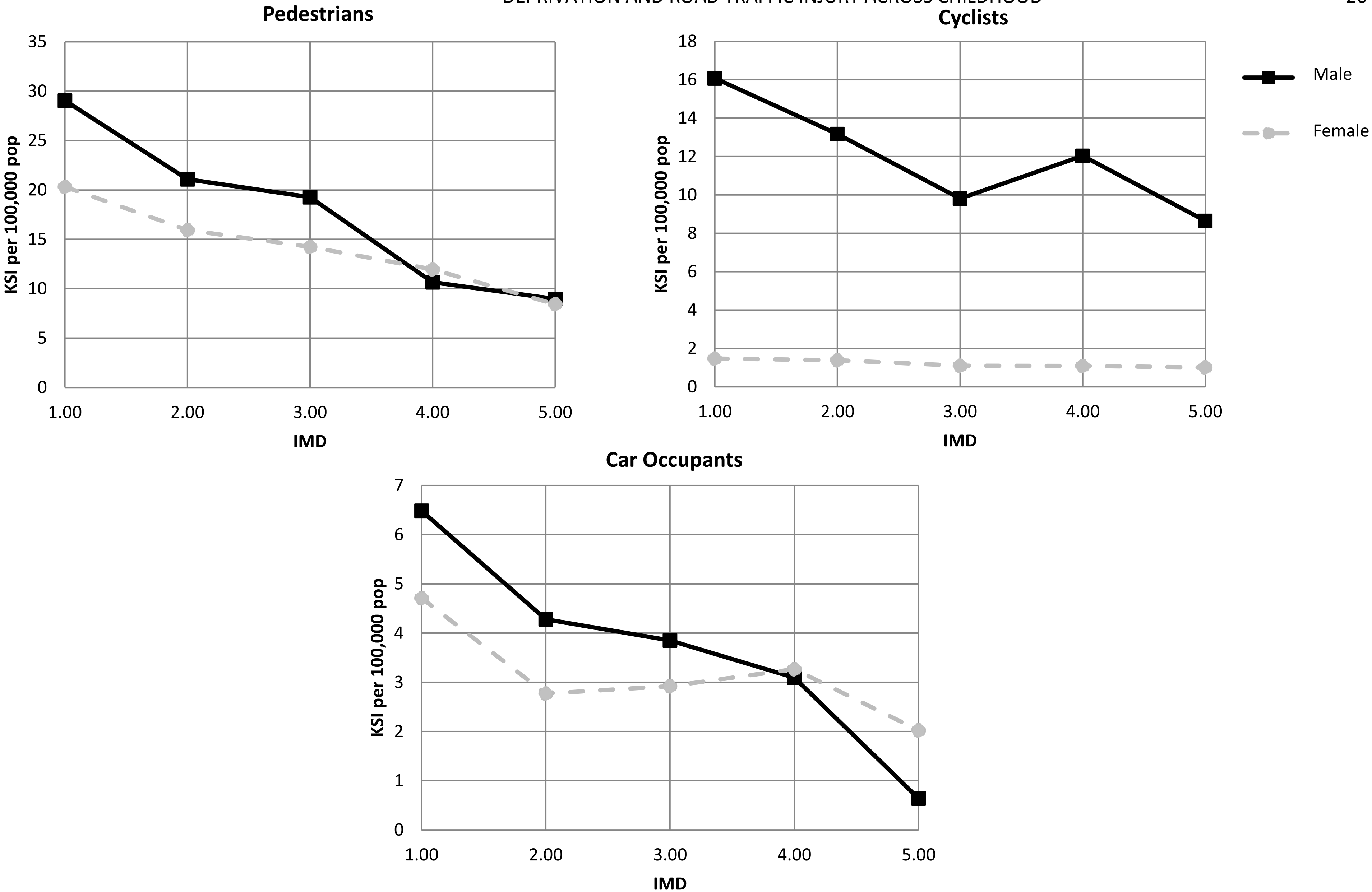

Figure 3. KSIs per 100,000 population across IMD quintiles for males and females 11 – 15 years-old in England during 2016

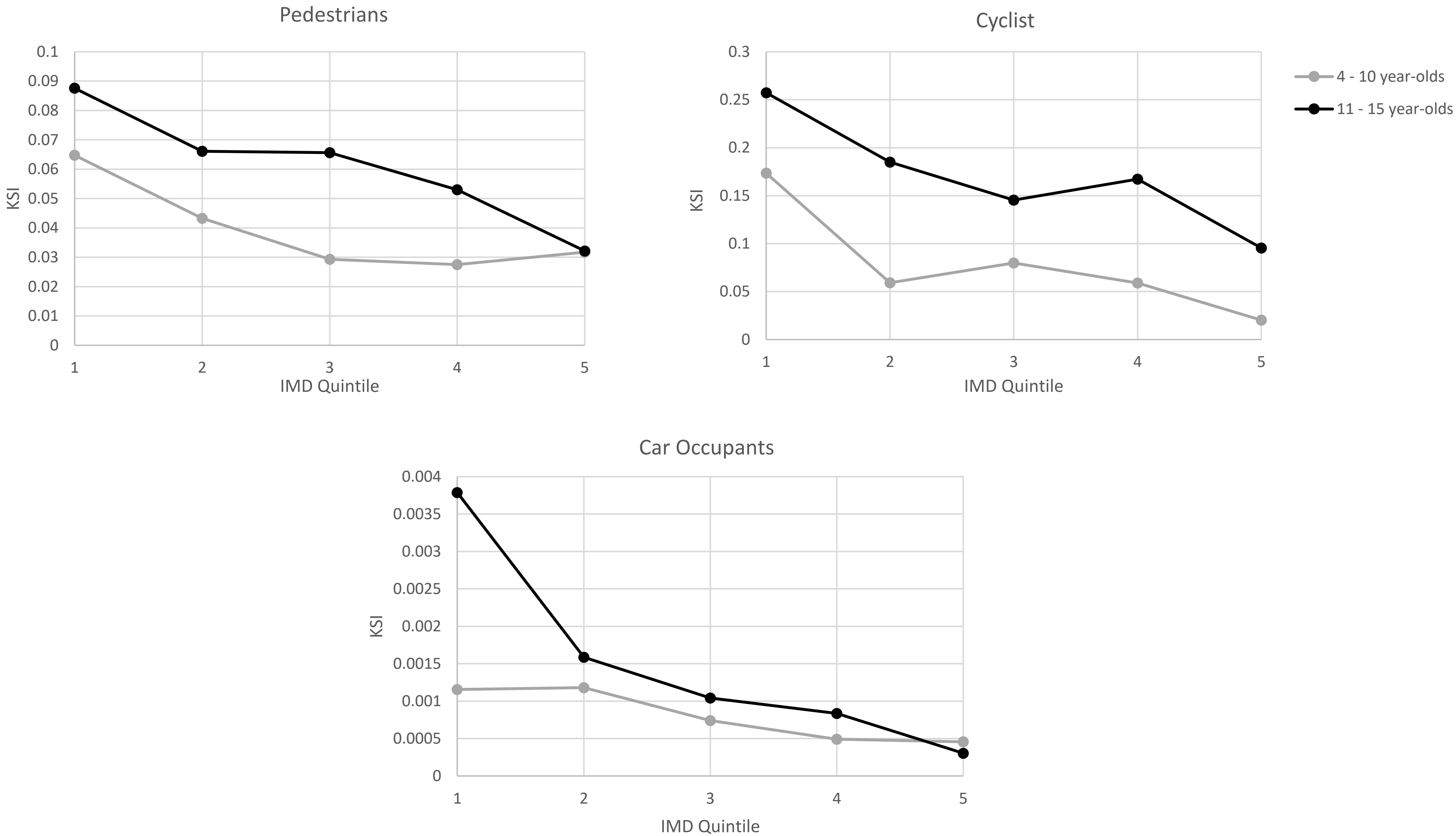

Figure 4. Rate of 4 – 10 and 11 – 15 year-olds KSI per 100,000 population in 2016 and average miles travelled per year across quintiles of deprivation