Deprivation and Road Safety in London

A report to the London Road Safety Unit

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Table of Contents

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Summary

The report *Deprivation and Road Safety in London* is in three parts. Part A explores the associations between deprivation and road traffic injury risk for different road user groups; Part B1 reviews the evidence on ways of reducing inequalities in injury risk; and Part B2 surveys current policy and practice across London on addressing deprivation in road safety.

A second report *Road Safety of London's Black and Asian Ethnic Minority Ethnic Groups*[1] is also available.

Part A: Relationships and Risks

We have shown that there is a relationship between deprivation and injury risk in London, both across the boroughs and within individual boroughs. The strongest relationship with deprivation is for pedestrians, where the most deprived are over twice as likely to be injured as the least deprived. This relationship was also found for adult cyclists in London. When factors that are not highly correlated with overall deprivation measures are taken into account, the gradients are reduced, but do not disappear, suggesting that there is something 'about' deprivation, over and above factors such as differential local road conditions, that is related to risk of injury.

Given that we are only able to measure relationships between risk and area characteristics, we cannot make any strong claims about the mechanisms likely to link them. However, evidence from other sources (e.g. London Area Travel Survey 2001 data, shown in the Appendix) suggests that exposure is likely to account for some of the difference. Children living in more deprived areas are more likely to travel as pedestrians (Sonkin *et al* 2006), and thus more likely to be exposed to risk of road traffic injury. In addition, people who class themselves as Black (African, Caribbean or Black other) are more likely to travel as pedestrians, and are therefore also more likely to be exposed to road injury risk.

In terms of recommendations for reducing the effect of deprivation on road injury without reducing the amount of walking that residents do, the key is to make walking and cycling safer, through reducing traffic speed and volume, and by improving the environment for walking and cycling.

[1] Steinbach R, Edwards P, Green J, and Grundy C (2007) Road Safety of London's Black and Asian Minority Ethnic Groups: A report to the London Road Safety Unit. London: LSHTM.

To monitor the impact of policy on the relationship between deprivation and injury risk, our analysis suggests that STATS19 and the Index of Multiple Deprivation, despite limitations, are adequate measures for monitoring. Although postcode incompleteness led to some biases in relationships between deprivation and injuries identified through STATS19, these did not impact greatly on the findings. Given that most child pedestrians are injured close to home, using site of collision rather than casualty postcode made little difference to the relationship between child pedestrian injuries and deprivation. Collision locations are always recorded and therefore analysis by collision location allows all casualties to be included. STATS19 data are known to only include injuries that are reported to the police, but our comparison with hospital admissions data suggest that STATS19 are sufficiently reliable.

Removing the Environment domain (which includes collision data) from the Index of Multiple Deprivation measure had little impact on the strength of relationships found, and so it is not necessary to recalculate the Index of Multiple Deprivation for future analyses. For monitoring changes in the relationship between injury and deprivation over time, the overall number of pedestrians injured, particularly children, is a sensitive measure with a strong relationship with deprivation. However, where possible this should take into account the distance travelled as a pedestrian (for example using London Area Travel Survey data when updated), to allow for different levels of walking by age and ethnic groups.

Part B1: Remedial measures

There is a growing evidence base relating to the effectiveness of interventions to reduce road traffic injuries, supporting the use of measures to reduce traffic volume and speed. There is little evidence that education, training and publicity measures alone reduce injury rates, suggesting that targeting these at deprived or other high risk populations is unlikely to reduce inequalities in traffic injury. To address deprivation effectively, road safety policy needs to take a broader public health approach, taking into account how shifts in transport modes are likely to impact on exposures to risk across London's population. The current strategy of encouraging walking and cycling is likely to reduce one key contributor to inequalities in risk (exposure differences) in the longer term.

Part B2: Policy and Practice

There are policy imperatives at both national and London levels to address the links between deprivation and injury rate. This part of the study aimed to examine the responses of London boroughs to these imperatives, and to identify the challenges to, and opportunities for, addressing deprivation in the context of road safety. Data came from published Road Safety Plans, interviews and a survey.

Across London, the major focus of road safety activities is achieving targets in injury reduction. In some boroughs, this is being done within broader ranging strategies of, for instance, road danger reduction or developing sustainable transport. Given the range of other policy agenda to be addressed, few boroughs prioritise action on deprivation specifically within road safety plans. However, many teams and individuals are addressing inequalities in terms of designing, implementing or prioritising interventions.

Setting aside those policies which directly address deprivation, as these are in general outside the remit of road safety teams, 'addressing inequalities' in road safety can entail one or more of three rather different policy strategies. First, deprivation can be taken into account through resource allocation by, for instance, using ward level indicators of deprivation as a measure of need or targeting interventions at those groups at highest risk. Second, it can be taken into account by delivering policies for which there is good evidence that they reduce inequalities in outcomes. Third, interventions can be tailored carefully at the specific needs of different sectors of the population, to ensure that services are being delivered appropriately across the borough.

There was considerable reported utilisation of the first strategy, with both engineering and educational interventions often targeted at those more in need. There are real challenges in adopting the second strategy, given the limited evidence about the causes of inequalities in injury risk and, following from this, little evidence on how best to address them. Some gains had been under the third strategy, in tailoring interventions through good practice in partnership and community consultation.

Although the RSPs suggested that many boroughs adopt holistic approaches to road safety within a broader vision for the borough (such as a road danger reduction

approach), in practice most staff reported using a rather more pragmatic approach based on local knowledge and speculation about likely causes.

The key challenges noted in achieving road safety goals whilst taking deprivation into account were: the lack of evidence on the causes of inequalities in injury risk and what could address them; having to prioritise programmes that will meet national and London casualty reduction targets; reported tensions in meeting obligations to provide universal services whilst targeting those at higher risk. Opportunities were: optimism about the gains made in road safety; the relatively high level and security of funding over the last 5 years; positive models of community consultation and partnership working and the commitment and enthusiasm of many local teams.

As it is impossible to recommend specific programmes that will reduce inequalities in injury risk, the recommendations from this research focus on developing strategies that move towards reducing a major cause of inequality (exposure differentials) through reducing traffic speed and volume. To do this in ways which take account of the challenges noted above, the way forward may lie in strengthening community participation and partnership as ways of both working with all communities within a borough (and thus delivering services that meet the needs of deprived as well as less deprived communities) and delivering road safety interventions which mesh with other policy goals (such as sustainable transport) rather than potentially conflict with them. This will require good partnership working within local authorities and across agencies. An integrated approach to road safety, which addresses deprivation as part of a broader strategy of reducing the dangers posed by traffic volumes and strengthening community participation, is less likely to result in fragmented and ineffective action.

Part A: Relationships and Risks

Section 1

Is there a link between deprivation and road traffic injury in London?

1. Introduction

The association between socio-economic deprivation and road injury risk in England and Wales was identified 10 years ago in a study of individual social class-coded child death records (Roberts 1996). The study found steep and widening social class gradients in injury mortality. The injury death rate for child pedestrians in the lowest social class was five times greater than that for children in the highest social class. The analysis was recently updated and the results show that these inequalities in road injury risk persist, and indeed may have increased. Compared to children of parents in the highest socio-economic class, the death rate in children of parents in the lowest socio-economic class was 20 times higher for pedestrians, 27 times higher for pedal cyclists and 5 times higher for car occupants (Edwards 2006).

There is also evidence that exposure to road traffic injury risk varies between socio-economic groups (Sonkin *et al* 2006). Using data from the National Travel Survey, Sonkin *et al* found that children from households without access to vehicles walk more than their counterparts in car-owning families. Per mile travelled, there are about 50 times more child cyclist deaths and nearly 30 times more child pedestrian deaths than there are deaths to child car occupants. These differences in risk by mode of travel are likely to contribute to the steep social class gradients in road traffic injury death rates. Although walking and cycling provide important benefits in terms of physical activity and have none of the adverse climate impacts of motorised travel, pedestrians and cyclists remain at greatest risk.

Evidence that these inequalities persist for non-fatal road injuries was provided in a study by Grayling *et al* (2003), who linked STATS19 road injury data to deprivation data based on the location of collisions of road accidents in England during 1999-2000. The study found a deprivation effect on pedestrian injury rates that remained after adjusting for other factors, such as road length and the numbers of road junctions. The most deprived tenth of wards were more than three times as likely to have a child casualty as the least deprived.

Despite steady casualty reductions for most road users across London (TfL, 2004) concerns remain that they have not been shared equally, particularly by the most vulnerable road users. In 2005, Transport for London commissioned the London School of Hygiene & Tropical Medicine to conduct a programme of research into deprivation and road injury risk, in order to provide an evidence base for recommendations that are applicable specifically to the London context. The aims of

the study were to: describe the strength of the relationship between deprivation and road traffic injury risk, and to identify risk markers; report on current policy in London; offer recommendations for reducing unequal road traffic injury risks and for accurate monitoring of changes over time.

In this report we examine the strength of the relationship between deprivation and road traffic injury risk for different road user groups in London. Our analysis covers children and adults, all casualties and specifically those killed or seriously injured, and we explore how the relationship varies using different measures of deprivation. Using post-coded STATS19 data collected by the Metropolitan Police and the City Police, we compare resident-based population road injury rates between areas in London. Using data collected in the 2001 census we assess whether these injury rates are linked to different measures of area deprivation. Then by linking casualties to the areas in which the collisions occur, we use data describing features of the road network in London to examine how much road injury risk is due to aspects of the road environment in the areas in which collisions occur. We consider which particular elements of deprivation have most impact on road injury risk and investigate which measures are most useful for application in road safety policy and for targeting interventions. We hope that the information this report provides will make a substantial contribution to the evidence base needed to improve road safety for all Londoners, especially those most vulnerable.

2. Methods

Analysis was carried out at census Lower Super Output Area level. These areas will be referred to throughout this report as 'SOAs'. The SOAs are geographic areas containing an average of 1,500 people and are defined by the Office for National Statistics (ONS) using measures of population size, mutual proximity and social homogeneity to provide robust small-area statistics for use in comparative analyses. In London there are 4,765 SOAs contained within 33 boroughs.

Measures of injury

We obtained a data file containing STATS19 data for all road traffic injury collisions in London between 1994 and 2004 from the London Road Safety Unit. Casualties were categorised according to age (0–15 years, 16-59 years and 60+ years), road user group (pedestrian, cyclist, motorcyclist and car occupant) and whether killed, seriously or slightly injured. Each casualty was assigned to a SOA in two ways: First, casualties were assigned to a SOA based on their home address postcode (where postcodes were complete), using the ONS' National Statistics Postcode Directory. Second, casualties were assigned to a SOA based on the Ordnance Survey grid reference where the collision occurred. Casualties with home address postcodes outside London were removed from the data set.

Measures of deprivation

We used several measures of small area relative deprivation to allow us to examine the relationships between road traffic injuries and different aspects of deprivation, and to consider which ones demonstrate the strongest relationship.

Index of Multiple Deprivation

The Index of Multiple Deprivation (IMD) brings together 36 indicators across seven domains of deprivation into an overall score and rank for a geographical area. The index was designed to provide a robust small-area measure of deprivation which encompasses the many different dimensions in which deprivation can be recognised and measured. The higher the IMD score, the more deprived the area. The index is widely used, although it has some limitations: the current version was produced in 2004, although the intention was for it to be produced routinely and regularly; and the resulting 'score' is on an ordered scale, so the difference between scores cannot be easily quantified (for example, the difference between IMD scores of 20 and 30 is not necessarily the same as that between 50 and 60).

The *'Environment' domain* of the IMD includes an indicator that relates to road traffic injuries to pedestrians and cyclists. We therefore recalculated IMD for our analysis by removing the Environment domain score, and re-combined the six remaining domains using methods described by the Office of the Deputy Prime Minister when constructing the index. Throughout this report we refer to this recalculated IMD score as 'IMD2'. As the Environment indicator relating to road traffic injuries has a relatively small weighting (contributing around 2.5% of the overall IMD score), this adjustment is unlikely to make much difference to the analysis, but could potentially explain some of the association with deprivation if found.

Income deprivation domain – comprising five indicators about households which are in receipt of income support or job seekers allowance, households which have tax credit and are low income and asylum seekers in support of subsistence and accommodation support.

Employment deprivation domain – comprising six indicators covering claimants of unemployment benefits, incapacity benefits, disablement allowance and participants in 'New Deal'.

Health deprivation and disability domain – comprising four indicators covering years of potential life lost, emergency hospital admissions and adults suffering mood disorders.

Education, skills and training domain – comprising seven indicators, six of which are about young people's performance and attendance at school and further education. The seventh indicator is the proportion of working age adults with no or low qualifications.

Barriers to housing and services domain – comprising seven indicators, four of which are measures of geographic distance to services (GP, supermarket, primary school, post office). The other three indicators relate to access to quality housing: proportion of households which are overcrowded, proportion of households receiving homeless provision assistance and difficulty of access to owner-occupation.

Crime domain – comprising four indicators covering recorded crime relating to burglary, theft, criminal damage and violence.

Unemployment indicator A (2001 census) – the percentage of economically active people aged 16-64 who are unemployed.

Unemployment indicator B (2001/02) – the percentage of population in receipt of benefits for unemployment. This indicator is theoretically available every year and so could provide a convenient measure with which to examine trends over time. However, due to confidentiality, it is only available for 83% of census areas.

Lone parents (2001 census) **–** the percentage of households which contain 'lone parent' families.

GCSE performance **–** the percentage of children not obtaining at least five G.C.S.Es at grade C or above. This indicator is theoretically available every year so could provide a convenient measure with which to examine trends over time. Due to confidentiality it is only available for 61% of census areas.

Adult qualifications (2001 census) **–** the percentage of the adult population without qualifications at level 2 or above.

Car ownership (2001 census) **–** the percentage of households without access to a car. Although frequently used as a measure of deprivation (e.g. in the Townsend score) lack of a car may not be indicative of disadvantage in London, where relatively affluent people may chose not to own a car.

Deprivation deciles

The values of each deprivation variable were obtained for all 4,765 census SOAs in London and were then used to rank the SOAs into deciles (tenths) from 1 (least deprived SOAs) to 10 (most deprived SOAs). These tenths of London's SOAs are referred to as 'deprivation deciles' throughout this report. The IMD2 variable was used for our initial analysis of the relationship between injury and deprivation.

Road network variables

Road network variables were incorporated in the analysis to take into account variations in the complexity of the road traffic environment between areas. The variables used were: number of road junctions (where two or more roads meet), length of A roads, length of B roads, length of minor roads and length of motorways. The density of road junctions within each SOA was calculated by first overlaying the junction locations onto the SOA boundaries using the ArcView Geographic Information System and summing to provide the number of junctions within each SOA, and then dividing by the SOA area in hectares. The speeds of each class of road (in the morning, off-peak and afternoon) were also available, at borough level, along with traffic flows and volumes.

Travel survey data

Data on the travel patterns of Londoners by age and ethnicity was available from the London Area Transport Survey (LATS 2001). The data, based on travel diaries kept by the survey participants, include information on modes of transport and these were used to assess possible differences in exposure to road injury risk. Access to the data was provided through the Romulus system (http://romulus.tfl.gov.uk/webview).

Ethnicity

The percentage of the resident population that described itself in the 2001 census as 'Black' or 'Black British' (including Black African, Black Caribbean and Black Other), and the percentage that described itself as 'Asian' or 'Asian British' (including Indian, Pakistani, Bangladeshi and Asian Other) were also included in the analysis. These percentages were included as ethnicity has previously been found to be associated with road injury and is known to be associated with deprivation. A detailed analysis of road traffic casualty rates in London by ethnic group is presented in a separate report.[2]

Statistical analysis

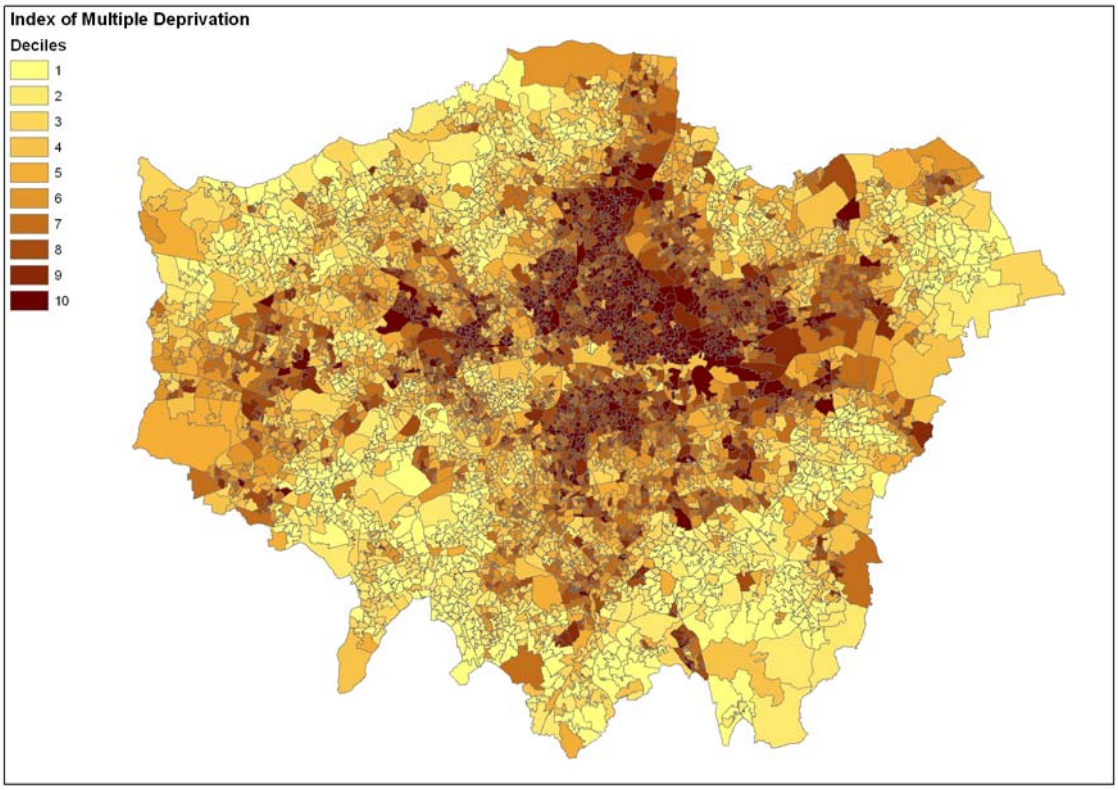
We estimated injury rates for each road user, age and severity group in two ways: first by counting the casualties in the areas in which they lived, and second by counting the casualties in the areas where the collisions occurred. We used the population resident in each area (from the 2001 census) as the denominator in both cases. For each road user, age and severity group, regression analysis was used to calculate injury rate ratios, with 95% confidence intervals, using the least deprived decile as the reference group. The Poisson distribution was used unless there was evidence for 'over-dispersion', when the Negative Binomial distribution was used. Standard errors were adjusted to allow for within-borough correlations in SOA injury rates (so called 'intra-cluster correlation'). Multivariable regression analysis was used to examine the relationships between injury rates and deprivation adjusting for other variables, such as the road network variables. Correlations between the different deprivation variables and the different road network variables were quantified using Pearson's correlation coefficient 'r'. Variables were selected for inclusion in the multivariable model if they were not highly correlated (i.e. if variables were included if $r<0.6$). All analyses were conducted using the Stata Statistical Software (StataCorp. 2005).

[2] Steinbach R, Edwards P, Green J, and Grundy C (2007) Road Safety of London's Black and Asian Minority Ethnic Groups: A report to the London Road Safety Unit. London: LSHTM.

3. Results

The STATS19 file contained data on 478,945 casualties out of a total of 399,012 road traffic collisions in London between 1994 and 2004. Of these casualties, 478,543 (99.9% of the total in the file) could be linked to a SOA, based on the location of the collision, and 128,554 (27% of the total in the data file) could be linked to the SOA in which the casualties lived, based on their home address postcodes. The reason that these two linkage percentages differ so markedly is that home address postcodes of casualties were not recorded in STATS19 prior to 1999, and are not complete for subsequent years. The values of the IMD2 deprivation variable for the 4,765 census SOAs in London by deprivation decile ranged from 0.90 to 79.10 and are shown in Map 1.

Deprivation deciles	IMD2 scores
1 (least deprived)	0.90 to 6.89
2	6.90 to 10.60
3	10.61 to 13.99
4	14.00 to 17.89
5	17.90 to 21.89
6	21.90 to 26.40
7	26.41 to 31.64
8	31.65 to 37.44
9	37.45 to 44.81
10 (most deprived)	44.82 to 79.10



Map 1 Relative deprivation in London: 4,765 census super output areas ranked by decile using the Index of Multiple Deprivation, 2004.

Road user groups

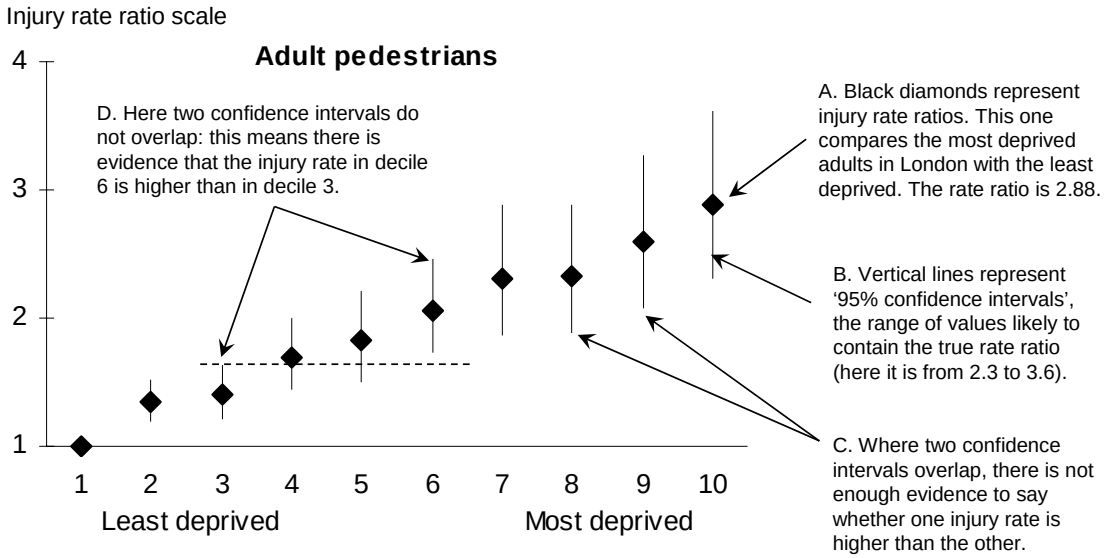
Our initial analysis of the relationship between injury rates and deprivation was based on injury rates for each road user, age and severity group, estimated using the areas in which the casualties in lived. There was a total of 13,797 adults injured as a pedestrian in London between 1999 and 2004, for whom a complete home postcode was known. The pedestrian injury rates within deprivation deciles ranged from 125 to 360 per 100,000 adults. The pedestrian injury rate ratio comparing the most deprived tenth of London's adults to that among the least deprived (i.e. the injury rate ratio) was therefore 360/125, which is 2.88. This means that the pedestrian injury rate among the most deprived adults was nearly three times as high as that among the least deprived.

Deprivation deciles	Adult pedestrian casualties with postcodes	Adult population	Pedestrian injury rate per 100,000
1	731	585,928	125
2	980	583,004	168
3	1031	588,266	175
4	1245	588,048	212
5	1328	584,932	227
6	1496	580,294	258
7	1656	572,062	289
8	1630	560,788	291
9	1770	545,096	325
10	1930	535,423	360
	13,797	5,723,841	

There was a total of 5,834 children injured as a pedestrian in London between 1999 and 2004, for whom a complete home postcode was known. Pedestrian injury rates within deprivation deciles ranged from 178 to 522 per 100,000 children. The ratio of the pedestrian injury rate among the most deprived tenth of London's children to that among the least deprived was therefore 522/178, which is 2.93. The pedestrian injury rate among the most deprived children was therefore also nearly three times as high as that among the least deprived.

Deprivation deciles	Child pedestrian casualties with postcodes	Child population	Pedestrian injury rate per 100,000
1	243	136,485	178
2	314	129,670	242
3	348	130,125	267
4	432	128,831	335
5	514	134,212	383
6	583	137,061	425
7	722	145,681	496
8	776	157,501	493
9	955	167,258	571
10	947	181,420	522
	5,834	1,448,244	

We now present these, and the remaining results, using graphs. We begin with an example that explains what each part of the graph means. The example below shows the results for adult pedestrians. Injury rate ratios are represented by black diamonds, and they show how much higher the injury rates in each deprivation decile are, when compared to the least deprived.



The vertical lines through each diamond (rate ratio) represent statistical '95% confidence intervals', and these show the range of values that we can be confident contain the true rate ratio, taking into account the numbers of casualties and the population in each area. In the example point A, the pedestrian injury rate among the most deprived adults in London is 2.88 times that among the least deprived. The 95% confidence interval (example point B) runs from 2.3 times to 3.6 times higher, which means that the injury rate among the most deprived adults could actually be as much as 3.6 times higher than the least deprived adults in London. In this report we write the injury rate and its confidence interval in this way: "2.9 (2.3 to 3.6)". As a general rule, if two confidence intervals overlap (example point C), we cannot say for certain that the rate ratios for the two deprivation deciles are different, even if the estimated rate ratios appear to be different. All the data that were used to make figures 1–4 are included in Table B3 in the Appendices.

Figure 1 shows pedestrian injury rate ratios for each deprivation decile compared with the least deprived decile, based on IMD2.

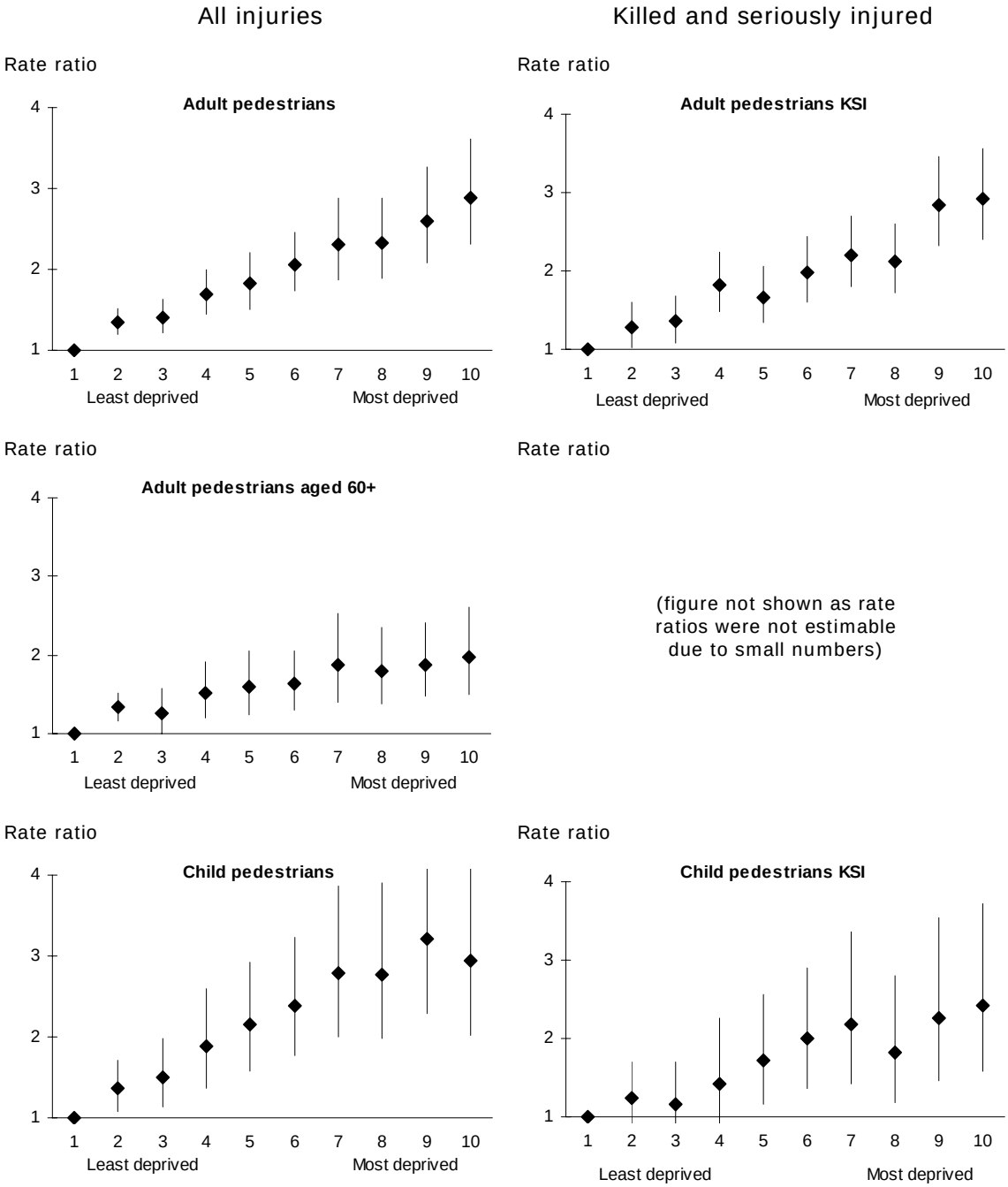


Figure 1 Pedestrian injury rate ratios by deprivation decile based on IMD2

The pedestrian injury rate for adults in most deprived areas was 2.9 (95% confidence interval 2.3 to 3.6) times that for adults in least deprived areas. This rate ratio did not change when restricted to casualties killed or seriously injured (2.9; 2.4 to 3.6 times). The pedestrian injury rate for adults aged 60 years or over living in most deprived areas was 2.0 (1.5 to 2.6) times that for adults living in least deprived areas. (The rate ratio for adults aged 60 years killed or seriously injured was not estimable due to small numbers.) Among children, the pedestrian injury rate in the most deprived areas was 2.9 (2.0 to 4.3) times that for children in

least deprived areas. For child pedestrians killed or seriously injured the rate in the most deprived areas was 2.4 (1.6 to 3.7) times that for children in least deprived areas.

Figure 2 (below) shows cycling injury rate ratios for adults and children. The cycling injury rate for adults in most deprived areas was 2.1 (1.5 to 2.8) times that for adults in least deprived areas. There was no evidence that this rate ratio changed significantly when restricted to adults killed or seriously injured cycling (2.7; 1.7 to 4.2 times), which was partly due to relatively small numbers of these casualties. There was some suggestion, (but again due to relatively smaller numbers, no good evidence) of a relationship between injuries to child cyclists and deprivation.

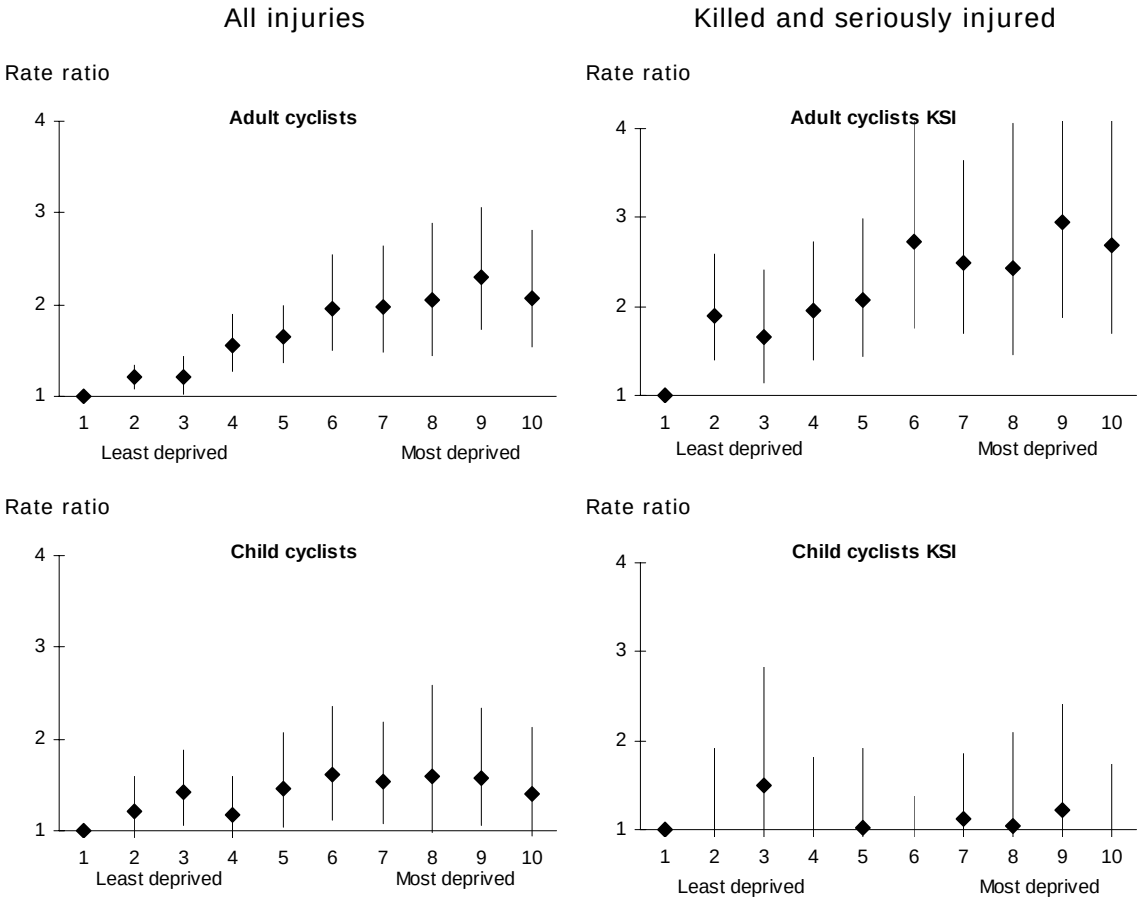


Figure 2 Cyclist injury rate ratios by deprivation decile based on IMD2

Figure 3 shows car occupant injury rate ratios for adults and children. There was little evidence for a relationship between injuries to adult car occupants and deprivation (injury rates were similar for most of the deprivation deciles). Among child car occupants there was more suggestion of a relationship between injury and

deprivation than for adults, with increased risk among the mid-range deprivation deciles.

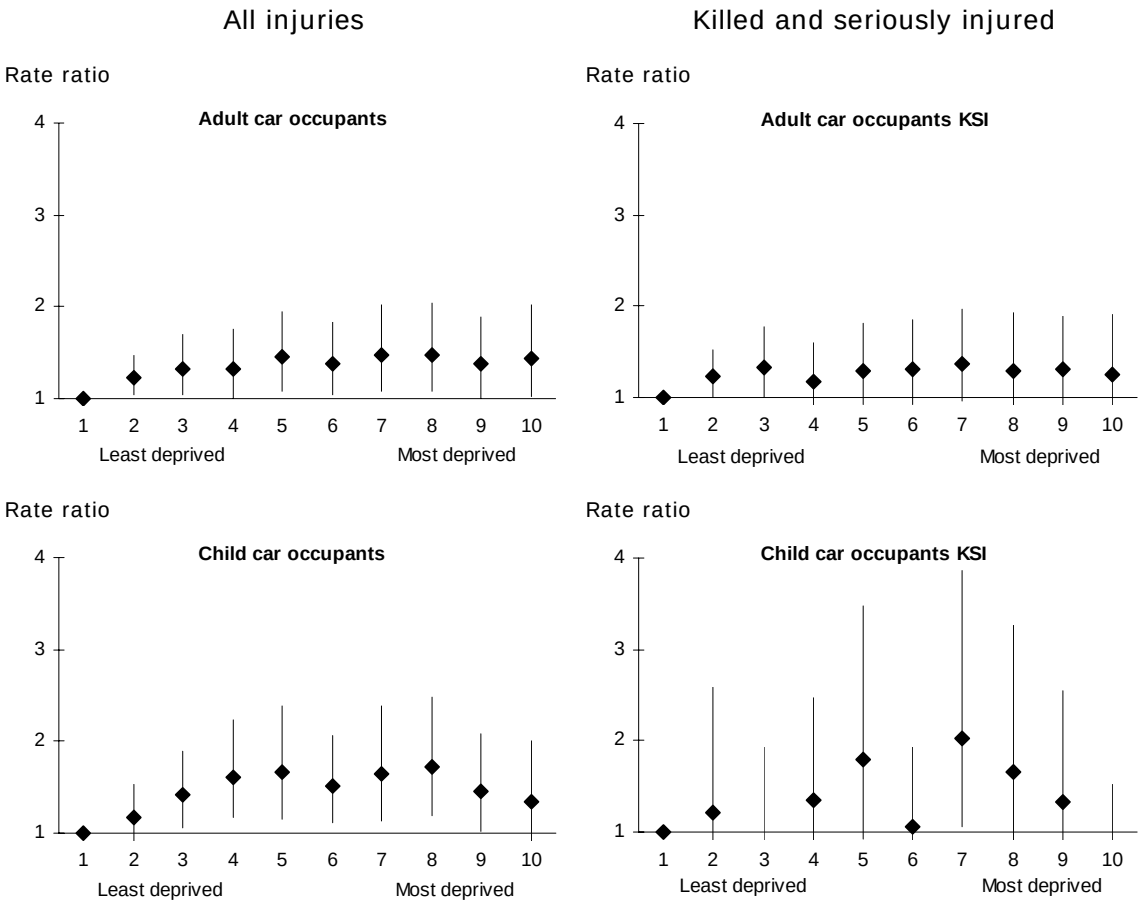


Figure 3 Car occupant injury rate ratios by deprivation decile based on IMD2

Figure 4 shows motorcycle injury rate ratios for adults only. There was some evidence for a relationship between injuries to adult motorcyclists and deprivation with rates about 50% higher among adults living in the mid-range deprivation deciles than among those living in the least deprived and most deprived areas.

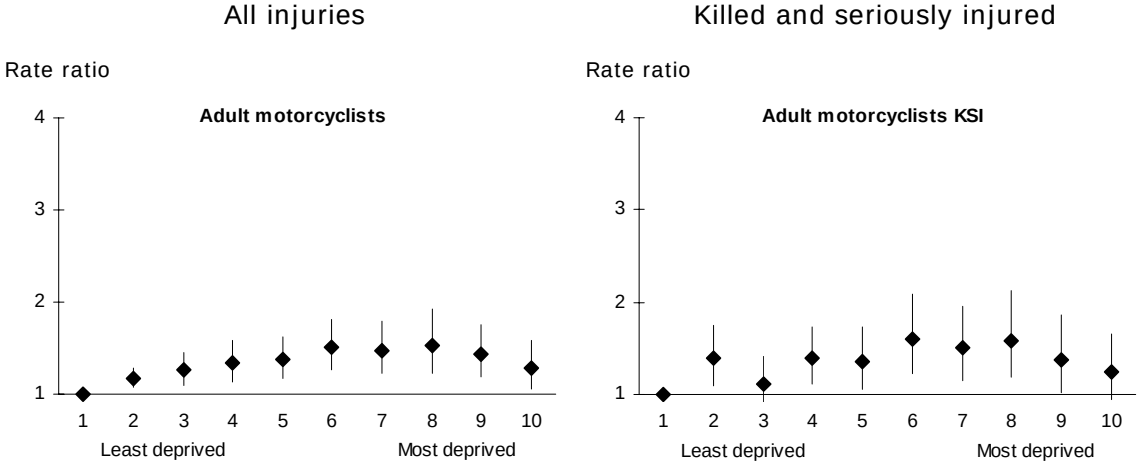


Figure 4 Motorcyclist injury rate ratios by deprivation decile based on IMD2

Relationship with deprivation within boroughs

We conducted analyses to investigate the relationship within Inner and Outer London separately, and within individual boroughs. This analysis is shown for pedestrian injuries only, as this road user group has shown the strongest association with deprivation so far. Figure 5a shows pedestrian injury rate ratios comparing deprivation deciles within Inner and Outer London separately. A stronger relationship with deprivation was seen for adults living in Outer London boroughs than among adults living in Inner London boroughs. The rate among the most deprived adults in Outer London was 2.8 (2.2 to 3.7) times that among the least deprived in Outer London, whereas in Inner London the rate among the most deprived was 1.9 (1.6 to 2.2) times that among the least deprived in Inner London. The relationships were more similar for children: among Inner London boroughs the child pedestrian injury rate in the most deprived areas was 3.2 (2.3 to 4.5) times that for children in least deprived areas, and among Outer London boroughs it was 3.1 (2.1 to 4.6) times.

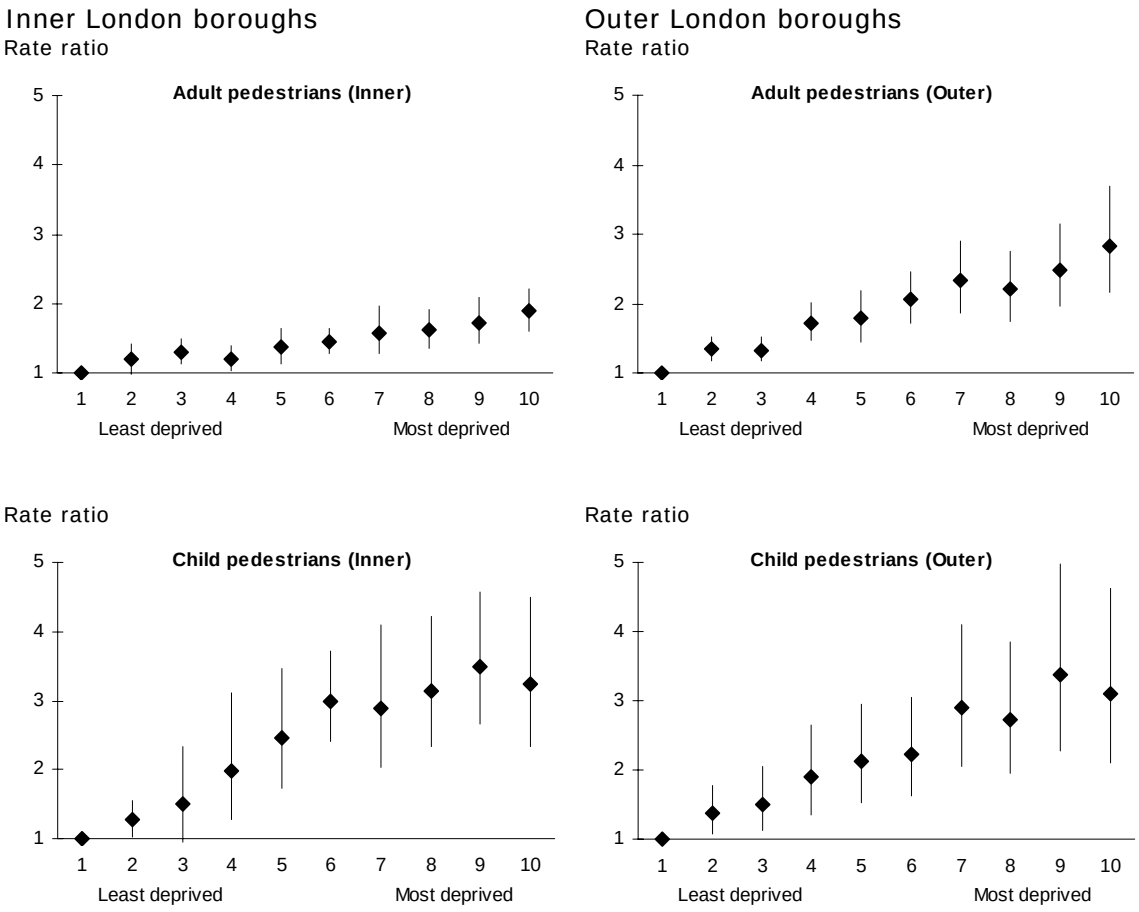


Figure 5a Pedestrian injury rate ratios stratified by Inner/Outer London, by deprivation decile based on IMD2

Figure 5b shows child pedestrian injury rate ratios within a random selection of four of the 33 London boroughs (short reports for each borough will also be made available from TfL). Rate ratios are shown for quintiles (fifths) of SOAs based on IMD2, comparing each with the least deprived quintile. In these figures, quintiles were used instead of deciles as the amount of data available for analysis is greatly reduced when considering casualties within single boroughs only.

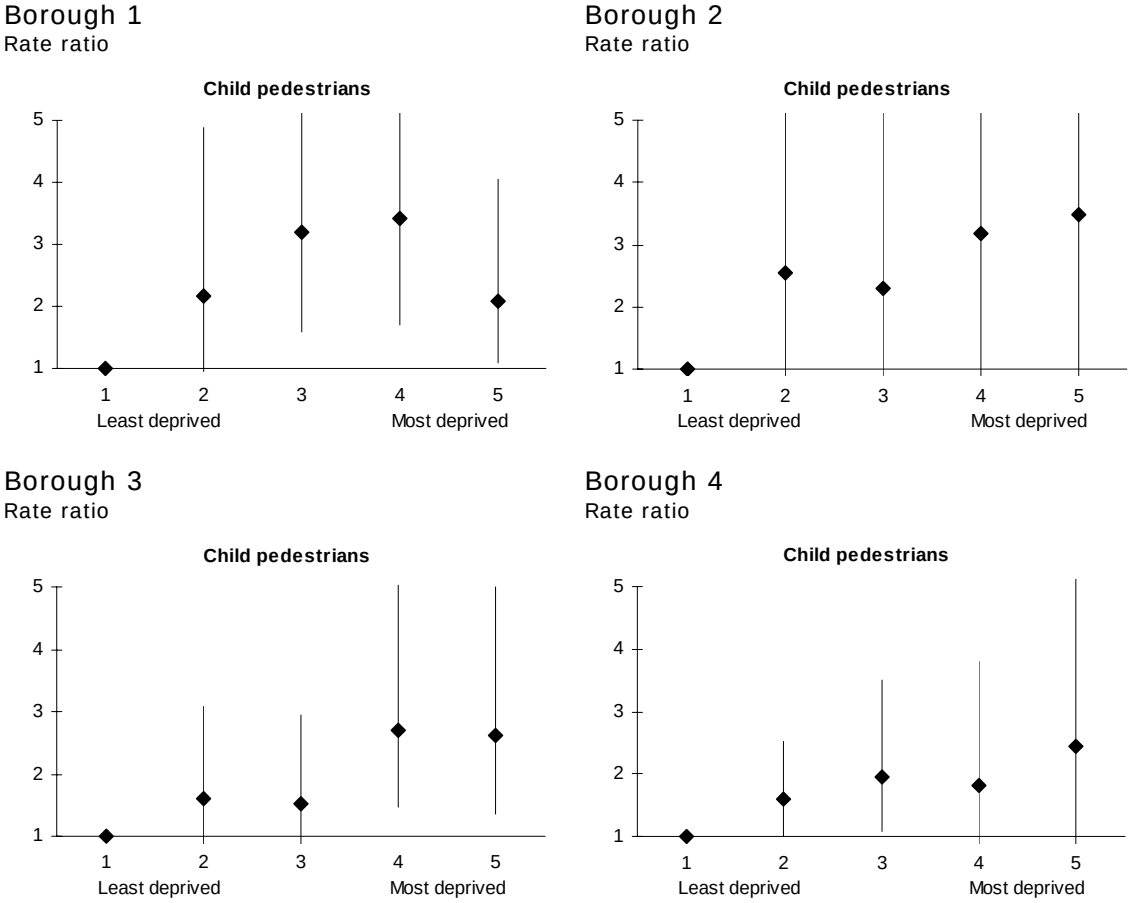


Figure 5b Child pedestrian injury rate ratios within four London boroughs, by deprivation quintile based on IMD2

Because the amount of casualty data available for analysis for a single borough is much lower, the confidence intervals for injury rate ratios are much wider than in the analysis for the whole of London. However, even with reduced amounts of data, there is still good evidence for a relationship between child pedestrian injury and deprivation within some boroughs.

Other deprivation indicators

Several of the other deprivation indicator variables (listed in section 2, Methods) were found to be highly correlated. If two variables are correlated it means that the value of one variable in a SOA is related to the value of the other variable. For example, IMD2 was almost perfectly correlated with IMD (shown in table 1 as a

correlation coefficient of 0.99) and this means that they are effectively both measuring the same thing. Similarly, IMD was highly correlated with the IMD Income, Employment and Health domains, as well as with the unemployment, lone parent and car ownership variables from the 2001 census. Where two variables are highly correlated we selected only one for inclusion in our statistical regression model.

Table 1 Correlations between IMD domains and 2001 census variables.

Variable	IMD	IMD2	Inc	Emp	Health	Educ	Barrs	Crime	UnEA	UnEB	Lone	GCSE	Qual
IMD2	**0.99**												
Income†	**0.95**	**0.96**											
Employment†	**0.94**	**0.95**	**0.93**										
Health†	**0.89**	**0.90**	**0.85**	**0.87**									
Education†	0.67	**0.70**	0.69	0.63	0.61								
Barriers†	0.67	0.66	0.56	0.52	0.58	0.28							
Crime†	0.63	0.61	0.49	0.48	0.53	0.27	0.37						
UEmpA	**0.88**	**0.88**	**0.89**	**0.85**	**0.74**	0.58	0.58	0.45					
UEmpB	**0.88**	**0.88**	**0.87**	**0.89**	**0.73**	0.49	0.53	0.41	**0.89**				
Lone parents	**0.71**	**0.74**	**0.80**	**0.71**	0.63	0.68	0.36	0.32	**0.70**	0.61			
GCSEs	0.27	0.30	0.34	0.31	0.28	0.38	0.03	0.09	0.24	0.22	0.38		
Qualifications	0.36	0.42	0.47	0.45	0.39	**0.73**	-0.04	0.04	0.34	0.30	0.53	0.53	
No Car	**-0.83**	**-0.79**	**-0.74**	**-0.74**	**-0.74**	-0.43	-0.63	-0.51	**-0.76**	**-0.72**	-0.50	-0.03	-0.02

†These variables are individual IMD domains (i.e. components of the total IMD score)
Correlation coefficients (r) greater than 0.7 are shown in bold.

Where deprivation indicators were highly correlated with IMD2, we found similar relationships between injury and deprivation for each road user group to those identified using IMD2 (the graphs showing these relationships are not therefore presented in this report).

The relationship between injury and deprivation was examined for the four remaining deprivation indicators that were <u>not</u> strongly correlated with IMD2: barriers to housing & services domain, crime domain, GCSE performance and adult qualifications. Again, this analysis is shown for pedestrian injuries only, as this road user group has shown the strongest association with deprivation so far. The results are shown in figure 6a and figure 6b.

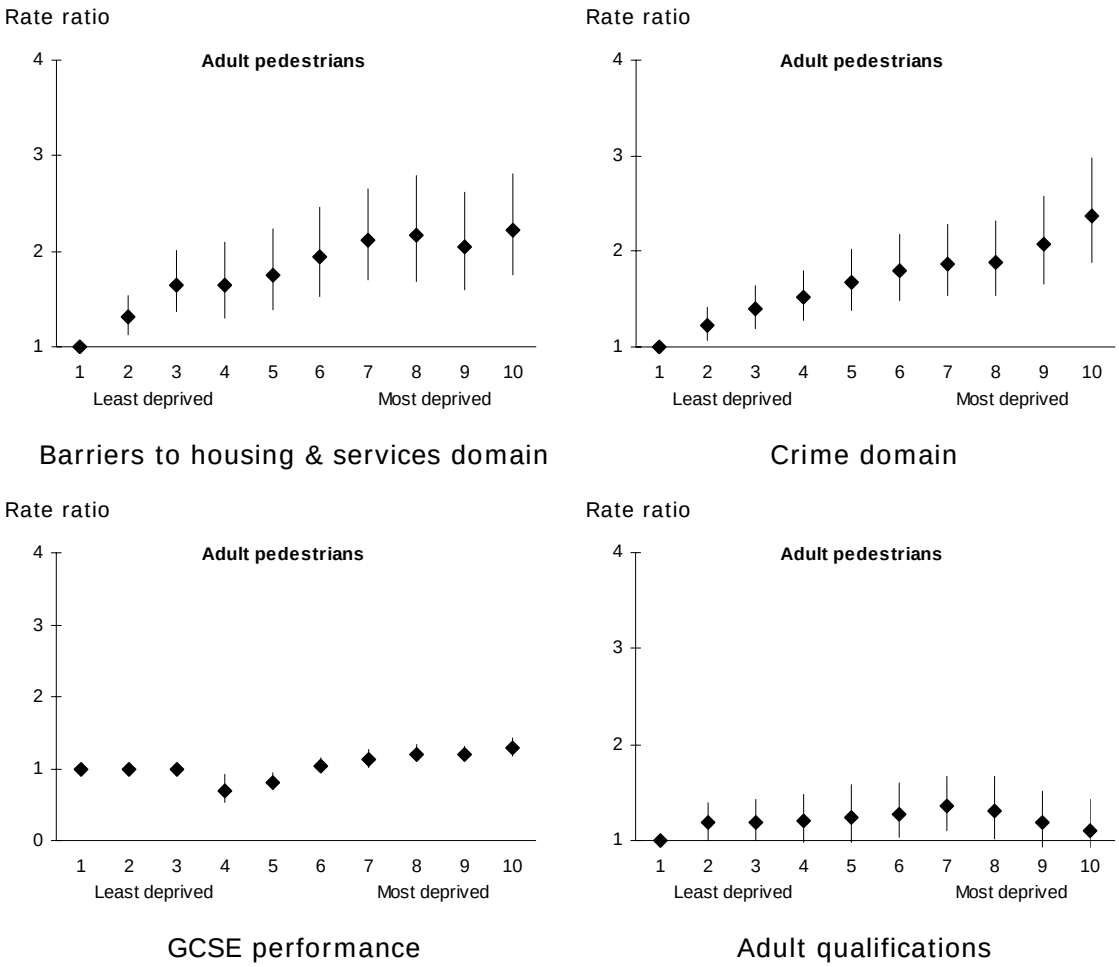


Figure 6a Adult pedestrian injury rate ratios by deprivation decile based on barriers to housing & services domain, crime domain, GCSE performance and adult qualifications

There was a positive relationship between adult pedestrian injury and increasing deprivation as measured by the barriers to housing & services IMD domain, and the crime IMD domain (figure 6a). There was little evidence for a relationship between adult pedestrian injury and deprivation when measured by the percentage of children in areas not obtaining at least five GCSEs (indeed it is difficult to see how adult pedestrian injury could be related to child education). There was little evidence of a relationship between adult pedestrian injury and the percentage of adults in areas without qualifications.

There was also a positive relationship between child pedestrian injury and increasing deprivation as measured by the IMD crime domain (figure 6b). There was some evidence for a relationship between child pedestrian injury and increasing deprivation as measured by percentages of children not obtaining at least five GCSEs at grade C or above. Among areas where the percentages of children

achieving GCSEs was lowest, the pedestrian injury rates were about 50% higher than in areas where children have at least five GCSEs (rate ratio 1.5; 1.3 to 1.7). There was also a positive relationship between child pedestrian injury and increasing percentages of the adult population without qualifications.

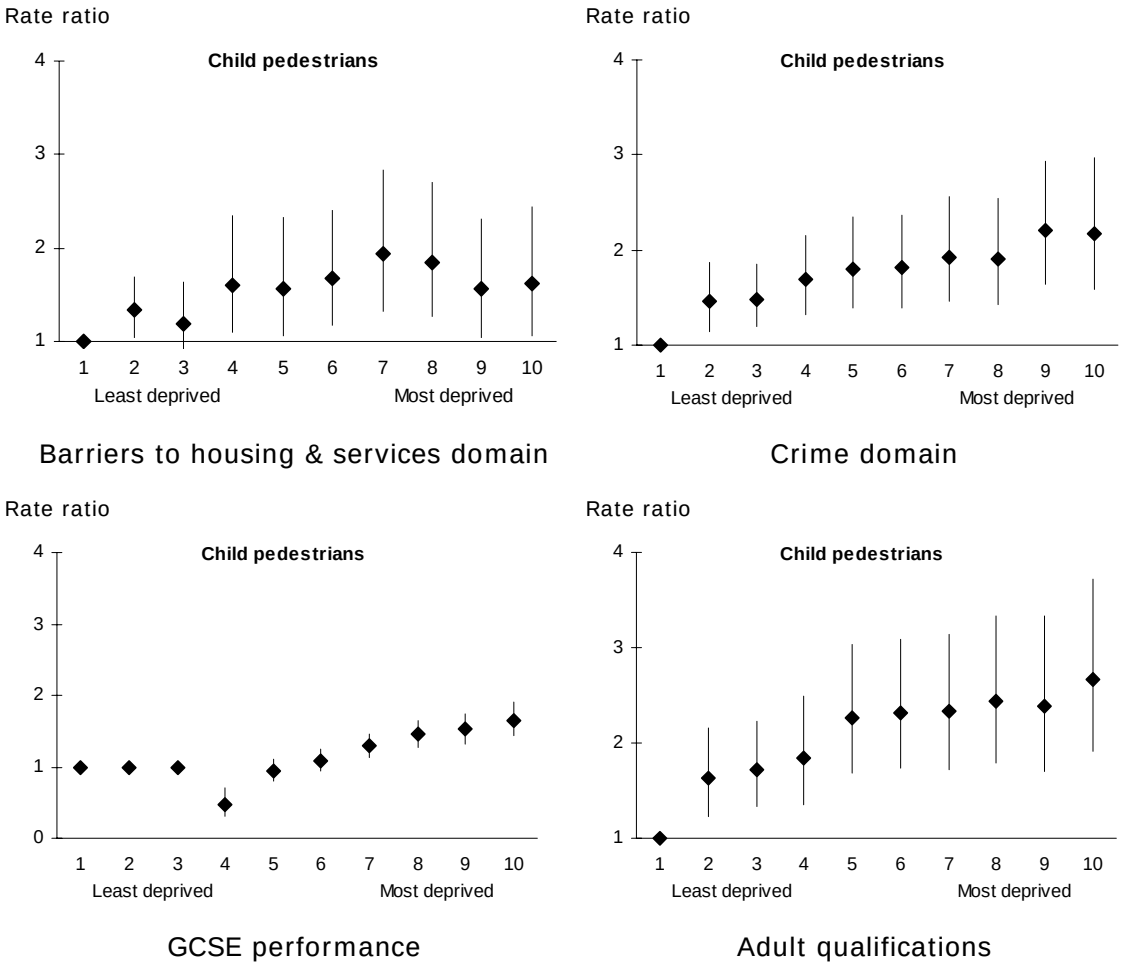


Figure 6b Child pedestrian injury rate ratios by deprivation decile based on barriers to housing & services domain, crime domain, GCSE performance and adult qualifications

These four deprivation indicators, barriers to housing & services domain, crime domain, GCSE performance and adult qualifications, were therefore found to be only weakly correlated with our main indicator IMD2, and separately associated with adult or child injury rates. We therefore decided to initially include all four indicators in our statistical regression model.

Road network variables

Several road network variables were found to be correlated (table 2). For example, the number of road junctions in a SOA was highly correlated with the length of A roads and minor roads. Correlations between average road speed and traffic

volume variables for the 33 boroughs are shown in Table B1 in the Appendices. Many of the road speed and volume variables were also highly correlated (for example, traffic volumes were highly correlated with the difference between morning and night time free-flow speeds). After careful consideration of which road network, road speed and volume variables were highly correlated with others, those selected for inclusion in the multivariable regression model were: number of junctions, length of B roads and motorways, junctions per kilometre, A roads and minor roads per hectare, average morning speed on A and B roads, average morning speed on motorways, and the difference between morning and night time free-flow speeds.

Table 2 Correlations between road network variables.

	Junc-tions	A roads	B roads	Minor roads	Motor ways	All roads	Junc /km	Junc /ha	A /ha	B /ha	Min /ha	MoW /ha
Length of A roads	**0.62**											
Length of B roads	0.19	0.05										
Length of minor roads	**0.82**	0.53	0.17									
Length of motorways	0.30	0.29	0.09	0.35								
Length of all roads	**0.83**	**0.72**	0.24	**0.96**	0.45							
Junctions per km	0.42	-0.02	0.00	-0.02	-0.06	-0.03						
Junctions per hectare	0.27	-0.05	-0.04	-0.13	-0.07	-0.12	**0.79**					
A roads per hectare	0.10	0.54	-0.08	-0.12	0.01	0.06	0.11	0.26				
B roads per hectare	-0.03	-0.09	**0.66**	-0.14	-0.03	-0.07	0.07	0.14	-0.07			
Minor roads per hectare	-0.12	-0.34	-0.21	-0.24	-0.13	-0.31	0.27	**0.68**	-0.07	0.00		
Motorways per hectare	0.11	0.14	-0.00	0.07	**0.62**	0.15	-0.03	-0.02	0.05	-0.03	-0.08	
All roads per hectare	-0.06	-0.09	-0.09	-0.30	-0.09	-0.27	0.30	**0.76**	0.36	0.17	**0.88**	0.00

Correlation coefficients (r) greater than 0.6 are shown in bold.

Ethnicity

The average percentages of the SOA populations within each deprivation decile that described itself as ‘Black’ increased from 1.5% in the least deprived decile, to 23.2% in the most deprived decile, an absolute increase of over 20%. The average percentages of the populations within each deprivation decile that described itself as ‘Asian’ increased from 6.6% in the least deprived decile to 15.6% in the most deprived decile, an increase of just under 10%.

The ethnic mix of the populations within each deprivation decile therefore changes as deprivation increases, with proportionately more of the populations describing themselves as ‘Black’.

Average percentages of populations in deprivation deciles by ethnicity

Deprivation deciles	Percentage 'Black' (with standard deviation)	Percentage 'Asian' (with standard deviation)
1	1.5% (1%)	6.6% (7%)
2	2.7% (2%)	7.8% (9%)
3	4.8% (5%)	11.7% (13%)
4	6.8% (6%)	12.8% (13%)
5	9.2% (7%)	14.5% (15%)
6	11.1% (7%)	12.5% (15%)
7	13.2% (8%)	12.7% (14%)
8	16.0% (10%)	13.0% (17%)
9	20.8% (12%)	12.2% (14%)
10	23.2% (12%)	15.6% (17%)

Multivariable analysis results

We now we present the results that compare injury rates by deprivation decile after adjusting for ethnicity, and the deprivation, road network, speed and volume variables that were not highly correlated. This analysis is shown for pedestrian injuries only, the road user group with the strongest association with deprivation.

Figure 7 (below) shows pedestrian injury rate ratios for adults and children after adjusting for: the percentage of the population that described itself as 'Black', the percentage of the population that described itself as 'Asian', education domain of the IMD, barriers to housing & services domain of the IMD, crime domain of the IMD, percentage of children not obtaining at least five GCSEs, number of road junctions, length of B roads and motorways, number of junctions per kilometre, length of A roads and minor roads per hectare, average morning speed on A roads, B roads and motorways, and the difference between morning and night time free-flow speeds.

Compared with the pedestrian injury rate ratios shown earlier in figure 1, that did not make any allowance for differences between areas (e.g. in terms of different ethnic mix or different types and speeds of roads), the rate ratios after adjustment for other variables tended to reduce among the most deprived areas. However, the pedestrian injury rates in the most deprived areas still remained over twice those in the least deprived areas. In the most deprived areas, the child pedestrian injury rate was reduced to 2.2 (1.6 to 3.1) times that for children in least deprived areas. For child pedestrians killed or seriously injured the rate in the most deprived areas was 2.4 (1.3 to 4.3) times that for children in least deprived areas. Among adults the pedestrian injury rate in the most deprived areas reduced to 2.2 (1.6 to 3.1) times that for adults in least deprived areas. The injury rate ratio when restricted to

adult pedestrians killed or seriously injured reduced to 2.4 (1.4 to 4.1) times that for adults in least deprived areas.

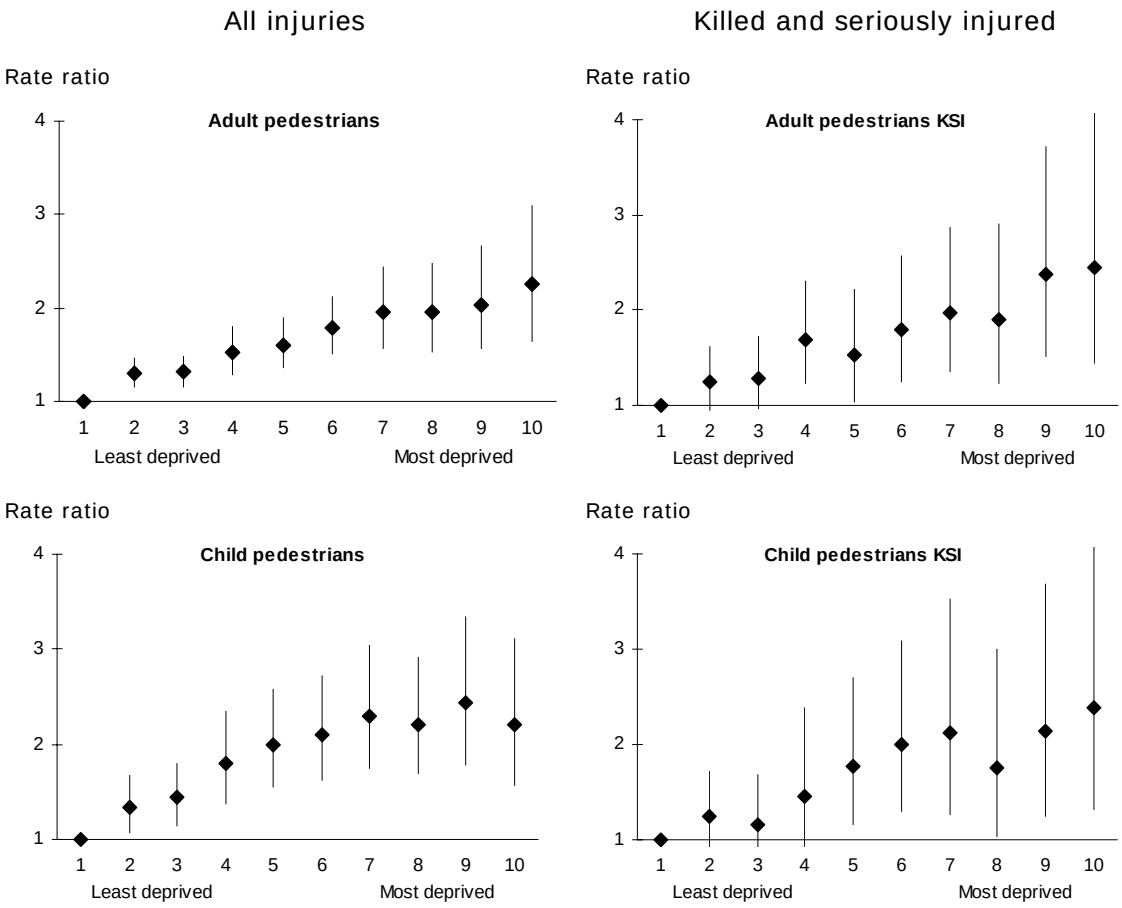


Figure 7 Pedestrian injury rate ratios by deprivation decile based on IMD2 adjusted for other variables†

†Adjusted for percentage population described as 'Black' and 'Asian'; education, barriers and crime IMD domains; percentage of children without GCSEs; road junctions and junctions per kilometre; length of B roads and motorways; lengths of A roads and minor roads per hectare, average morning speed on A roads, B roads and motorways, and the difference between morning and night time free-flow speeds.

Other than IMD2, the variables in the multivariable model most strongly associated with child pedestrian injury rates, and which might therefore be considered 'risk markers' were: percentage of the population that described itself as 'Black', numbers of road junctions, number of junctions per kilometre, length of motorways, barriers to housing and services, and low educational levels.

The variables most strongly associated with adult pedestrian injury rates were: percentage of population described as 'Black', A roads per hectare, levels of crime, and the difference between morning and night time free-flow traffic speeds. The number of junctions was also strongly associated with adult pedestrians killed or seriously injured.

Multivariable analysis (by site of collision)

Our second analysis of the relationship between injury rates and deprivation was based on injury rates for each road user, age and severity group, estimated using the areas in which the collisions occurred. The strength of this analysis is that it uses all casualties from STATS19, not just those with complete home postcodes. As the road network variables describe the road traffic environment, they have more relevance to this analysis based on the locations of the collisions, than they did to the analysis based on the areas of residence of the casualties. One drawback, however, is that now the deprivation variables and the ethnicity variables being used in the analysis describe the populations resident in the areas of collisions, and may now have no relevance to the characteristics of the casualties.

We repeated the multivariable analysis, again using the numbers of pedestrian casualties within each SOA where the collisions occurred. Figure 8 shows pedestrian injury rate ratios for adults and children after adjusting for the same variables above, using numbers of pedestrian casualties within each SOA where the collisions occurred. Compared with the results shown in figure 7, the relationship between adult pedestrian injury rates and deprivation steepened, although the confidence intervals for the rate ratios widened considerably. The relationship between child pedestrian rates and deprivation was unchanged. (The reason that the size of the confidence intervals increased in the analysis of adult pedestrians, is due to higher correlations in SOA injury rates within boroughs, when rates are calculated using the location of collisions, compared to when they are calculated using the home addresses of casualties.)

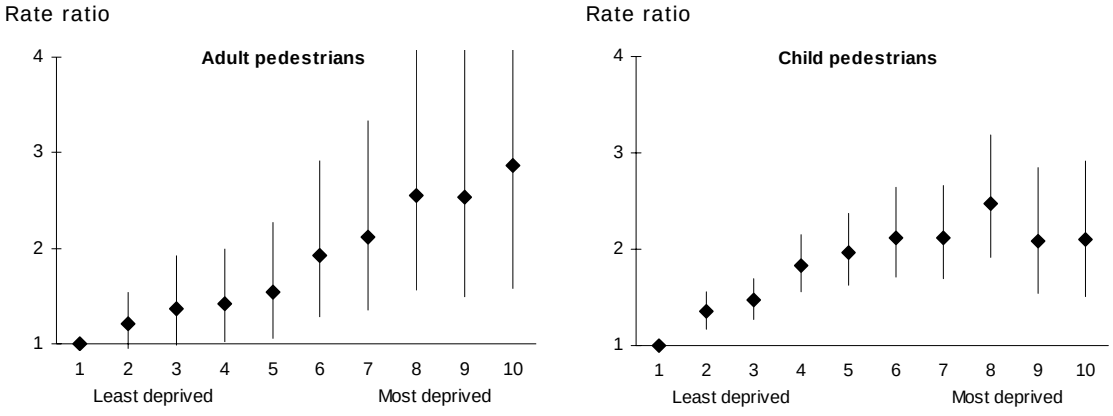


Figure 8 Pedestrian injury rate ratios by deprivation decile based on IMD2 and SOA of collision location, adjusted for other variables†

†Adjusted for percentage population described as 'Black' and 'Asian'; education, barriers and crime IMD domains; percentage of children without GCSEs; road junctions and junctions per kilometre; length of B roads and motorways; lengths of A roads and minor roads per hectare, average morning speed on A roads, B roads and motorways, and the difference between morning and night time free-flow speeds.

In the analysis of casualties using the SOA of collision location, other than IMD2, the variables in the multivariable model most strongly associated with child pedestrian injury rates, and which might therefore be considered 'risk markers' were: number of road junctions, number of junctions per kilometre, length and morning speeds of B roads, length and morning speeds of motorways, A roads per hectare, barriers to housing and services, levels of crime, percentage of children not obtaining at least five GCSEs.

The variables most strongly associated with adult pedestrian injury rates were: low levels of educational qualifications, levels of crime, percentage of children not obtaining at least five GCSEs, number of road junctions, length of B roads, length of motorways, A roads per hectare and the morning speeds of A roads.

4. Discussion

Principal findings

We have identified a strong deprivation effect on road traffic injury rates in London, particularly for adult and child pedestrians, and for adult cyclists. We have also found evidence for a positive relationship between injury rates and other indicators of deprivation that were not also correlated with the IMD. A deprivation effect remained after adjusting for the effects of differences between areas in the road network, differences in the speeds and volume of traffic, and differences in the percentage of the population described as 'Black'. After taking these other variables into account, adult pedestrians and child pedestrians in the most deprived areas of London remain 2.5 times more likely to be killed or seriously injured than their counterparts in the least deprived areas.

We found evidence that a relationship between road injury and deprivation also exists within individual boroughs. The deprivation relationship for child pedestrian casualties was similar when comparing Inner and Outer London boroughs. However, a stronger relationship with deprivation was seen for adult pedestrians living in Outer London boroughs, than among adults living in Inner London boroughs. One possible explanation for this result could be a mixture of higher levels of walking by the more deprived adults in Outer London, compared with the more deprived adults in Inner London, and by lower levels of walking by the least deprived adults in Outer London compared with the least deprived in Inner London.

The relationships between deprivation and injury to car occupants and motorcyclists are less clear. Our results suggest that injury risk to these road user groups is lowest amongst people living in the most deprived and the least deprived areas, with a 'flattened horseshoe' shape to the distribution of injury rate ratios by deprivation decile. Due to the relatively small numbers used in the analysis, any interpretation of these relationships must be made tentatively, but may possibly be explained by differences in the amounts of time that people from these areas are exposed to risk of road injury as motorcyclists or as car occupants.

We investigated the effects of several variables on injury rates at the same time, using multivariable regression methods: first by using areas where casualties lived, and then by using areas where collisions occurred. Using areas where casualties lived, the variables that explained some of the relationship between child pedestrian injury and deprivation (and which could therefore be considered as 'risk

markers') were: percentage of the population described as 'Black', numbers of road junctions, number of junctions per kilometre, length of motorways, barriers to housing and services, and low educational levels. For adult pedestrians the variables identified were: percentage 'Black', A roads per hectare, levels of crime, and the difference between morning and night time free-flow traffic speeds.

When using areas where the collisions occurred, the variables that explained some of the relationship between pedestrian injury and deprivation were: the number of road junctions, the number of junctions per kilometre, the length and speeds of B roads, the length and speeds of motorways, A roads per hectare, barriers to housing and services, levels of crime, and percentage of children not obtaining at least five GCSEs. For adult pedestrians the variables were: low levels of educational qualifications, levels of crime, percentage of children not obtaining at least five GCSEs, number of road junctions, length of B roads, length of motorways, A roads per hectare, and the speeds of A roads.

The main reason that the variables identified in these two separate analyses differ, is that road network, traffic volume and traffic speed variables describe the road environment, and have most relevance to the analysis based on collision location, whereas deprivation and ethnicity variables describe people, and have most relevance to the analysis based on the populations from which casualties come. What is clear from both analyses, is that steep inequalities in road injuries remain, even after taking into account the many factors that are known to increase road injury risk.

Before we make recommendations for future monitoring of the relationship between road injury and deprivation, we need to be aware of possible criticisms of our work.

Methodological issues

One limitation of our analysis of casualties by SOA of residence is due to the incompleteness of the home address postcodes in the STATS19 data. This analysis is necessarily based on a greatly reduced sample (27%) of the available data, reducing the precision of our estimates of the relative risks to road users. This approach is also susceptible to selection bias. Our initial analysis of the STATS19 data for TfL (not presented here) found evidence that casualty postcodes more likely to be complete for females than males, for casualties aged 35–54 years, for those with less severe injuries, and for car occupants. The lowest levels of completeness were for pedestrians. An analysis of all casualty records would

increase the precision of estimated risks and reduce possible selection bias. However, the only way to use all STATS19 casualties without complete postcodes, is to analyse casualties by location of collision, and to use the resident populations of those areas as the exposed population. If casualties are injured close to home, this assumption may be valid.

A second limitation is related to the use of STATS19 data. It is known that there is under-reporting of road traffic injuries to the police (Gill *et al* 2006) and so we do not know how representative STATS19 data are of all road injuries in London. Alternative measures of road traffic injuries include health service data. Hospital admissions data are available from the Department of Health and contain information on age, International Classification of Diseases external cause code (e.g. pedestrian, cyclist, etc.), primary diagnosis code (e.g. fractured femur), and census output area code. These data have higher levels of postcode completion than STATS19. For sufficiently serious road traffic injuries, we could be fairly confident that the casualties will be admitted to hospital and therefore certainly included in this data set. An analysis of these records would therefore have higher protection against the selection biases likely when using STATS19 data.

A further weakness of this study that must be recognised, is that it is an ecological analysis. This means that our analysis is based on geographic areas and populations, rather than on individuals. The road injury risks we have estimated in our study are therefore based on averages of population data aggregated at census output area level, and these population risks may not apply to every individual living in those areas. However, it is known from analyses of individual records (Edwards *et al* 2006, Sonkin *et al* 2006) that the risks of fatal road injury are far greater for the most deprived than the least deprived. Our results are therefore consistent with those based on individual records.

Possible mechanisms

It is important to note that it is not necessarily the deprivation of an area *per se* that causes increased risk. Overall, the risk of being involved in a road traffic collision increases with the time spent travelling, the distance travelled and exposure to different types of transport and road environments. For example, people living in more deprived areas may be more likely to be injured as pedestrians because they don't have a car and are more likely to be walking. Injury rates may therefore tell us more about how travel behaviour and exposure to transport varies by the different levels of area-level deprivation. Analysis of the

London Area Transport Survey data (LATS 2001) supports this hypothesis (see Table B2 in the Appendices) where there is evidence that a greater proportion of trips made by children and adults who described themselves as 'Black' are by walking, than that of their white counterparts.

Further analyses

In order to have confidence in the results of our study, given the possible limitations, we will next consider the following questions:

- Can we use site of collision instead of casualty postcode?
- Would our results be different using health service data?
- Can we use IMD without removing the Environment domain?
- How can we monitor the relationship between injury and deprivation over time?

The methods, results and discussion from further analyses that answer each of the four questions are presented next in Section 2 of *Relationships & Risks*. For each analysis, we focus on pedestrian injuries, as this road user group has shown the strongest association with deprivation.

We will end our report by recommending an appropriately valid and robust method for monitoring the relationship between road injury risk and deprivation in London in the future.

Part A: Relationships and Risks

Section 2

Further analyses

5. Can we use site of collision instead of casualty postcode for analysis?

As we have seen in Section 1 of Part A of this report, a major limitation of our analysis of casualties by SOA of residence is due to the incompleteness of home postcodes in the STATS19 data. A method of analysis that could use all of the casualty records in STATS19 data would benefit from increased precision and from the reduced possibility of selection bias in the results.

Here we assess whether our results are changed when we analyse the casualty data using the areas in which the collisions occurred, instead of the areas in which the casualties lived.

(a) Does variation in postcode completeness affect the results?

Introduction

The first question that we must answer is: 'does variation in postcode completeness affect the results?' STATS19 data in London include a field for postcode of residence of the casualty, but it is not always complete. The postcode field has only been used since 1999 and the completeness of this field varies considerably by year and by borough. Differences in levels of postcode completeness within, and between boroughs, may have had an effect on our results. We examined the sensitivity of our estimates of the strength of the relationship between injury and deprivation, to the exclusion of borough data where postcode completeness was particularly low (see table A1 in the Appendices for postcode completeness by borough).

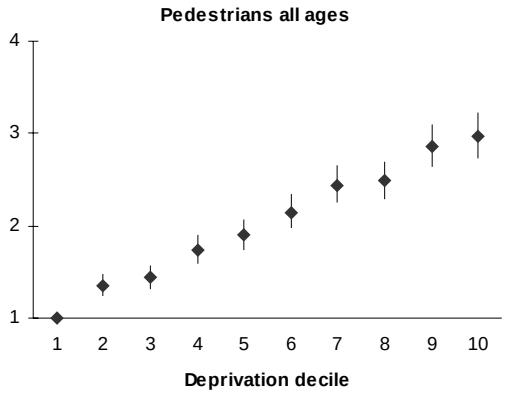
Methods

We examined the relationship between child pedestrian injury rates and deprivation using all data with complete postcodes, only using data from boroughs where more than 30% of casualties had a complete postcode, and only using data from boroughs where more than 50% had a complete postcode (figure 9).

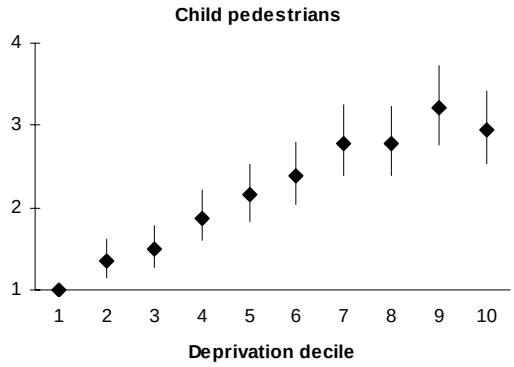
Results

Relationships with deprivation using all casualty data with complete postcodes:

Rate ratio

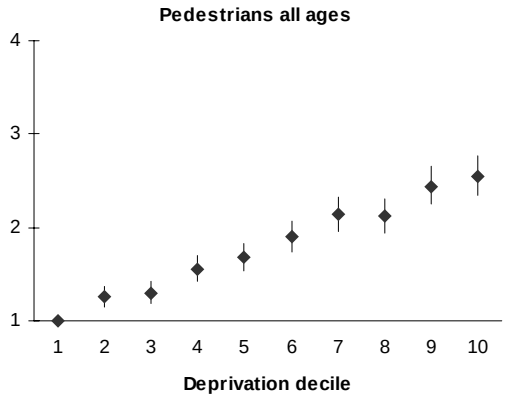


Rate ratio

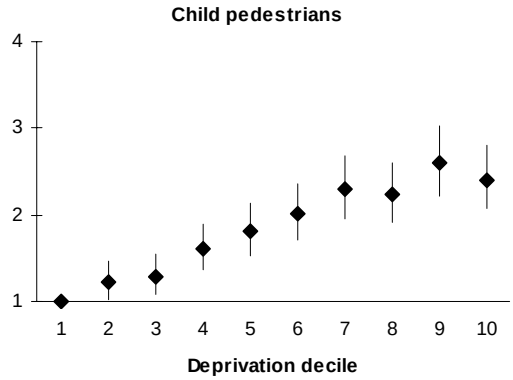


Relationships only using casualty data from boroughs where postcodes were more than 30% complete:

Rate ratio

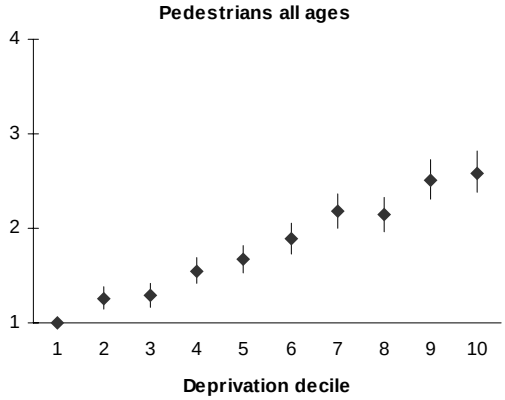


Rate ratio



Relationships only using casualty data from boroughs where postcodes were more than 50% complete:

Rate ratio



Rate ratio

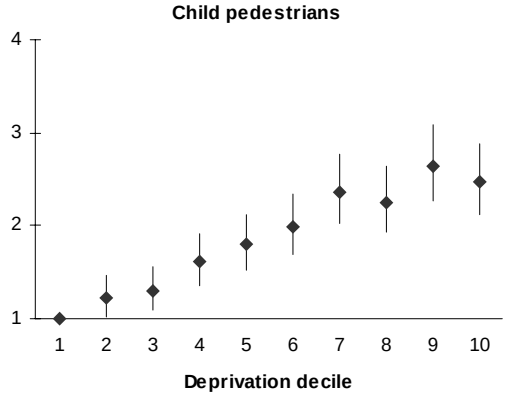


Figure 9: relationships between pedestrian injury rates and deprivation using all data with complete postcodes, only data from boroughs with over 30% complete postcode and over 50% complete postcodes

These results are summarised in table 3 below. When all casualty data are included, the pedestrian injury rate in the most deprived is 2.97 times that among the least deprived. However, when we only use casualty data from boroughs where postcodes were more than 30% complete the injury rate ratio drops to 2.55 times. The injury rate ratio remains at about 2.5 when we only use casualty data from boroughs where postcodes were more than 50% complete.

Table 3: Rate ratios for pedestrian injuries comparing most deprived decile with least deprived decile

	Pedestrians all ages	Child pedestrians
All	2.97 (2.31 - 3.81)	2.95 (2.02 - 4.30)
Over 30% postcoded	2.55 (2.21 - 2.94)	2.41 (1.93 - 3.00)
Over 50% postcoded	2.59 (2.23 - 3.00)	2.48 (1.97 – 3.12)

Discussion

When the analysis is restricted to boroughs with over 30% or 50% complete casualty postcodes, the strength of the relationship observed between injury and deprivation was reduced. This analysis suggests that variation in the levels of recording complete postcodes between boroughs partially explains the strength of the observed relationship between deprivation and injury. The injury rate ratio was reduced overall, which may be because more affluent boroughs were excluded (i.e. Richmond, Kingston, Merton from table A1 in the Appendices) than deprived boroughs. By removing the least deprived boroughs from the analysis, there are likely to be smaller differences overall between the most and least deprived areas in the boroughs remaining.

Although it is clear that the relationship between deprivation and road injury remains, these results suggest that care must be taken when only using complete postcoded data. Furthermore, any comparisons between injury rates over time will be susceptible to variation in the levels of casualty postcoding over time.

(b) Do the results differ when using casualties at collision locations?

Introduction

The second question that we must answer is 'does the relationship with deprivation differ if we use casualties in the areas where the collisions occur?' The STATS19 data contain several variables relating to location, including grid coordinate of collision site, postcode of residence of casualties and postcode where the vehicles are registered. The two variables of interest here are casualty postcode and the grid reference of collision site. In ecological study designs such as this, casualties are usually linked to deprivation data based on the place where the casualty lives. However, as we have seen, postcode completeness in STATS19 is highly variable and still improving over time. The changing level of postcode completeness makes looking at changes over time unreliable. An alternative is to conduct an analysis using casualties at the sites of collisions. This was the approach taken by Grayling *et al* (2003) who were unable to use home address postcodes in their analysis of STATS19 data for England.

Distance from home to location of collision

The first stage in understanding whether collision location can be used in the analysis of injury and deprivation is to examine how far people are from home when they are injured, and to examine how this varies with age and by mode of transport. The collision location should only be used to link casualties to indicators of deprivation if casualties live in the areas, or close to the areas, where the collision occurred. Analysis was carried out using all casualties where full postcodes were available (146,658 casualties in London from 1999–2004). Full details of this analysis and results can be found in the Appendices; key results are presented in table 4 below. The key result was that although there were large differences in distances from home to site of collisions between age groups and modes of transport, the majority of collisions occur within 3km from home ('as the crow flies'). For child pedestrians, distance from home was very small (median 0.56km; mean 1.56km). Child cyclists were also injured close to home (median 0.45km; mean 0.98km). Cyclists in general were injured relatively close to home (median 2.14km; mean 3.26km). These distances confirm that child pedestrians and child cyclists who are injured are likely to be in collisions close to where they live. It follows that the analysis of the relationship between child pedestrian and child cyclist road injuries and deprivation can be conducted using all casualties at the collision location, rather than restricted to only those with complete home address postcodes.

Table 4 Distance (km) from home to location of collision by age and mode of transport, for casualties living in London.

Mode of transport	Age Group	N Records	Mean	SE	Median	5th centile	95th centile
Pedestrian	0-15	5,834	1.56	2.61	0.56	0.04	6.24
	16-59	11,270	3.81	4.86	1.73	0.08	14.22
	60+	2,950	2.36	3.87	0.76	0.06	10.90
	All ages	20,054	2.94	4.30	1.06	0.06	12.26
Pedal cycle	0-15	1,420	0.98	1.61	0.45	0.05	3.61
	16-59	8,650	3.66	3.49	2.60	0.30	10.64
	60+	665	2.96	3.05	1.94	0.18	8.97
	All ages	10,735	3.26	3.39	2.14	0.16	10.10
Car	0-15	3,887	3.65	4.40	2.23	0.19	11.68
	16-59	54,652	4.76	5.13	3.04	0.24	15.12
	60+	7,037	4.15	4.84	2.51	0.17	13.82
	All ages	65,576	4.63	5.07	2.92	0.23	14.86
Powered 2-wheeler	0-15	180	2.68	3.45	1.35	0.11	9.59
	16-59	20,570	5.90	5.38	4.26	0.38	16.80
	60+	687	5.22	5.03	3.58	0.35	16.11
	All ages	21,437	5.86	5.37	4.22	0.38	16.75
All Modes	0-15	12,169	2.29	3.49	1.02	0.05	8.86
	16-59	101,797	4.87	5.14	3.14	0.22	15.42
	60+	14,588	3.59	4.53	1.92	0.12	13.03
	All ages	128,554	4.48	5.01	2.75	0.16	14.81

Methods

Using the coordinate for the collision in STATS19, a geographical dataset was created in ArcView (N.B. Mapinfo could also have been used as effectively). This showed the location of each collision and allowed it to be drawn onto maps. By overlaying the collisions onto the boundaries for the SOA, these points were linked to the SOA in which they were contained. The result was a table showing the collision identifier and the SOA code. These data were then joined with the casualty data to provide a single table with information about the casualty and the SOA. This was summarised by SOA to provide the number of casualties by age and mode of transport for each SOA. Deprivation indicators relating to the SOA were then added, including IMD2 and population counts, to produce the final dataset for analysis.

Although we know that child pedestrian and cyclist collisions occur close to home, not all will occur within the SOA in which the collision occurred. Roads often form the divide between SOAs. An ‘adjacency’ table was therefore created for every SOA. This table listed what are called ‘adjacent pairs’, where the first column represents

the SOA of interest and the second represents the SOA it is adjacent to. Further variables were added to the SOA collisions table, giving the sum of the population and the number of collisions by age and mode of transport in adjacent SOAs. The table therefore contained information on the number of collisions (by age and mode of transport) that occurred in the SOA, the number of collisions that occurred in the SOA and those adjacent to it, the populations resident within the SOA, the populations resident in the SOA and those adjacent to it, and IMD. Regression analysis was conducted three times, using number of casualties and populations for the SOA, number of casualties for the SOA, and the adjacent smoothed populations and both adjacent smoothed number of casualties and populations.

Results

The rate ratio for child pedestrian casualties comparing the most deprived decile with the least deprived decile was 2.9 (2.0-4.3) using SOA of residence, compared with 2.6 (2.2–3.1) using SOA of location of collision. Including the population from adjacent areas in the analysis had little effect on the strength of the relationship with deprivation. For child pedestrian casualties in SOAs where collisions occurred, the rate ratio was 2.6 (2.2–3.1) and 2.8 (CI 2.4–3.2) after including the population from adjacent areas.

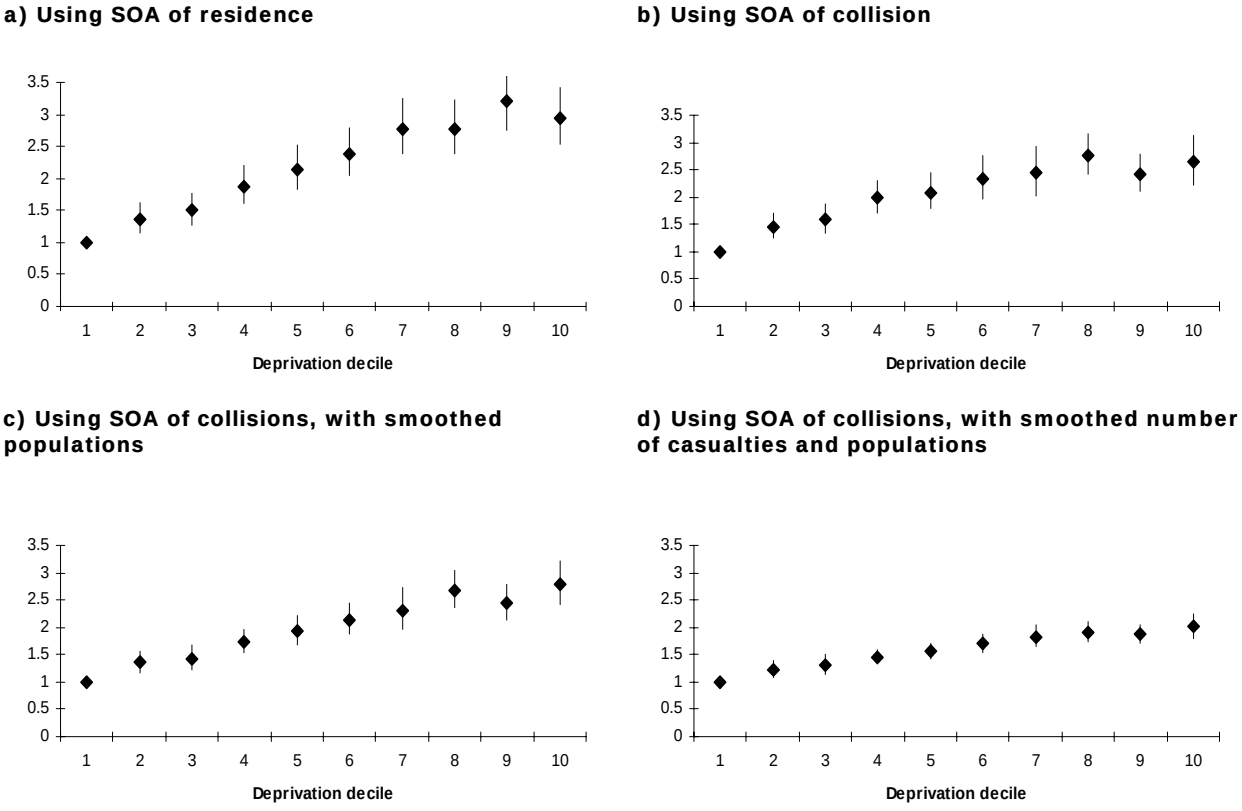


Figure 10: relationships between pedestrian injury rates and deprivation using SOA of residence, SOA of collision, SOA with adjacent population, SOA with adjacent casualties and population

Discussion

We found the relationship between injury and deprivation similar irrespective of method of analysis. The rate of child pedestrian injury increases with level of IMD, and provides similar results whether using postcode of casualties or the SOA in which the collision occurred. Including casualties and the populations from adjacent areas reduced the strength of the relationship somewhat. Using adjacency is a type of smoothing and has an effect similar to looking at larger areas, and it will reduce variation between areas. The smoothed rate ratio may also represent the lowest level of effect. The relationship between deprivation and road traffic casualties therefore appears to be robust to these approaches.

Using collision location to link numbers of casualties to an area and its relative deprivation requires collisions to occur in those areas. It is clear from the distance analysis that while this is acceptable for child pedestrian casualties and for cyclist casualties, it may not be appropriate for casualties using other modes of transport. As the median distance from home increases, so too does the proportion of incorrectly assigned deprivation values. It could be argued that for all pedestrians and cyclists, looking at adjacency-smoothed populations would cover a large enough area to include the majority of the population at risk.

The final question over using casualties at the location of collisions relates to commercial areas such as central London. The population of these areas and the casualties from collisions occurring there, will largely live outside the area and travel there for work. While it would be possible to calculate an estimate of daytime work populations and the deprivation level of this population using travel to work statistics, the amount of work and datasets required would be costly with small return in terms of improved knowledge about the relationship between deprivation and collisions. When looking at large areas, the effect of including these commercial areas would be small. Should our work be repeated on smaller areas, such as local authorities, it may be sensible to carry out the analysis with and without the areas of commerce, such as shopping high streets. This approach would provide a more robust estimate of the strength of the association between road injury and deprivation.

Conclusions

For certain outcomes, especially child pedestrian and cyclist casualties, it is acceptable to conduct an analysis linking casualties to the resident population of the area in which the collision occurred. It would not be appropriate to conduct this

analysis for other modes of transport, as these casualties tend not to be injured close to home (and so outside of the SOA or adjacent area). Analysis by area of location of collision instead of by area of residence of casualties gives a similar relationship with deprivation and can be used until postcode completeness improves in London.

To monitor the relationship between deprivation and road traffic casualties over time, it would be preferable to conduct the analysis using SOA or census Wards, as these are commonly used in both routine work by TfL, boroughs and in academic research. These analyses should be made both including and excluding commercial areas.

6. Would our results be different using health service data?

Introduction

It is known that there is under-reporting of road traffic injuries to the police (Gill *et al* 2006). Because of this, we do not know how representative STATS19 data are of all road injuries in London, and therefore whether our results may be biased. An alternative measure of road traffic injury is using hospital admissions data, available from the Department of Health. Although it is known that hospital admissions data may not be complete with regard to cause of injury, we decided to use this alternative measure of road injury to assess whether the strength of the relationship with deprivation in London is different to that found using STATS19.

Methods

We obtained an extract of Hospital Episode Statistics from the Department of Health containing records of all admissions to NHS hospitals in England due to external causes during a five-year period around the 2001 census (1999–2004). External cause was coded according to the external causes of morbidity and mortality chapter of the 10th revision of the International Classification of Diseases (ICD). Primary diagnosis was coded according to the chapter on injury, poisoning and certain other consequences of external causes. Each record included the patient's age, gender, year of admission, external cause code, primary diagnosis code, and census output area code.

We calculated hospital admission rates due to injury to child and adult pedestrians using population data from the 2001 census, and then examined the associations between these rates and IMD2. To increase the precision of our estimates we combined all admissions occurring during the five year period. To reduce any remaining effects of selection bias in our results (e.g. due to health service supply factors independent of the injuries) we separately analysed a conservative selection of injuries known to be sufficiently serious that the majority of cases would be admitted to hospital (Davie 2006). The primary diagnoses defined as 'serious' were: fracture of the neck of the femur (ICD S72.0), intracranial injury (ICD S06.1–.9), injuries of nerves and spinal cord at neck level (ICD S14), and multiple fractures of ribs (ICD S22.4).

Results

There were 25,017 records of hospital admissions to Londoners during the period 1999 to 2004, where the cause of the injury was known to be a road traffic collision. Of these admissions, 1,778 (7%) were for an injury classed as 'serious'. There were 8,072 admissions to pedestrians, of which 829 (10%) were for serious injuries. Among admissions to cyclists, car occupants and motorcyclists, approximately 6% were for serious injuries. Pedestrians were the largest group and accounted for one third of all admissions.

	All injuries		Serious injuries			
	Adults	Children	Adults	Children	Total of all admissions	Total serious injuries
Pedestrians	5779	2293	678	151	8072	829
Cyclists	2832	2158	207	86	4990	293
Car occupants	5525	451	317	29	5976	346
Motorcyclists	5639	340	297	13	5979	310
	19775	5242	1499	279	25017	1778

Relationship with deprivation

The pedestrian injury rate for adults in the most deprived areas was 2.6 (95% confidence interval 2.0 to 3.3) times that for adults in least deprived areas (figure 11). The rate ratio when restricted to admissions for 'serious' injuries only decreased slightly to 2.2 (1.0 to 4.6).

Among children, the pedestrian injury rate in the most deprived areas was 3.3 (2.3 to 4.9) times that for children in least deprived areas. For child pedestrian admissions for 'serious' injuries the rate in the most deprived areas was 5.6 (1.1 to 28.2) times that for children in least deprived areas.

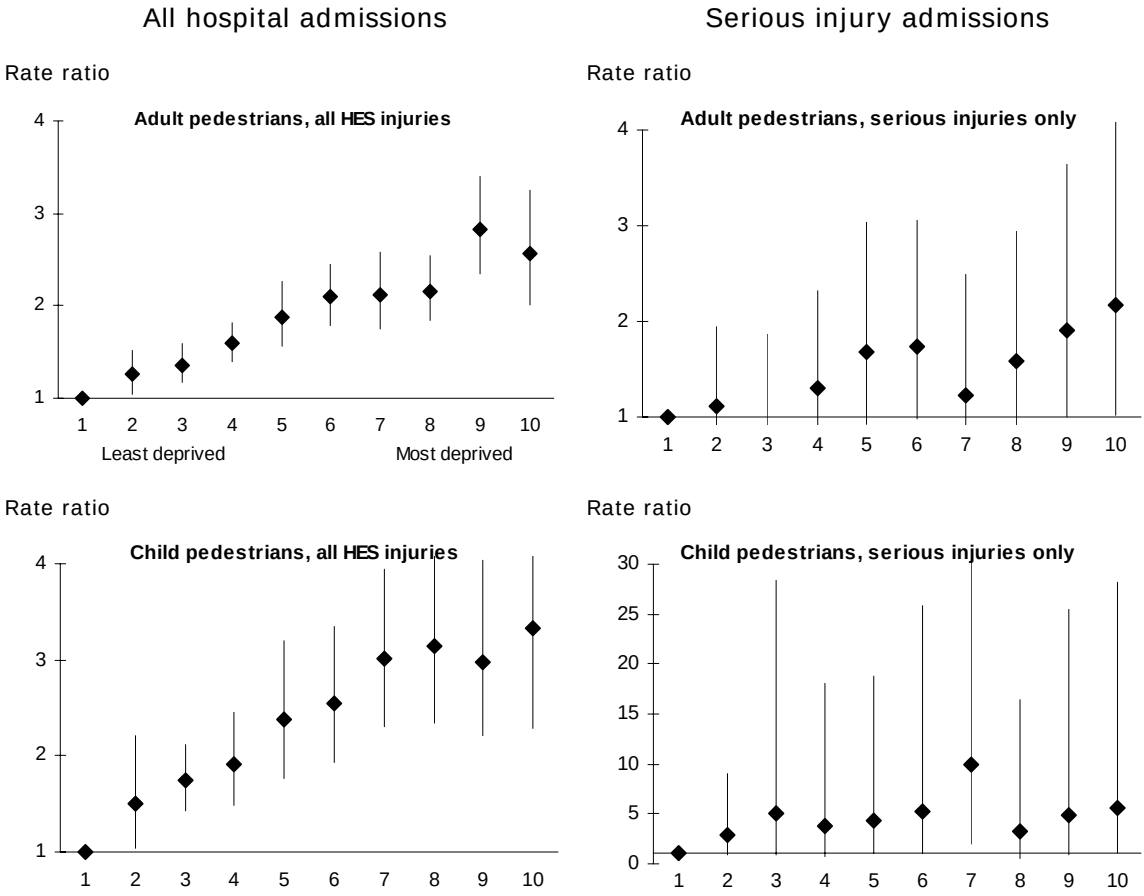


Figure 11 Pedestrian injury rate ratios by deprivation decile based on IMD2

Conclusions

Using hospital admissions data, we found that the strength of the relationship between pedestrian injury rates and deprivation did not change materially from that observed when using STATS19 data. When the analysis was restricted to 'serious' injuries only, the strength of the relationship appeared to decrease somewhat in adults, and to increase in children. However, in both cases, the confidence intervals for the rate ratios widened considerably due to the smaller numbers of these casualties in the analysis. STATS19 data would therefore appear to be sufficiently reliable for analyses of the relationship between deprivation and road injury risk.

7. Can we use IMD without removing the Environment domain?

Introduction

One domain in the index of multiple deprivation score, the *'Environment' domain*, includes indicators measuring road traffic collisions involving injury to pedestrians and cyclists. These indicators together contribute around 5% to the overall deprivation score. The *Environment* domain also contains a measure of pollution which is strongly linked to traffic flow. For this reason, the deprivation score was re-calculated with removal of this *Environment* domain for the analysis presented in Section 1 of this report. Failure to do this could make it difficult to accurately quantify the association between deprivation and injury.

Methods

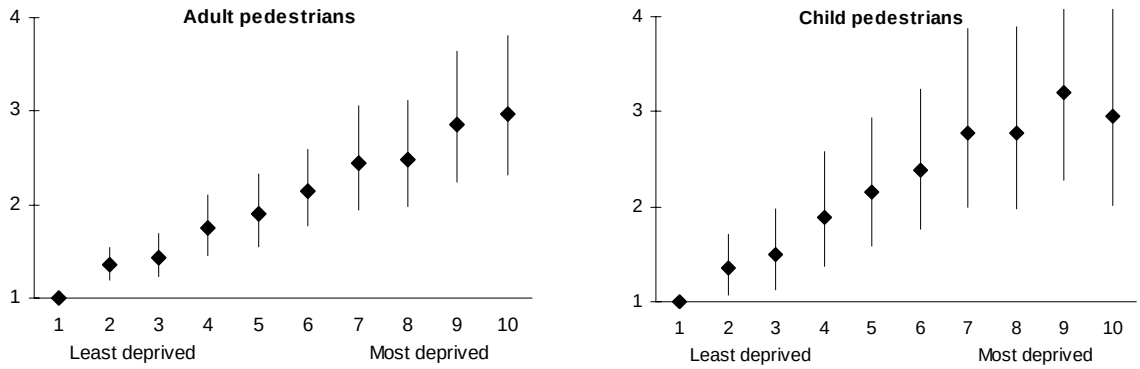
We have found already (Section 1, table 1) that IMD and IMD2 are almost perfectly correlated (r=0.99) and so we should expect that the IMD will produce similar relationships with injury to those using the adjusted IMD2. In order to confirm this, we repeated some of the analysis using the original index of multiple deprivation with the Environment domain still included. Figure 12 shows a comparison of injury rate ratios for adult and child pedestrian casualties in the areas in which collisions occurred, using IMD2 and the unadjusted IMD.

Results

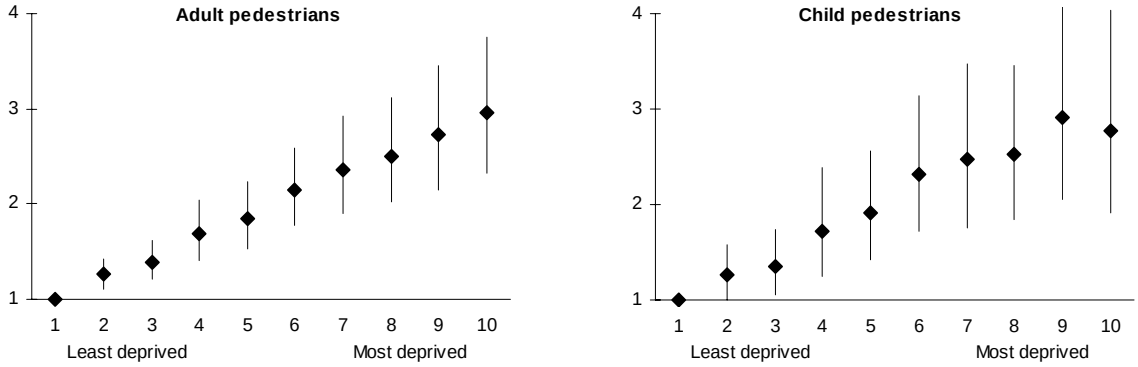
There was little difference between the strength of the relationship with deprivation using either IMD2 or IMD. For adult pedestrian casualties using IMD2, the injury rate in the most deprived decile was 3.0 (2.3–3.8) times higher than in the least deprived decile. For IMD2 it was 2.9 (2.3–3.7) times higher. For child pedestrians the injury rate was 2.9 (2.0– 4.3) times higher using IMD2 and 2.8 (1.9–4.0) times higher using IMD1.

Conclusion

Based on these results we do not consider that the recalculation of the IMD score to remove the Environment domain offers any material benefits over using the full IMD, in assessing the strength of the relationship between injury and deprivation.



IMD with environment domain removed (IMD2)



IMD with environment domain included (IMD1)

Figure 12 Pedestrian injury rate ratios by deprivation decile based on IMD1 (including environment domain) and IMD2 (environment domain excluded)

8. How can we monitor the relationship between injury and deprivation over time?

Introduction

There has been a steady decline in the number of child casualties in London since 1994. Figures 13 and 14 show the number of child pedestrian casualties over the period 1994 to 2004, demonstrating a particularly steep reduction from 2001. There were 46% fewer child pedestrian casualties and 50% fewer child pedestrians killed or seriously injured in 2004 compared with 1994.

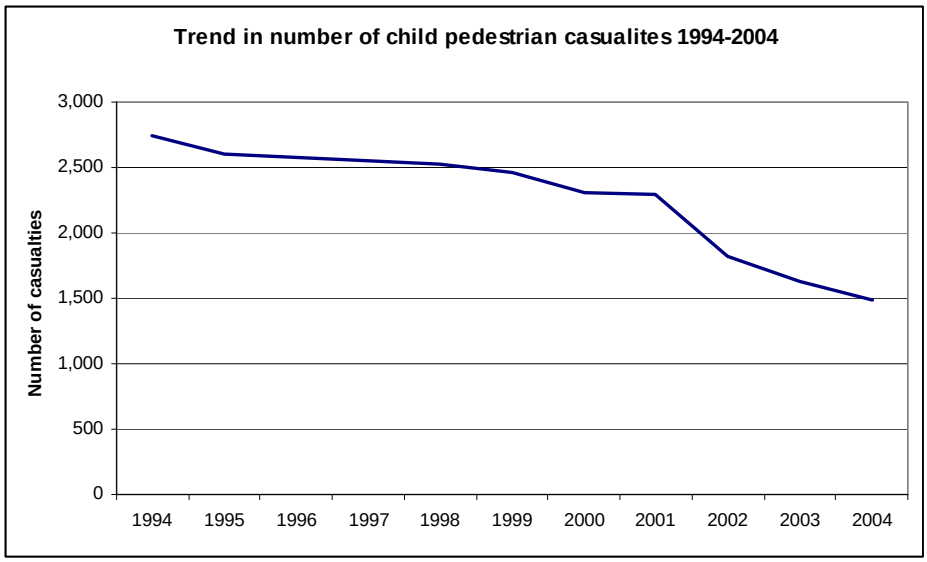


Figure 13 Trend in number of child pedestrian casualties 1994-2004

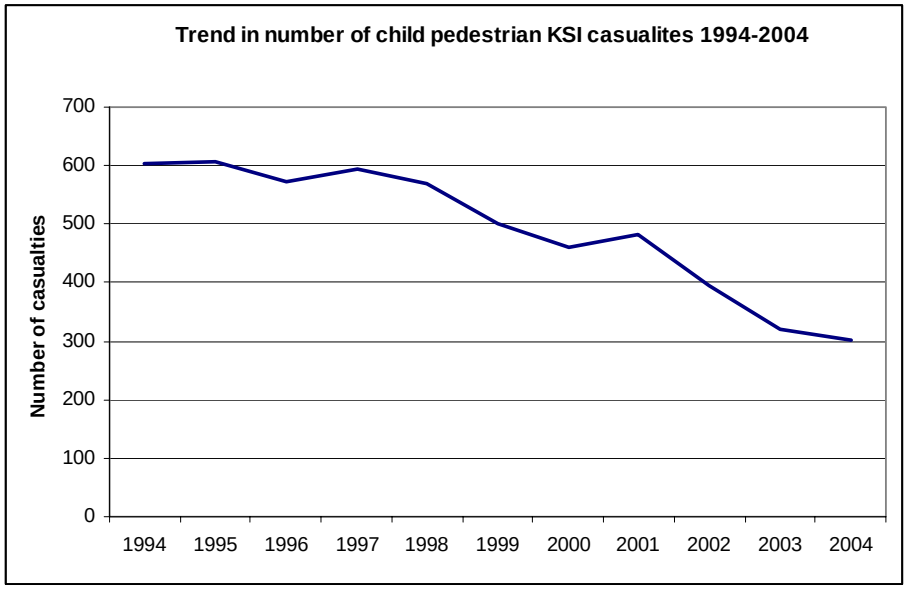


Figure 14 Trend in number of child pedestrian KSI casualties 1994-2004

Whilst casualty reductions overall are encouraging, we wish to know whether the relationship between injury rates and deprivation is changing over time. If road safety interventions have been successfully targeted in the more deprived areas where child pedestrian injury rates are higher, we may expect there to have been a reduction in the strength of the relationship with deprivation, as well as an overall reduction in pedestrian casualty rates. Conversely, if there has been a smaller reduction in casualty rates in the more deprived areas than in less deprived areas, then this may lead to a strengthening of the relationship with deprivation, even with a reduction in pedestrian casualty rates overall. Recent research has demonstrated that inequalities in child injury death rates in England remain, despite an overall fall in mortality (Edwards *et al* 2006).

Methods

We calculated average annual injury rates for child (0-15 years) pedestrian casualties separately for three time periods: 1994–96, 1997-2000, 2001–04 and by deprivation quintile (fifths) using IMD2, based on the location of the collisions (not on the home postcodes of casualties). Quintiles were used instead of deciles as the analysis was based on data divided into three samples and so the amount of data available was reduced for each time period considered. Injury rates were calculated for all child pedestrian casualties and those killed or seriously injured.

Because the majority of child pedestrian injuries occurred close to home (see Appendices) it is valid to calculate injury rates for areas using the number of casualties occurring and the resident population. It is not currently possible to conduct a similar analysis using casualties' home postcodes, as postcodes are only available since 1999, and their completeness and quality vary over time.

Results

Figures 15 and 16 show the average annual injury rates by quintile of deprivation for the three time periods 1994–96, 1997-2000, and 2001–04.

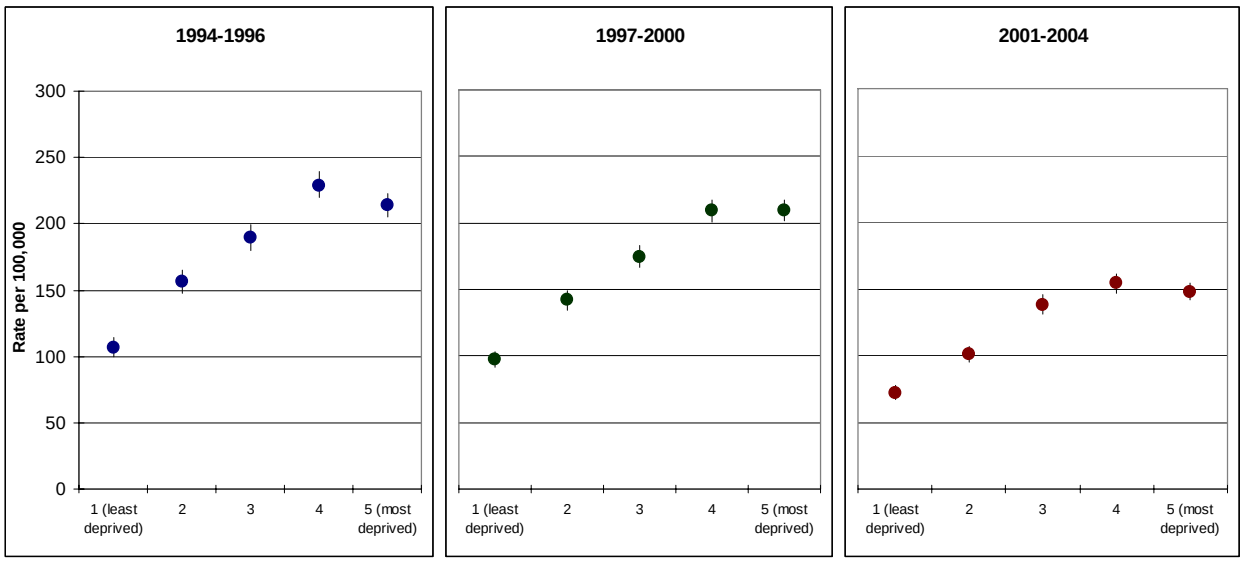


Figure 15 Average annual child pedestrian casualty (all severities) rate with 95% confidence intervals per 100,000 children aged 0-15 years

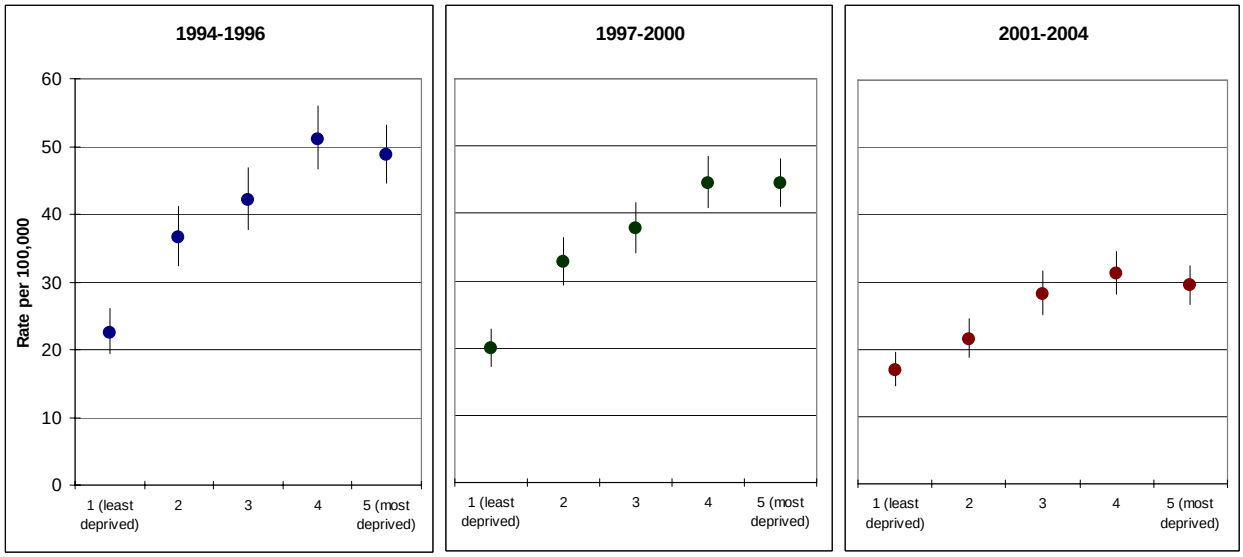


Figure 16 Average annual child pedestrian KSI casualty rates with 95% confidence intervals per 100,000 children aged 0-15 years

The downward shift in the rates over these time periods confirms the overall fall in child pedestrian casualties, particularly in the most recent period. However, the figures suggest that there has been little change in the relative distribution of casualties by deprivation quintile. In the period 1994-96, the child pedestrian injury rate in the most deprived areas was 2.0 (1.9 to 2.2) times higher than in the least deprived areas. For child pedestrians killed or seriously injured the rate was 2.2 (1.8 to 2.6) times higher. In the period 2001-04, the child pedestrian injury rate in

the most deprived areas was 2.0 (1.9 to 2.2) times higher than in the least deprived areas. For child pedestrians killed or seriously injured there was a slight (but not statistically significant) reduction in the rate ratio to 1.7 (1.5 to 2.1). Because the confidence intervals comparing the most deprived with the least deprived in these two periods are overlapping, we cannot say for certain that the rate ratios are different, even though the estimated rate ratio for child pedestrians killed and seriously injured in 2001-04 appears to have dropped.

Discussion

These results show that there has been little change in the relationship between child pedestrian injury rates and deprivation over the period 1994–2004. Despite a large reduction overall in the numbers of casualties, the injury rate in the most deprived fifth of areas in London has remained twice that in the least deprived fifth of areas. As shown in Section 1 of this report, the injury rate ratio is even higher (almost three times) when comparing the most deprived tenth of areas with the least deprived tenth.

For child pedestrians who were killed or seriously injured, the strength of the relationship with deprivation decreased slightly in 2001-04 compared with 1994-96. Although this reduction was not statistically significant, this finding is encouraging as it suggests a possible narrowing of inequality alongside the good progress being made in reducing the total numbers of serious injuries amongst child pedestrians. This may indicate some success in road safety interventions targeted specifically in deprived areas with high levels of child pedestrian injury.

Our analysis assumes that the relative level of deprivation in different areas remains constant across the time period, whereas in reality the absolute and relative level of deprivation in an area can change substantially over 10 years due to factors such as regeneration programmes, population migration or environmental change. It would be preferable to use a measure of deprivation that is consistent and updated regularly in order to allow for changes in deprivation, when looking at the relationship with casualty levels. The Index of Multiple Deprivation used (released in 2004 using data mainly from the time period 2001-03) was designed to be a robust small-area measure of deprivation and is in theory updateable in the future. Until this is next updated, other measures of deprivation could be used which are available more frequently from routine data sources, such as the rate of employment benefit uptake in an area, which was found to be highly correlated with IMD (table 1 in Section 1).

Our analysis also used 2001 census populations as the denominators in all three time periods, whereas the population is changing over time. However, this change is small (around a 0.1% increase in the child population in London per year) and therefore unlikely to substantially affect our results. However, the effect may be more important if the analysis was to be repeated at smaller geographic levels, such as boroughs. In order to repeat this analysis at borough level, super output area population projections (available from the Office for National Statistics or the GLA) could be used to adjust for population changes over time.

Conclusion

This analysis has demonstrated a method which can be used to monitor changes to the relationship between injury and deprivation over time. This approach can be used to assess whether road safety interventions are successfully reducing relative inequalities in injury levels between populations, in addition to monitoring the overall change in numbers. The approach can be used at borough level as a means of evaluating whether particular interventions targeting certain areas, or specific population groups have been successful in reducing inequalities. When more complete postcode data are available over a longer period of time, it will also be possible to test for changes in inequalities in resident-based road traffic injury risks.

9. Recommendations

Following from the analyses presented within *Relationships and Risks*, our recommendations for future monitoring of the relationship between road traffic injury and deprivation in London are as follows:

- **The relationship between road injury and deprivation in London should be monitored using child pedestrian casualties and adult pedestrian casualties as the primary injury outcome groups.**

- **All severities of pedestrian casualties from the STATS19 data should be included.**

- **Casualties should be linked to either the census super output areas or the wards in which the collisions occurred.**

- **The Index of Multiple Deprivation (IMD) should be used as the measure of area deprivation. The IMD does not need to be recalculated to have its Environment domain removed.**

- **Care is needed when monitoring the relationship between road injury and deprivation within individual London boroughs, due to the relatively small numbers of casualties occurring at this level.**

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Appendix A

Distances from home to location of collision

We recognise that the STATS19 data are not collected with the intention of estimating distance from home to site of collision, and that postcodes will be missing for various reasons. It is not intended that the postcode completion data included in this Appendix for each London borough be taken as a comment on practices within those boroughs.

Introduction

In the STATS19 dataset there are two variables that relate to location, the location of the collision and the postcode of residence of the casualties. Ideally each casualty would be linked to the area they live in through this postcode. However in London postcodes started to be collected from 1999 and their completeness varies greatly between areas. Table A1 shows postcode completeness by borough. Overall we have a valid Postcode for less than 60% of casualties. If only data with complete and valid postcodes are used in analysis, large amounts of data will be excluded. The location of each collision is known for all cases. However, unless we know in which areas the casualties live, we are unable to say what their deprivation scores are, or what exposed populations to use as denominators.

In this analysis, we select every casualty with a complete home postcode and estimate how far they are from home when they were involved in the collision. It is intended that this analysis by mode of transport and age group will inform other decisions on whether our analysis of injury and deprivation can be based on areas where collisions occur.

Methods

For casualties where a full postcode was available, the straight line distance between the location of collision and the casualty postcode was calculated. This was carried out in ArcView, but could have just as easily have been carried out in Excel or most other data packages. It was decided to look at distance in relation to the following:

- Age
- Mode of transport
- Severity of casualty
- Urbanisation

The first analysis was to look at distance by age and mode of transport. Simple tabulations were generated to look at how distance changed by group. The measures of distance used were the mean and median distance, and 5th and 95th percentiles. The analysis was carried out for all casualties with a complete postcode and restricted to casualties living in London. A similar analysis was conducted by injury severity and separately by borough.

To examine how urbanisation affects distance from home to sites of collision, an urban rural score was generated. A smoothed population density was generated. Initially population density (the number of people per hectare) was calculated for each 2001 census super output area (SOA). This simple score is a common urban rural indicator, the more people per hectare the more urban. However, large open spaces, or commercial areas have less people per hectare and so are less urban. Also, this indicator does not reflect living in central London versus the outskirts. "Smoothed" population densities were then generated. Within ArcView a table was created that listed the distance from each SOA to every other SOA within 5km. This table was linked into census populations and the summed population and area was generated. These data were then used to generate the 5km smoothed population density. For an area to be urban within this indicator, all SOAs within 5km had to be urban, given a gradation of urbanisation within London. Each casualty was linked the to the urban-rural indicator for the SOA of residence. The data were then tabulated.

Results

Full postcodes were available for a total of 146,658 casualties, 128,554 of whom that lived in London. Table A1 shows the numbers of casualties and the completeness of postcodes for each borough. Boroughs in which less than 30% of casualties have a valid postcode are highlighted. There was large variation in distance from home to site of collision by age and mode of transport. Table A2 presents the distances by age and mode of transport. Child pedestrian casualties are injured close to home, with a mean distance of 1.56km (median 0.56km). Child cyclists are also injured close to home, with a mean of 0.98km (median 0.45km). Cyclists in general are injured relatively close to home, mean 3.26km, (median 2.14km). The median distance from home to collision for all road user groups is 2.75km. Table A3 shows these distances when non-London residents injured in London are included. Tables A4 and A5 show the results by severity of casualty and for urbanisation.

Discussion

We found that the majority of road traffic injuries occur within an average distance of 3km from home. Furthermore, child pedestrian and child cyclist injuries occur so close to home that they can be assumed to have come from the exposed population resident within the areas in which the collision occurred.

Not every casualty had a complete postcode, and our analysis was therefore only based on a subset of the casualty data. We do not know if there is selection bias, although it is possible to examine the distributions by age, sex, and mode of transport. We have assumed that there is no bias operating and that the results are representative for London. The data also only represent London residents. There was a difference between casualties living inside London (table A2) and those that live outside London (table A3).

In all cases the distance data were skewed to the right, with a few casualties injured long distances from home. This skew gives rise to large differences between the mean and median distances. This would be expected for cars occupant casualties, but it was also present for pedestrians and cyclists and probably represents people using combined forms of transport (e.g. taking a train into central London and being injured as a pedestrian while there). Because of the skew, median distances were chosen as the appropriate distance to use for this analysis. It may be possible to assume that all pedestrians injured further than 5km from home were using combined transport modes, and to analyse the data separately for those injured within 5km of home, but this would need further investigation.

It is no surprise to find that distance changes by age and by transport mode. It would be expected that pedestrians are injured closer to home than those in cars, and that younger people would be closer to home than older people. Looking at all modes, the median distance from home was 2.75km which means that the majority of collisions occur very close to home. We found a slight difference in the results when looking at severity. Killed and seriously injured casualties tended to be slightly closer to home. Similar results were found for “urbanisation”. The median distance from home decreases as the area becomes more urban. Again, as a relatively simple analysis, these results are limited in what conclusions can be drawn.

The key findings in this analysis relate to child pedestrian and cyclist casualties. Looking only at casualties living in London, child pedestrians are injured close to home. These short distances mean that child pedestrians and cyclists are likely to be involved in a collision in the area where they live, for example in the SOA of their residence, or adjacent to it. This means that it may be possible to carry out analysis using location of collision, using populations and census information about the SOA in which the collision occurs. Casualty rates can then be generated and the relationships between casualty rates and other socio-economic factors examined. There are, of course, limitations with this approach: the majority of casualties will come from the resident population, but some will not.

Conclusions

The majority of road traffic injuries occur within 3km from home. Young people are injured closer to home than older people, and pedestrians are injured closer to home than car occupants. This may have important policy and road traffic injury reduction implications. Child pedestrian and child cyclist injuries tend to occur so close to home that the location of collision may be used to link casualties to population information to derive injury rates and rate ratios for analysis.

Table A1: Data tabulated by London Borough, showing postcode completeness (boroughs with <30% highlighted)

Name	Code	Total no of casualties	No. with valid UK postcodes	% valid UK postcodes	No. with valid London postcodes	% valid London postcodes
City of London	00AA	2,527	1259	49.8%	1031	40.8%
Barking and Dagenham	00AB	5,172	3,402	65.8%	3,046	58.9%
Barnet	00AC	10,836	7,048	65.0%	5,928	54.7%
Bexley	00AD	5,171	3,732	72.2%	3,194	61.8%
Brent	00AE	8,856	5,081	57.4%	4,711	53.2%
Bromley	00AF	7,543	5,452	72.3%	4,954	65.7%
Camden	00AG	8,796	1,165	13.2%	1,009	11.5%
Croydon	00AH	9,868	6,678	67.7%	5,957	60.4%
Ealing	00AJ	10,783	6,957	64.5%	6,331	58.7%
Enfield	00AK	10,009	6,991	69.8%	5,805	58.0%
Greenwich	00AL	7,718	5,201	67.4%	4,602	59.6%
Hackney	00AM	7,706	4,658	60.4%	4,316	56.0%
Hammersmith and Fulham	00AN	5,850	3,096	52.9%	2,821	48.2%
Haringey	00AP	7,443	4,521	60.7%	4,149	55.7%
Harrow	00AQ	4,532	3,097	68.3%	2,724	60.1%
Havering	00AR	7,036	4,817	68.5%	3,783	53.8%
Hillingdon	00AS	8,781	5,917	67.4%	4,808	54.8%
Hounslow	00AT	8,139	1,846	22.7%	1,548	19.0%
Islington	00AU	7,474	3,106	41.6%	2,812	37.6%
Kensington and Chelsea	00AW	5,859	3,833	65.4%	3,438	58.7%
Kingston upon Thames	00AX	3,375	388	11.5%	300	8.9%
Lambeth	00AY	11,275	6,956	61.7%	6,449	57.2%
Lewisham	00AZ	8,788	5,864	66.7%	5,482	62.4%
Merton	00BA	4,722	545	11.5%	497	10.5%
Newham	00BB	7,440	4,348	58.4%	3,974	53.4%
Redbridge	00BC	8,369	5,677	67.8%	4,943	59.1%
Richmond upon Thames	00BD	4,344	584	13.4%	494	11.4%
Southwark	00BE	10,093	6,784	67.2%	6,264	62.1%
Sutton	00BF	4,381	2,595	59.2%	2,251	51.4%
Tower Hamlets	00BG	7,369	4,722	64.1%	4,061	55.1%
Waltham Forest	00BH	6,648	4,239	63.8%	3,812	57.3%
Wandsworth	00BJ	8,084	4,785	59.2%	4,322	53.5%
Westminster	00BK	15,657	9,335	59.6%	8,006	51.1%

Table A2: Distance (km) from home by age and mode of transport, for casualties that live in London.

Mode of transport	Age Group	N Records	Mean	SE	Median	5th centile	95th centile
Pedestrian	0-15	5,834	1.56	2.61	0.56	0.04	6.24
	16-59	11,270	3.81	4.86	1.73	0.08	14.22
	60+	2,950	2.36	3.87	0.76	0.06	10.90
	All ages	20,054	2.94	4.30	1.06	0.06	12.26
Pedal cycle	0-15	1,420	0.98	1.61	0.45	0.05	3.61
	16-59	8,650	3.66	3.49	2.60	0.30	10.64
	60+	665	2.96	3.05	1.94	0.18	8.97
	All ages	10,735	3.26	3.39	2.14	0.16	10.10
Car	0-15	3,887	3.65	4.40	2.23	0.19	11.68
	16-59	54,652	4.76	5.13	3.04	0.24	15.12
	60+	7,037	4.15	4.84	2.51	0.17	13.82
	All ages	65,576	4.63	5.07	2.92	0.23	14.86
Powered 2-wheeler	0-15	180	2.68	3.45	1.35	0.11	9.59
	16-59	20,570	5.90	5.38	4.26	0.38	16.80
	60+	687	5.22	5.03	3.58	0.35	16.11
	All ages	21,437	5.86	5.37	4.22	0.38	16.75
All Modes	0-15	12,169	2.29	3.49	1.02	0.05	8.86
	16-59	101,797	4.87	5.14	3.14	0.22	15.42
	60+	14,588	3.59	4.53	1.92	0.12	13.03
	All ages	128,554	4.48	5.01	2.75	0.16	14.81

Table A3: Distance (km) from home to location of collision by age and mode of transport, including non-London residents injured in London.

Mode of transport	Age Group	N Records	Mean	SE	Median	5th centile	95th centile
Pedestrian	0-15	5980	2.76	15.8	0.58	0.04	7.275
	16-59	12314	10.92	39.32	2.14	0.08	37.04
	60+	3142	8.97	41.13	0.85	0.07	20.84
	All ages	21436	8.35	34.9	1.25	0.06	22.98
Pedal Cycle	0-15	1444	1.42	8.85	0.46	0.05	3.77
	16-59	9098	6	20.15	2.76	0.31	13.85
	60+	695	3.57	7.73	1.97	0.19	9.98
	All ages	11237	5.27	18.58	2.27	0.17	12.57
Car	0-15	4371	8.77	30.69	2.59	0.2	25.81
	16-59	63699	11.48	32.76	3.75	0.28	38.67
	60+	8100	11	33.69	3.11	0.2	39.88
	All ages	76170	11.27	32.75	3.58	0.26	38.11
Powered 2-wheeler	0-15	191	5.94	24.07	1.5	0.11	15.44
	16-59	24353	11.63	28.32	5.34	0.44	38.9
	60+	804	11.88	35.83	4.47	0.4	39.17
	All ages	25348	11.59	28.56	5.26	0.43	38.11
All Modes	0-15	12891	5.12	23.51	1.13	0.06	13.18
	16-59	117555	11.42	33.04	3.87	0.25	38.38
	60+	16212	9.96	35.82	2.3	0.13	31.55
	All ages	146658	10.7	32.69	3.36	0.17	35.88

Table A4: Distance (km) from residence to location of collision by age and injury severity.

Age	Killed		Serious		Slight	
	Number	Median (CI)	Number	Median (CI)	Number	Median (CI)
0-15	35	0.70 (0.17 - 22.87)	1,821	0.81 (0.04 - 8.39)	10,313	1.05 (0.06 - 8.93)
16-59	346	3.11 (0.24 - 17.48)	10,499	3.01 (0.19 - 15.44)	90,952	3.15 (0.22 - 15.41)
60+	176	0.85 (0.08 - 7.46)	1,912	1.57 (0.09 - 12.14)	12,500	2.00 (0.13 - 13.2)
All	557	1.99 (0.13 - 15.43)	14,232	2.44 (0.12 - 14.51)	113,765	2.79 (0.16 - 14.84)

Table A5: Distance (km) from residence to location of collision for pedestrian casualties, by age and urbanisation.

Age Group		5km smoothed population density, quintiles				
		1	2	3	4	5
0-15	Number	989	1101	1348	1394	999
	Median	0.65	0.56	0.60	0.52	0.47
	(CI)	(0.05 - 6.34)	(0.04 - 6.06)	(0.03 - 6.38)	(0.04 - 6.25)	(0.04 - 5.99)
16-59	Number	1371	1830	2345	3062	2662
	Median	2.52	2.08	1.73	1.80	1.25
	(CI)	(0.09 - 20.29)	(0.08 - 16.85)	(0.07 - 14.03)	(0.08 - 11.53)	(0.07 - 8.44)
60+	Number	486	512	674	675	603
	Median	0.78	0.85	0.80	0.70	0.65
	(CI)	(0.06 - 16.06)	(0.08 - 13.77)	(0.07 - 11.86)	(0.06 - 8.99)	(0.06 - 6.34)
All	Number	2846	3446	4367	5131	4264
	Median	1.15	1.16	1.01	1.10	0.89
	(CI)	(0.06 - 17.48)	(0.06 - 14.62)	(0.05 - 12.63)	(0.06 - 10.44)	(0.06 - 7.78)

Table B1 Correlations between road speed and traffic volume variables

	a_am	a_off	a_pm	b_am	b_off	b_pm	m_am	m_off	m_pm	tlrn_am	tlrn_off	tlrn_pm	ntlrn_am	ntlrn_o	ntlrn_p	am_d	int_d	pm_delay	flow 00	flow 01	flow 02	flow 03	flow 04
a_off	**0.91**																						
a_pm	**0.89**	**0.95**																					
b_am	0.08	0.14	0.14																				
b_off	0.27	0.40	0.36	**0.80**																			
b_pm	0.20	0.28	0.30	**0.83**	**0.88**																		
m_am	0.45	0.46	0.41	0.18	0.43	0.23																	
m_off	0.46	0.46	0.41	0.19	0.45	0.26	**0.99**																
m_pm	0.43	0.41	0.36	0.21	0.43	0.27	**0.94**	**0.97**															
tlrn_am	**0.85**	**0.77**	**0.79**	-0.08	0.01	-0.02	0.19	0.17	0.15														
tlrn_off	**0.77**	**0.83**	**0.80**	0.06	0.20	0.18	0.10	0.09	0.05	**0.84**													
tlrn_pm	**0.76**	**0.82**	**0.90**	0.03	0.17	0.16	0.12	0.12	0.08	**0.87**	**0.90**												
ntlrn_am	**0.82**	**0.74**	**0.70**	0.29	0.35	0.26	0.35	0.38	0.38	0.53	0.47	0.48											
ntlrn_off	**0.84**	**0.89**	**0.84**	0.27	0.55	0.39	0.50	0.50	0.45	0.58	0.57	**0.60**	**0.84**										
ntlrn_pm	**0.87**	**0.86**	**0.87**	0.37	0.53	0.48	0.44	0.45	0.41	**0.63**	**0.61**	**0.65**	**0.86**	**0.92**									
am_delay	0.12	0.22	0.22	0.09	0.30	0.14	0.15	0.19	0.26	0.11	0.16	0.28	0.11	0.23	0.10								
inter_delay	-0.18	-0.16	-0.18	0.04	0.07	-0.01	-0.08	-0.07	0.01	-0.14	-0.10	-0.06	-0.10	-0.10	-0.20	**0.82**							
pm_delay	0.00	0.08	0.01	0.17	0.28	0.14	0.14	0.16	0.23	-0.01	0.06	0.08	0.04	0.11	-0.04	**0.92**	**0.92**						
flow_00	0.55	0.58	0.57	0.12	0.37	0.20	0.50	0.50	0.49	0.51	0.47	0.55	0.41	0.52	0.47	**0.74**	0.48	**0.67**					
flow_01	0.56	0.59	0.57	0.13	0.38	0.21	0.50	0.51	0.50	0.52	0.48	0.55	0.42	0.53	0.47	**0.75**	0.48	**0.68**	**1.00**				
flow_02	0.57	**0.60**	0.58	0.13	0.39	0.22	0.52	0.52	0.51	0.52	0.48	0.55	0.43	0.54	0.48	**0.75**	0.47	**0.67**	**1.00**	**1.00**			
flow_03	0.55	0.59	0.56	0.12	0.38	0.21	0.48	0.49	0.49	0.51	0.48	0.55	0.42	0.53	0.46	**0.76**	0.49	**0.69**	**1.00**	**1.00**	**1.00**		
flow_04	0.57	**0.60**	0.57	0.10	0.36	0.19	0.48	0.50	0.49	0.52	0.48	0.55	0.43	0.53	0.47	**0.75**	0.48	**0.67**	**1.00**	**1.00**	**1.00**	**1.00**	
ave_flow	0.52	0.55	0.54	0.12	0.38	0.21	0.49	0.49	0.49	0.48	0.43	0.52	0.38	0.50	0.44	**0.76**	0.50	**0.68**	**1.00**	**1.00**	**0.99**	**0.99**	**0.99**

Correlation coefficients (r) greater than 0.6 are shown in bold. Details of variables: [road type]_am/off/pm: average morning/off-peak/evening speed on road; am/inter/pm_delay: difference between morning and night time free flow speed; flow_00-04: traffic volume in 2000-04.

Table B2 Percentage of trips made by children and adults by mode of transport and by ethnicity (LATS 2001)

Mode	Children		Adults	
	White	Black	White	Black
Walk	40%	51%	27%	28%
Cycle	2%	1%	5%	3%
Bus	11%	20%	9%	23%
Car	44%	25%	46%	33%
Tube/train	2%	3%	12%	13%

From this analysis of LATS data, there is evidence that a greater proportion of trips made by children who classed themselves as 'Black', were by walking, compared with children who classed themselves as 'White'. Among adults who classed themselves as 'Black', a greater proportion of trips were by bus compared with adults who classed themselves as 'White'. As trips by bus require walking to and from bus stops, there is therefore evidence that people classed as 'Black' walk more than do their white counterparts.

Table B3 Injury rate ratios (95% confidence intervals) comparing each deprivation decile with the least deprived (data used in figures 1–4).

	Children		Adults	
	All injuries	KSI only	All injuries	KSI only
Pedestrians				
Deprivation decile				
1	1	1	1	1
2	1.36 (1.07 to 1.72)	1.24 (0.90 to 1.70)	1.35 (1.19 to 1.52)	1.27 (1.01 to 1.59)
3	1.50 (1.13 to 1.98)	1.15 (0.77 to 1.71)	1.40 (1.20 to 1.64)	1.35 (1.08 to 1.69)
4	1.88 (1.37 to 2.59)	1.42 (0.90 to 2.25)	1.69 (1.43 to 2.00)	1.81 (1.47 to 2.24)
5	2.15 (1.58 to 2.93)	1.72 (1.16 to 2.55)	1.82 (1.50 to 2.21)	1.66 (1.34 to 2.05)
6	2.39 (1.76 to 3.23)	1.99 (1.37 to 2.90)	2.07 (1.74 to 2.46)	1.98 (1.61 to 2.43)
7	2.78 (2.00 to 3.87)	2.18 (1.41 to 3.36)	2.32 (1.86 to 2.88)	2.21 (1.80 to 2.71)
8	2.78 (1.98 to 3.90)	1.82 (1.18 to 2.80)	2.33 (1.88 to 2.88)	2.12 (1.72 to 2.60)
9	3.20 (2.29 to 4.49)	2.26 (1.45 to 3.53)	2.60 (2.07 to 3.28)	2.83 (2.32 to 3.45)
10	2.95 (2.02 to 4.30)	2.42 (1.57 to 3.72)	2.89 (2.30 to 3.62)	2.92 (2.39 to 3.55)
Cyclists				
Deprivation decile				
1	1	1	1	1
2	1.22 (0.93 to 1.60)	0.85 (0.38 to 1.91)	1.21 (1.08 to 1.35)	1.90 (1.39 to 2.58)
3	1.41 (1.06 to 1.89)	1.51 (0.80 to 2.82)	1.21 (1.02 to 1.45)	1.66 (1.15 to 2.41)
4	1.17 (0.87 to 1.58)	0.93 (0.48 to 1.81)	1.55 (1.27 to 1.90)	1.95 (1.39 to 2.73)
5	1.47 (1.04 to 2.07)	1.02 (0.54 to 1.92)	1.65 (1.35 to 2.00)	2.08 (1.44 to 2.99)
6	1.61 (1.11 to 2.35)	0.75 (0.40 to 1.38)	1.95 (1.50 to 2.54)	2.72 (1.76 to 4.21)
7	1.54 (1.08 to 2.19)	1.11 (0.67 to 1.85)	1.98 (1.48 to 2.65)	2.49 (1.70 to 3.64)
8	1.59 (0.98 to 2.58)	1.03 (0.51 to 2.08)	2.04 (1.44 to 2.89)	2.44 (1.46 to 4.06)
9	1.57 (1.05 to 2.34)	1.23 (0.62 to 2.42)	2.30 (1.73 to 3.07)	2.95 (1.87 to 4.65)
10	1.41 (0.94 to 2.12)	0.80 (0.37 to 1.73)	2.08 (1.53 to 2.82)	2.68 (1.69 to 4.24)
Car occupants				
Deprivation decile				
1	1	1	1	1
2	1.17 (0.90 to 1.54)	1.21 (0.57 to 2.58)	1.23 (1.03 to 1.47)	1.24 (1.00 to 1.53)
3	1.42 (1.07 to 1.88)	0.87 (0.39 to 1.93)	1.33 (1.04 to 1.69)	1.34 (1.01 to 1.78)
4	1.61 (1.16 to 2.24)	1.35 (0.73 to 2.48)	1.33 (1.00 to 1.77)	1.18 (0.86 to 1.61)
5	1.66 (1.15 to 2.39)	1.79 (0.92 to 3.48)	1.45 (1.08 to 1.94)	1.30 (0.93 to 1.82)
6	1.52 (1.11 to 2.07)	1.06 (0.59 to 1.92)	1.37 (1.03 to 1.83)	1.30 (0.92 to 1.85)
7	1.64 (1.14 to 2.38)	2.03 (1.06 to 3.87)	1.48 (1.08 to 2.03)	1.37 (0.95 to 1.97)
8	1.72 (1.19 to 2.48)	1.66 (0.85 to 3.26)	1.48 (1.07 to 2.05)	1.29 (0.86 to 1.93)
9	1.46 (1.02 to 2.07)	1.33 (0.69 to 2.55)	1.37 (0.99 to 1.90)	1.30 (0.90 to 1.88)
10	1.35 (0.90 to 2.01)	0.77 (0.39 to 1.52)	1.43 (1.02 to 2.02)	1.26 (0.83 to 1.91)
Motorcyclists				
Deprivation decile				
1			1	1
2			1.18 (1.07 to 1.29)	1.39 (1.10 to 1.76)
3			1.26 (1.09 to 1.45)	1.12 (0.88 to 1.42)
4			1.34 (1.13 to 1.58)	1.39 (1.11 to 1.74)
5			1.37 (1.16 to 1.62)	1.35 (1.06 to 1.73)
6			1.51 (1.26 to 1.82)	1.60 (1.23 to 2.09)
7			1.48 (1.22 to 1.79)	1.50 (1.15 to 1.96)
8			1.53 (1.23 to 1.92)	1.59 (1.18 to 2.12)
9			1.44 (1.18 to 1.76)	1.37 (1.02 to 1.85)
10			1.29 (1.05 to 1.58)	1.25 (0.94 to 1.65)

Part B1: Remedial measures for addressing deprivation and road traffic injuries: the issues, evidence and broader context

1. Aims

The aim of this part of the project was to identify ways of reducing social inequalities in road traffic injury risk in London. To do this, this section will outline the context of evidence based policy in injury prevention, review the key findings of existing reviews of the relevant evidence bases and suggest that remedial measures need to be based on a broad understanding of the public health context of traffic injury.

2. Introduction

There is increasing pressure to ensure that policy is evidence based: that is, that it utilises the best available evidence on what 'will work'. There is a growing, though still inadequate, evidence base on what works to reduce injury from traffic. However, the strongest evidence (from randomised controlled trials) usually relates to a single outcome. An initial problem is that there are a number of relevant outcomes, which might include:

- Reducing the overall number of traffic injuries
- Reducing the number of serious and fatal traffic injuries
- Reducing inequalities in the rates of traffic injuries

In addition, there are other transport policy goals which must be addressed. In London, these include those set out in the Mayor's London Road Safety Plan of promoting walking and cycling. Given that 'what works' to achieve one aim may not work to achieve another, selecting evidence-based interventions entails first making value judgements about the primary aim.

This is particularly pertinent in the context of policies designed to address inequalities. As in other areas of health (see, e.g., Reading *et al* 1994), interventions which are effective in reducing overall numbers of injuries may increase the inequalities gradient. For childhood accidents, our previous research has suggested that although there has been a decline in overall fatalities, this has happened at a slower rate in the most deprived groups, thus exacerbating inequalities (Edwards *et al* 2006).

To reduce inequalities in injury risk, one strategy is to aim to reduce the risk for the most disadvantaged groups in society more quickly than in other groups. This requires knowing which interventions are likely to be effective in reducing injury, whether they are likely to reduce injury for all groups in the population, and whether it is possible (in practical and policy terms) to prioritise delivering interventions to those groups at highest risk. This requires additional evidence on how to deliver interventions appropriately to different population groups. A second strategy is to deliver universal population interventions which are likely to shift the gradient of risks across the population, for instance by changing the balance between transport modes.

This section of the report addresses these questions of identifying effective interventions, and identifying how best to address inequalities in risk. Given that this inevitably involves value judgements about exactly what the aims of policy are, this section also puts the questions of evidence and equity in a necessarily broader context of public health.

3. Evidence on road traffic injury

There are now a number of reviews of what works on reducing traffic injuries, largely drawn from urban contexts and therefore relevant to London (WHO 2004, Morrison *et al* 2003, Bunn *et al* 2003, Royal *et al* 2005, Wilson *et al* 2006, Duperrex *et al* 2002) as well as general reviews which include recommendations on road safety (Towner *et al* 2005). International comparative studies can provide some clues to the particular patterns of risk in the UK. The Sunflower study (Koornstra *et al* 2002), for instance, compared traffic injuries in Sweden, the UK and the Netherlands and found that the UK had relatively higher pedestrian and motorcyclist risks and lower car occupant risks. In the Netherlands, there were very high rates of cycling, but relatively low risks, suggesting that there is a 'safety effect', a finding corroborated by other international comparisons (Jacobsen 2003). This has relevance to London, with the expectation that increasing levels of cycling and walking is likely to decrease the risk associated with these modes of transport.

Engineering interventions

Although there are no randomised controlled trials in the area, evidence from before-after trials suggests that traffic calming schemes can reduce injuries in general (Bunn *et al* 2003). There is some evidence to suggest that road humps may reduce local collisions but increase them in surrounding roads (Morrison *et al* 2003). However, evidence from a study in London (Webster *et al* 2003) suggests

that this kind of collision migration has not occurred in London. An interesting example of effectiveness depending on aim is that of guard rails and crash cushions, which may increase the number of accidents, but decrease their severity (Elvik 1995). Speed enforcement devices (radars, speed cameras) were identified as reducing collisions and injury related collisions, with evidence of continued effects over time (Wilson *et al* 2006).

Educational, training and publicity interventions

Health promotion interventions, whether aimed at individuals, community based on mass media, are more difficult to evaluate in terms of their likely impact on health, and most evaluations focus on process outcomes such as reported behaviour change (wearing a helmet, possession of safety equipment) rather than injury outcomes, as these are difficult to attribute to an intervention. In general, publicity and information campaigns on their own have not been shown to reduce deaths and serious injuries, although they may be a necessary adjunct to the introduction of new legislation or enforcement (WHO 2004: 34).

There have been 24 randomised controlled trials of driver education for the prevention of road traffic crashes including a total of 300,000 participants (Ker *et al* 2003). When these results are pooled in a meta-analysis it is clear that there is no evidence that this approach is effective. Indeed, this review provides clear evidence that these approaches are ineffective. School based driver education is also ineffective and may actually increase road death rates by encouraging young people to start driving (Cochrane Injuries Group 2001). Pedestrian skills training programmes for children have been evaluated in a number of controlled trials but still there is no evidence that these programmes are effective in reducing injury rates (Duperrex *et al* 2002). There is some evidence that educational programmes can increase uptake of car seat use by children, although benefits might be short-lived (Morrison *et al* 2003).

A review of interventions to promote cycle helmet wearing (Royal *et al* 2005) concluded that there was better evidence for the effectiveness of community based interventions that provided free helmets in increasing helmet use, although the reviewers could not assess the impact of these interventions on injury rates or cycle use.

Broader transport policies

The above suggests that a narrow focus on road user education or on the implementation of isolated road safety measures is no longer appropriate.

Questions such as “what works in road safety?” have too often resulted in narrowly focused reviews of the research literature. Although it cannot be doubted that controlled trials provide the most valid evidence of effectiveness, it is more difficult to evaluate broader policy interventions using such designs with the result that we have high quality evidence but only for the most trivial transportation safety interventions.

As noted above, there is poor evidence for the effectiveness of most educational interventions. On the other hand the evidence for the effectiveness of interventions that tackle road danger itself is more compelling. Interventions that lower vehicle speeds in residential areas such as area wide traffic engineering measures are effective in reducing crashes (Bunn *et al* 2003) Because kinetic energy increases with the square of vehicle velocity, small increases in vehicle speeds can result in much larger increases in the risk of death and serious injury for vulnerable road users.

Although there have been no randomised controlled trials of large scale road traffic reduction measures, there have been a number of natural experiments that provide an indication of the potential of these approaches. The 1973 oil crises resulted in a dramatic reduction in the availability of petrol and a substantial increase in the petrol price. In response, some countries introduced car free days and other restrictions in the use of car travel. During this period there were sizeable reductions in the death rates for child pedestrians but they increased again once the travel restrictions were lifted (Roberts *et al* 1992, Roberts *et al* 1995). The death rate for child pedestrians is strongly correlated with traffic volume in the USA. When traffic volumes decrease, or when the rate of increase in traffic volumes slows, there are substantial declines in child pedestrian death rates. The results of these natural experiments are entirely consistent with the results from non-experimental studies (the only methodological approaches that are feasible) which show that traffic volume and vehicle speed are the strongest environmental risk factors for pedestrian injury.

4. Evidence on reducing inequalities

Although there is good evidence for the existence of socio-economic inequalities in traffic injury risk, there is as yet inadequate understanding of why this is, and thus how one might design interventions to address it (Leflamme and Diderichsen 2000). As Towner *et al* (2005) noted in their review of interventions to address inequalities, there have been very few interventions studies which address this

question directly. There have been a number of programmes that have attempted to focus on areas of deprivation, or on particular communities, in the hope that this would reduce injury rates in these areas or groups, but as yet, there is no evidence that this is likely to reduce overall gradients in terms of socio-economic factors. Towner *et al* (2005) end by making a number of recommendations for practitioners for this kind of 'targeting', based on their review, but these are in general based on 'good practice' process issues such as ensuring there are crèche provisions for training, or choosing low cost interventions. Given the limited evidence for the effectiveness of educational interventions, it is unlikely that, however well delivered they are, they will reduce injury rates. As yet, we cannot provide any evidence based recommendations on what is likely to address inequalities through targeting, only suggest that broader traffic safety policies take into account the issues which impact on likely causes of risk inequalities, such as differential exposure to risk. The rest of this document therefore sets out this broader context.

5. Road traffic injury in a public health context

As part A of this report showed, collisions between motor vehicles and pedestrians, and between motor vehicles and bicyclists, remain a leading cause of death and disability among children and young adults in London. Pedestrian and cyclist injuries are however just one of the many adverse public health consequences of road transport in London.

Walking and cycling are healthier forms of travel for the individual and the environment, but are in decline in England and Wales (Sonkin *et al* 2006). Since 1985, the average distance children travel as a car occupant has *increased by 70%* whilst the average mileage walked has *declined by 19%*, and the average mileage cycled has *declined by 58%*. It is essential for both personal and planetary health that walking and cycling are made safe and enjoyable and that these trends are reversed. The focus of road safety efforts must therefore be road danger reduction, principally by reducing traffic volumes and vehicle speeds and by encouraging safe walking and cycling, as stated in the Mayor's Transport Strategy. The advantage of this approach is that as well as reducing road deaths and injuries, this will encourage Londoners to be more physically active, it will reduce urban air pollution and it will reduce greenhouse gas emissions and its devastating climatic consequences.

6. Equity in a public health context

Over the years, motor manufacturers have endeavoured to improve the safety of *motor vehicle occupants.* In the UK, the death rate for child motor vehicle occupants has declined from 0.04 deaths per 10 million passenger miles in 1985 to 0.01 deaths per 10 million passenger miles in 2003 (Sonkin *et al* 2006) Because of the increase in car travel by children, the death rate per head of population has not declined to nearly the same extent, nevertheless it has declined.

Motor vehicles however, are expensive and many families cannot afford one. These families depend on walking, cycling and public transport. Children in households without access to a vehicle, or where the head of household is not working, or where households are rented, walk further each year than do their more affluent counterparts (Sonkin *et al* 2006) In 2003, children without access to a vehicle walked twice the distance walked by children in families with access to two or more vehicles. Because they walk more, children from poor families are at greater risk of pedestrian injury. The pedestrian injury death rate for children in the lowest social class is 20 times greater than for children in the highest social class. For pedal cyclists the death rate for the poorest children is 27 times greater than that for the most affluent (Edwards *et al* 2006). Whereas the more affluent motor vehicle occupants have benefited from the increased safety of motor vehicles, the increasing road danger that has accompanied increasing traffic volumes has increased the injury risks for the less affluent road users, the pedestrians and the cyclists. As Part A of this report showed, these differences are found across London.

These inequalities in injury risk are mirrored in the other public health problems of road transport. Wealthy people can afford to live away from traffic noise and pollution whereas poor people cannot. Similarly, wealthy people generate more greenhouse gas emissions than poorer people. A recent survey by the Transport Studies Unit at the University of Oxford found clear evidence that people in high income groups (>£40k per year) are more likely to fall into the highest greenhouse gas emissions quintile than people from low income groups (<£10k per year).(TSU) Even though the highest earners comprised only 12% of the survey respondents they comprise 23% of total climate change impacts at an average of 11.3 tonnes of CO_2. The most affluent people earn four times as much and produce on average 3.6 times the annual greenhouse gas emissions of the lowest earners.

7. Policy implications

Macro social policy initiatives: From a broader public health perspective, the current social class gradients in road traffic injury death rates reflect a deeper societal inequality in fossil fuel energy use. Wealthy people consume more fossil fuel energy and as a result they generate more road danger, more urban air pollution, and more greenhouse gas emissions. At a global level these inequalities are even more extreme. Rich people in rich countries are responsible for most greenhouse gas emissions worldwide but poor people in poor countries will be most affected by the climatic impacts. (Roberts *et al* 2005)

Transport policy initiatives: The general strategy must be to improve transport options, promote walking and cycling and discourage motor vehicle use. Car free planning, designing particular urban areas for minimal motor vehicle use, would be a key element. This might include new housing developments where residents are discouraged from owning private cars, pedestrian-oriented commercial streets where driving is discouraged or prohibited, parks that encourage or require non-automotive access, and imposing restrictions on driving, such as during air pollution emergencies or a major sport event (such as the Olympics) that would otherwise create excessive traffic problems.

8. Conclusions

It is essential for both personal and environmental health that walking and cycling are made safe and enjoyable. The focus of road safety efforts must therefore be reducing traffic volumes and vehicle speeds and by encouraging safe walking and cycling. There are many different road danger reduction interventions and whilst only some of these have been subjected to controlled trials there is good epidemiological evidence in support of the broader policy direction. The advantage of this approach is that as well as reducing road deaths and injuries, road danger reduction will encourage Londoners to be more physically active, will reduce urban air pollution and will reduce greenhouse gas emissions and its devastating climatic consequences. As this approach will also reduce the differentials of exposure risks between the most and least deprived sections of the population, we believe it is also the policy most likely to contribute to reducing inequalities in injury outcome.

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Part B2: Policy & Practice

1. Introduction

National policy context

Reducing both overall injury rates and the deprivation gradient are national policy priorities. Nationally, *Tomorrow's roads, safer for everyone* (DETR 2000) sets out targets to reduce casualties by 2010 by 40% for those KSI, 50% of children and 10% of slight casualty figures. The Department for Transport have also issued guidance on how local authorities should tackle the road safety implications of disadvantage (DfT 2003). This obliges Local Authorities (LAs) (who have not demonstrated that they have no problem with disadvantage) to aim to reduce casualties in their most deprived 10% of wards at a greater rate, and to state how they have done so in their annual progress reports. The guidance suggests LAs consider the underlying factors for high casualty rates and outline a strategy to address them in collaboration with other agencies and, possibly, with the local community.

Policy in London

As the national targets were likely to be met, the *Mayor's Transport Strategy* proposed a London wide Road Safety Plan, published in 2001. This set out additional targets for reducing the numbers of vulnerable road users (pedestrians, cyclists and powered two wheeler users) killed and seriously injured by 40% to focus attention on these groups. In 2005, the Mayor agreed more stringent targets of 50% reductions for road casualties, with 60% reductions for children. The strategy was also intended to promote walking and cycling and recognise the increase in the use of powered two wheelers. This is in the context of the overall strategy of using transport as an enabler, and a route to improving social equality in the capital. London's population faces particular problems with social equality, with the highest levels of child poverty in the country; high unemployment (particularly for lone parents and some ethnic minority groups) in Inner London; and sharply polarised incomes (Mayor of London 2002). Not surprisingly, then, an IPPR report suggested that the 'deprivation effect' in injury risk is more pronounced in London (Grayling *et al* 2002: 22).

However, as London is not typical of the country as a whole, the mechanisms that link deprivation and injury risk may be different in London, and the typical indicators used to research these links may be inappropriate. The high volume of commuter traffic and work-related vehicles moving through London, for instance,

means that the volume of traffic may have little to do with the number of cars or population resident within an area. Populations also fluctuate considerably throughout the day with some parts of London having large populations during the day, but almost none at night. The availability of public transport and the volume of traffic on roads also means that car ownership does not show the same socio-economic gradient as the rest of the country, with many people in London choosing not to own a car. For these reasons it is important to explore at a local level what challenges are faced in addressing the issue of deprivation in the context of London's streets and populations.

Evidence based policy

The relationship between social deprivation and the risk of fatal injury is well established, particularly for children. Recent analysis of data for England and Wales, for instance, found that for all injuries the mortality rate for children of unemployed parents was 13 times that of the most affluent group, with deaths for pedestrian injuries 20 times higher (Edwards *et al* 2006). Injuries not resulting in deaths are more difficult to investigate, but there is still considerable evidence that those living in more deprived households or areas are at higher risk. Hippisley-Cox *et al* (2002) found a higher risk of hospital admission for common causes of injury, particularly in young children, in Trent region, for those living in areas with high levels of socio-economic deprivation. An IPPR report estimated that the likelihood of child pedestrian injury is four times higher in the most deprived ward in England than the least deprived (Grayling *et al* 2002). This difference was not entirely accounted for by environmental factors such as road networks or population density, suggesting that there is something about deprivation over and above the built environment that puts people at risk The findings from part A of this project would support this, given that the deprivation gradients identified for London were not accounted for by differences in road network factors.

There is a growing evidence base on effective interventions to improve road safety (see previous section). In general, interventions to reduce traffic speed and volume do reduce injury rates. Interventions to separate different kinds of road user may reduce injury rates, but often at a cost of reducing active transport. Although it is more difficult to demonstrate any direct effect for education, training and publicity (ETP) interventions, given that they aim to change attitudes or behaviours, and the links between these and outcome may not be strong, such interventions may have an important impact on the 'cultural' background which makes legislation on, for instance, seat belt wearing or drink-driving more acceptable. Education about traffic

systems and laws is also, in a broader sense, part of the citizenship education to which the population have a right. However, although these interventions may reduce overall rates of injury, they have done little, historically, to affect the inequality gradient. The inverse is also true: targeting deprived areas may have costs in reducing overall casualty rates. Graham *et al* (2002), for instance, in a detailed analysis of the influences of socio-economic deprivation on child pedestrian casualties, note that simply prioritising 20mph zones in deprived areas may not lead to large casualty reductions, as there are other factors that lead to high injury rates (Graham *et al* 2002).

In a recently updated review, Towner *et al* (2005) identified a number of interventions on road safety for which there was good evidence which were targeted at particular at-risk communities, but none that were designed specifically to reduce the gradient. The lack of evidence for interventions which will address inequalities in injury risk reflects the lack of consensus about how to explain the link between, for instance, deprivation and risk. This in turn generates controversy about how to deal with the impacts of deprivation on road safety. A key area of debate is the extent to which the observed association between deprivation and injury risk can be explained by **exposure** – that is, the more deprived you are, the more likely you are to be travelling as a pedestrian, more likely to live near a busy road and less likely as a child to have a safe place to play and so on. There is good evidence to suggest that these exposure differences account for some of the increased risk. Recent analysis of travel survey data suggested that indicators of deprivation were related to distances walked by children (Sonkin *et al* 2006), and Christie (1999) found that those from lower socio-economic groups were more likely to play out in the road environment. Our analysis of the data for London (see report for Part A) also suggested that greater exposure accounted for at least some of the differential.

The remaining difference could potentially be explained by **cultural** factors, broadly including behavioural differences (e.g. in preferred areas for play or the supervision of children) or attitudinal differences (e.g. to risk taking). However, these are extremely difficult to identify in research, and much of the evidence comes from surveys using agreement with normative statements about risk taking attitudes (see e.g. Christie 1995), which may tell us little about people's actual behaviour. Even where behavioural or attitudinal differences can be identified, it is difficult to relate those to actual differences in injury rates. As Towner *et al* (2005: 19)

conclude 'Many of these theories to explain increased risk among different cultural groups, although plausible, remain untested'.

Implementing policy in London

Even if there was a consensus around how to achieve casualty reductions and address socio-economic inequalities, there would still be a challenge in implementing policy based on sound evidence at the local level. Previous work has demonstrated that scientific evidence for effectiveness is a necessary, but not sufficient, condition of effective policy: an understanding of the local constraints, needs and acceptability to users is also needed (DiGuiseppi *et al* 2002, Green 2000a, b). Large gaps remain in our knowledge of how to plan acceptable interventions for London's diverse communities and how to implement them in such a way as to resonate with the needs of those communities and individuals most at risk of road traffic injury.

The London boroughs face disparate challenges, given the range of populations across the city. Some, for instance, have long-established ethnic minority communities with elected representatives on local councils and well developed community structures which provide partner organisations with which to work. Others have larger numbers of more recently-arrived ethnic minority communities that may be more diverse, with few obvious community gatekeepers. Many Inner London boroughs have high rates of relative deprivation, and geographic areas that can be targeted with road safety interventions, whereas Outer London boroughs may have much smaller pockets of deprivation that are more difficult to identify, and for which it is more difficult to attract funding.

Aims

The aims of this part of the project were:

- to document current policy and practice across London;
- to identify the possibilities and challenges in addressing the links between deprivation and road injury risks in London boroughs.

2. Methods

To achieve the aims of documenting current practice and identifying challenges and opportunities for work on deprivation and road safety, we first looked broadly across London to get an overview of what those working in local authorities were doing. Second, we looked in more detail at the work of a number of boroughs. We drew on several sources of evidence for this.

Data sources

The data for this section come from three main sources:

- a review of all the **Road Safety Plans** from the London boroughs
- **interviews** with a group of key stakeholders
- A **survey** of all boroughs to identify current resources and priorities for road safety, and of Road Safety Officers to explore approaches to road safety

Review of Road Safety Plans

Not all boroughs had produced a separate Road Safety Plan (RSP), but most had a current Local Implementation Plan available. One borough was still in the process of drafting their RSP, so we reviewed 32 plans. However, as the format, presentation, intended audience and content of these varied greatly, it was not possible to identify reliably current policy and practice across London solely from the plans. We therefore used a survey of all Boroughs (see below) to supplement information. The review of the RSPs was used to identify the broad context of road safety policy across London and identify a range of boroughs to include in the interview phase.

Interviews

Interviews were conducted with 35 key stakeholders who were purposively selected to cover a range of Inner and Outer boroughs, and those with a range of approaches to road safety (as suggested in the RSPs). We talked to Road Safety Officers (RSOs), engineers and heads of traffic planning, representatives from partner organisations such as the London Fire Brigade, and those from local communities such as head teachers and residents' associations. These participants came from 10 boroughs, 5 each from Inner and Outer London areas.

The aim of the interviews was to look in detail at the ways in which deprivation was addressed within road safety policy, and to identify the key challenges and opportunities for addressing inequalities in injury risk at the borough level. The

roles or organisational locations of those interviewed are summarised in Table 1. These role descriptions are general, rather than specific job titles. The term 'Road Safety Officer', for instance, includes those with widely ranging job descriptions, from heads of large teams to those responsible for School Travel Plans. Those described as 'in other roles' in the borough include those who are not specifically or exclusively located within the road safety team. This includes research staff responsible for analysing collision data, those with a wider brief, such as regeneration, and elected councillors.

Table 1: Roles/organisational location of those interviewed

Role / organisation	**Number**
Road Safety Officers	11
Borough Transport Planning/Engineering	11
Borough – other roles	4
Statutory partner organisations (LFB, Police)	4
Community partner organisations (Schools, community associations etc)	5
Total	**35**

In addition to the formal interviews, we held informal discussions with a number of other stakeholders, including representatives from TfL and the GLA, local residents and researchers. These discussions were for background information.

Surveys

The survey was in two parts:

1. A survey of all **boroughs**, to identify current levels of resourcing and priorities for road safety. This was addressed to the person listed as responsible for the RSP in each Borough. The aim of this part was to document current policy and practice. (N=33)

2. A survey of all **RSO**s for whom we had contact details (n=163). The aim of this part was to describe the practice, priorities and attitudes of those delivering road safety across London in order to identify how generalisable findings from the interview study were.

Both surveys used a brief questionnaire, which was developed after analysis of the RSPs and interviews, and piloted with volunteers at TfL and two boroughs. As the aim of this phase of the study was to enable generalisations to be made, it was

essential to achieve a good response rate. We therefore enclosed a stamped addressed envelope and a small incentive to thank respondents for their time, in accordance with current research practice and the best available evidence on improving survey response rates.[3] Response rates for the two surveys are in Table 2.

Table 2: Response rates for the surveys

	1. Borough Survey	**2. RSO survey**
Sent	33	163
Returned	15	83
Response rate	**45%**	**51%**

The response rate for the RSO survey is an underestimate, as we aimed for an 'inclusive' mailing, and many recipients (such as cycle training officers) did not consider themselves to be Road Safety Officers. Respondents came from most boroughs, and included 50 respondents from Outer London boroughs and 33 from Inner London boroughs.

Confidentiality

In this report, the RSPs are attributed where appropriate, as these are in the public domain. Comments from those interviewed and responding to the survey are anonymised, as views were given in confidence with permission to quote if not individually attributed. Minor contextual details (such as road names) have been changed or omitted where necessary to maintain confidentiality.

[3] Some respondents considered the incentive inappropriate, and either returned the cash or wrote to say it had been given to charity funds. Returned cash has been donated to a road safety charity.

3. Findings 1: How deprivation is addressed

The first section of findings documents the salience of deprivation as an issue for road safety teams, and the range of ways in which they were taking it into account in their work.

The broader context of road safety policy

LAs are developing their road safety plans within a relatively complex policy environment, in which deprivation is only one issue they are asked to consider. Road safety issues overlap with crime reduction, community involvement, sustainability, commercial development and health, among other agenda. Financial resources for road safety are also complex. In addition to mainstream sources, funding for road safety may come from Section 106 agreements, Public Service Agreements, Urban regeneration funds and a host of other streams of money, making it difficult to identify comparatively across London how much was allocated within each Borough. Table 3 summarises average budget allocations from major funding streams within the Inner and Outer London boroughs which responded to the survey.

Table 3: Reported resource allocation for road safety2006-7(N= 15 responses)

	Inner London average per borough (£k)	**Outer London average per borough (£k)**
TfL allocation from BSP/LIPS for local safety schemes	442	723
TfL allocation for 20mph zones	344	156
TfL allocation from BPS/LIPS for ETP	44	22
Engineering/local safety schemes from council budget	263	51
Allocation for School Travel Plans	316	240
From section 106 agreements	69	99

The RSPs provided an overview of the context of road safety policy and the range of approaches used across the boroughs. All but two of the plans explicitly addressed the Mayor's targets for casualty reduction in London as well as the DfT ones, and 13 also addressed 'stretched' additional casualty reduction targets, generally resulting from Local Public Service Agreements. Some also reported that they were signatories to the European Commission's European Road Safety Charter, with an aim of reducing traffic-related deaths by at least 50% by 2010. The main thrust of the RSPs was, not surprisingly, action orientated towards meeting casualty

reduction targets, but these broader policy agenda also shaped individual LA responses to different degrees.

For some Boroughs, the RSP was an opportunity to set out an integrated, overall approach to road safety and how it co-ordinated with other policy aims relating to issues such as sustainability, health or crime reduction. Two examples are:

- Brent begins Chapter 6 of its LIP with a statement about its orientation to the **Road Danger Reduction** approach (which has the aim of reducing road hazards at source, and in the context of promoting active and sustainable transport) and the rest of the plan follows on from this.

- Islington begins with its strategic vision of **'One Islington'** focused on making Islington a greener place to live; a place where people of all backgrounds are able to realise their full potential; a borough of safe, empowered communities.

Most plans made some mention of the contribution of road safety to other goals, such as access, health or sustainability, e.g.:

> The elderly and families with young children report a degree of insecurity in areas of high volume traffic … Reduced vehicle speeds would also encourage more people to make journeys by alternative modes … [and thus] have an effect in improving air quality … encourage people to use more environmentally friendly modes of transport (Hillingdon RSP: 177).

Other boroughs focused more tightly on achieving targets solely in terms of traffic collisions. Enfield, for instance, begins its review of the RSP with a stated purpose that is orientated to both behaviour and environment:

> To induce improvements in road user behaviour and attempt to eliminate the road environmental conditions which give rise to road accidents.

RSPs with these less holistic approaches tended to focus more narrowly on proposed interventions to contribute to meeting targets, with little comment on how these might fit into priorities in other areas. However, in discussing the development of LIPs with key stakeholders, this sometimes reflected the process of

production of the RSP itself, rather than any lack of overview within the road safety team.

In interviews, where there was a sense of overall 'vision', it was clear how both engineering and ETP approaches co-ordinated with other aims, such as increasing active transport or increasing community involvement. Such teams were often based in the same or nearby offices, with a high degree of collaboration within the LA, as well as with external partners. However, given the 'policy overload' some professionals are feeling, and the day to day difficulties of coping with workloads, this integration is difficult to achieve, and many reported at least potential conflicts of road safety aims with other agenda. This most common mentioned was between 'safety' and broader health concerns. An example here was the focus on keeping healthy and keeping safe as one of the five areas of *Every Child Matters.* Here, with schools having access to small streams of money for capital investment for Safer Routes to School, there may be conflicts between wanting to encourage cycling to improve children's health, which may (in the short term) increase the risk of injury.

In practice, there are still incentives for making 'trade offs' between aims such as safety and health, especially where targets are considered as monitoring casualty rates in terms of absolute numbers, rather than by exposure. One RSO was blunt about the trade off:

> There is a huge great argument about [increasing the numbers of cyclists]. As a road safety officer I don't want to see anybody cycle, I consider it dangerous, but … the cyclist lobby believe that the more cyclists you get on the road you get to a point where people know there are cyclists and its actually safer because you expect to see cyclists everywhere … But as road safety people we deal with raw, crude data and if the cycle accidents go up then we are upset … we just work on crude data, it doesn't matter what the usage is! (RSO Outer London)

These tensions were evident in a number of boroughs, where sole concern with achieving numerical targets lead to difficulties in also addressing broader policy aims such as increasing active transport or addressing community concerns with, for instance, speed humps.

Deprivation in terms of the overall approach to road safety

In the context of addressing these other policy agenda, it is not surprising that few (6) of the RSPs discussed deprivation specifically as an issue directly relevant to road safety, and of those that did, most merely noted that there was an association between deprivation and risk of injury. In talking to road safety professionals, though, it was clear that this association is well known in most boroughs, and for many individuals it was an issue that they were keen to address as relevant to their population. Some boroughs had carried out their own analysis or mapping to demonstrate a link between deprivation and injury risk within the borough, although for some of the Outer London boroughs with few accidents, there was little apparent connection. Across London, of the boroughs responding to that question (14) only 2 (both in Inner London) reported that deprivation was a priority issue when planning for road safety. For the 12 who said it was not, the main reasons given were: the priority is to improve road safety for the whole borough (8); that prioritising locations with high collision rates would address the link (5) and that they believed current strategies already addressed the link (5).

In the survey of RSOs, we asked how far respondents agreed that there didn't appear to be a relationship between deprivation and injury rate in their borough, and how far they agreed with prioritising services at those most at risk. Summarised results for Inner and Outer London boroughs are shown in Table 4.

Table 4: RSOs views of relevance of deprivation, universal provision and targeting

	Number (%) in Inner London 'agree / agree agree strongly'	**Number (%) in Outer London who 'agree / agree strongly'**	**Total (%)**
In this Borough, there doesn't appear to be a significant relationship between deprivation and injury rates	6 (18)	28 (56)	34 (41)
Our main priority is providing the same level of service to the whole population	14 (42)	32 (64)	46 (55)
We should be targeting resources to those who are most at-risk.	28 (84)	38 (76)	66 (80)

This suggests a stronger feeling in the Outer London areas that deprivation was not really a significant issue for the borough, and that priorities were to provide services for the whole population. In Inner London, RSOs were slightly more concerned to target resources. Significantly fewer RSOs in Inner London than in

Outer London agreed that in their borough 'there doesn't appear to be a significant relationship'. When asked about what factors were used to prioritise ETP interventions, RSOs in Inner London were more likely to report that deprivation was the 'only' or 'main' reason than those in Outer London (10 (30%) compared with 4 (8%)). Most of those interviewed accepted the link between deprivation and injury rate, even if was not considered a significant issue for them locally in relatively affluent boroughs. For those boroughs that were actively trying to address inequalities in injury risk, a number of significant challenges to developing effective policy emerged. These were:

- The lack of knowledge, or lack of consensus, about why deprivation is linked to injury risk.
- Following on from this, the lack of effective models for addressing deprivation.
- At borough level, the difficulty of evaluating the impact of interventions on the deprivation gradient.

The survey of RSOs suggested a widespread view that there are difficulties in identifying what it is about deprivation that might lead to higher risk. Here, the majority of respondents agreed that exposure, risk taking and perceptions of risk were *all* the 'main' reason for higher injury rates. Although this looks contradictory, it reflects the real problem in both disentangling complex webs of causation, and with being asked to speculate on factors for which there is, as yet, little conclusive evidence. RSOs in Inner London were less likely to identify behaviour or risk perceptions as the 'main' reason for increased risk.

Table 5: RSOs views of the 'main' reason for higher injury rates in some groups

	Number (%) in Inner London 'agree / agree strongly'	**Number (%) in Outer London who 'agree / agree strongly'**	**Total (%)**
The main reason for higher injury rates in some social groups is that they are more exposed to risk	20 (60)	33 (66)	53 (64)
The main reason for higher rates in some social groups is that risk taking behaviour is different.	10 (30)	35 (70)	45 (54)
The main reason for higher rates in some social groups is that their perceptions of risk are different	14 (42)	34 (68)	48 (58)

RSOs also report a lack of firm evidence about which communities are at higher risk, and what effective interventions there were to address inequalities. Not surprisingly, RSOs were less wholehearted in their support of engineering solutions than the engineers we interviewed. In fact, only 5 agreed that engineering interventions were the best way to address inequalities.

Table 6: RSOs views of knowledge/ ways to address the problem

	Number (%) in Inner London 'agree/ agree strongly'	**Number (%) in Outer London who 'agree/agree strongly'**	**Total (%)**
We do not have enough information to know which communities are at higher risk	10 (30)	23 (46)	33 (40)
We don't know enough about which interventions are effective in addressing inequalities	17 (51)	22 (44)	39 (47)
The best way to address inequalities in injury rates is through road engineering interventions, not education	2 (6)	3 (6)	5 (6)

The problem is particularly acute with ETP interventions, which are difficult to evaluate in terms of any direct impact on casualties, let alone in terms of their impact on deprivation. Most boroughs did evaluate their programmes, but were limited to largely process evaluations to monitor acceptability. One borough brought in outside consultants to evaluate programmes, but even they only offered advice on how to do the process better, rather than advise on evaluating outcomes (RSO, Inner London).

Approaches to deprivation

Despite these gaps in the evidence, and the views in some boroughs that deprivation was not a major concern, most of those interviewed were directing some policy effort at the issue, from a number of different perspectives. Given the lack of consensus about what is effective, these efforts were, not surprisingly, pragmatic, and in general characterised as 'trying a bit of everything', or by working on common sense ideas about what might link deprivation and risk. Nonetheless, it is possible to distinguish some broad themes in the different approaches to framing the 'problem' of deprivation and injury. These do not

necessarily represent the views of different people or boroughs (as most drew on several approaches) but are perhaps worth distinguishing as potential approaches.

a) The structural approach: addressing the causes of inequality

The most radical way to address the issue of inequalities in injury risk is to reduce the inequalities that give rise to it. Clearly such structural measures are beyond the scope of road safety departments, but some broader LIPs and individuals did express a view that the only effective way to address the problem may be to address the root causes of deprivation, through for instance, policies which would increase local employment or improve educational opportunities.

The broader structural view was, not surprisingly, more common, among stakeholders not located exclusively in road safety. One local councillor for instance, expressed a view that a heavily engineered approach ran rather counter to other aims (improving the street scene) and that investment might more profitably be made at redressing inequalities directly, for instance through education:

> But what you do then is deliver more railings that keep pedestrians away, and this runs exactly counter to what I would say needed to happen. So I mean, you see more railings and more heavy engineering solutions on TFL roads in deprived boroughs, which seems to me like a kind of simple way of putting it… if they could put more money into education, I think this is a real issue actually, but actually if they could see that education is going to have a longer term and sustainable impact, and would be better for the street scene generally as well (Borough, other role, Inner London)

In practice, though, road safety teams are charged with addressing the *effects* of deprivation, rather than its causes, and the approaches evident in their work were, of necessity, located at this level.

b) Road Danger Reduction approach

Many RSPs reported that the LA was a signatory to the Road Danger Reduction Charter, and some professionals were working explicitly with a road danger reduction approach. Within this, deprivation is addressed implicitly through a focus on achieving genuine reductions in danger for all road users, and discouraging the use of private motor vehicles. Given that greater exposure to risk explains a significant proportion of the added risk for more deprived users, any initiatives

which reduce their exposure to risk are likely to impact on inequalities. However, in practice, even those working within this approach, and seeing reducing exposure to danger as the key to addressing deprivation, recognised that this reflected a complex mix of factors:

> Exposure. I mean it's exposure to the road environment, more than their peers, but also you have to remember that …in a lot of these areas not only are, you know, the children more streetwise and exposed to road traffic, you maybe have more incidences of crime so, they're potentially exposed to two different things there, but they tend to intertwine so… you may have more incidences of joy riding, stolen cars within a certain area where you've got a double exposure, you've got a younger child exposed to traffic risks and also exposed to the criminal element as well. I mean it's very difficult to pinpoint any sort of singular thing … (Road Planning, Inner London)

Others were working more implicitly with this kind of approach, recognising that issues such as crime, perceptions of danger and road traffic collisions were likely to be not only linked, but also relevant to deprivation:

> Yeah, things like train station and bus interchanges, that seems to be in the poorer areas, for some reason. … I mean certainly a couple of years ago they seemed to be our main focus or our main hotspots. And the strange thing is there seems to be a crime link as well. I feel they're linked. It's the area connected to what's there because it's such a busy place. (Statutory partner organisation)

Although the Road Danger Reduction approach was frequently mentioned in RSPs, few of those interviewed from road safety or traffic planning teams made reference to it directly. This could be an artefact of the data collection methods, as those working within this approach might be less likely to be responding to surveys. At the extreme, a few boroughs fund no education or training at all directly. One Outer Borough funded no RSOs, on the grounds that engineering solutions offer better value for money, and that traditional educational approaches offered, according to the engineer interviewed, 'limited benefit' (Planning, Outer London).

For the RSOs, employed to provide programmes that are orientated primarily to education, or changing behaviour, their scope to contribute to this kind of approach is perhaps limited, and although road danger reduction may be a backdrop to their

strategic thinking about road safety, it may not be a driver of policy at a day to day level. Indeed, reflecting survey views (see Table 6) for some, the issue was clearly not road danger reduction, but rather altering behaviour on the roads:

> Well, you've then got to explain to them [local residents] it's not the road that's dangerous, it's the people using the road that causes it to be dangerous. And it might well be that if somebody has got knocked down as a pedestrian, did they look or what? You know, it could well be their fault and particularly when it becomes fatal it's very difficult to deal with them and say "Well look, it's not the road necessarily." It could be that the child or adult or whatever it is has walked out without looking. (Borough, other role, Outer London)

One response to the survey explicitly drew on road danger reduction, and indeed reported that this perspective made it difficult for them to complete the questionnaires, which they felt were framed in such a way that road danger reduction approaches could not be accommodated.

c) The 'empiricist' approach: addressing collision data

The 'empiricist' approach to addressing inequalities was typical of most of those interviewed in engineering and traffic planning teams. It was also reflected in the survey, in which boroughs were asked to identify what factors were taken into account when prioritising interventions. All (15) mentioned collision data as either the most important factor (13) or the one that was always taken into account (2), and all mentioned cost effectiveness as most important (2) or always taken into account (13). However, community concerns were 'always taken into account' by 7, and taken into account 'if possible' by 8. Levels of deprivation was the factor least likely to be taken into account, with 7 boroughs saying it was when possible, and 7 it was not an issue.

In general, most road traffic planning and engineering staff in many boroughs were clear that for them, the key issue was reducing the number of casualties and that the major, or only, criteria for selecting sites for action was the number of collisions:

> [This borough] has had its own priorities over years and they've simply been to look at where the majority or the biggest clusters of casualties are happening and deal with those in that order, but it does now appear that

> Transport for London are looking for more and more control over that and we're having to conform with their ways of thinking, which, you know, aren't that dissimilar from ours, to be honest, … [we don't prioritise] on areas of deprivation. Um, there's clearly a link between deprivation and numbers of collisions that occur, but our responsibility is on the numbers of collisions and if an area has a high number of collisions that will be an area we focus on compared to an area that maybe hasn't got as many injury collisions. (Planning, Outer London)

> We are targeting areas where there are the most number of casualties ……so we are working towards it. It might not be like a direct link of deprivation and, you know, that's where we're going to focus on, but by doing this we are getting the areas that have high a casualty rate…. the engineering measures are targeted to where the accidents are regardless of what deprivation or ethnic mix or anything else, they're purely focused on the accident levels. (Engineer, Inner London)

> Clearly, if you target directly where the accidents are then you are targeting directly social deprivation issues… (Traffic management, Inner London)

This empiricist approach was justified firstly on the grounds that engineers felt that targeting those areas with most collisions was most likely to contribute to casualty reduction, their primary aim. Second, they felt that it was also likely to address deprivation in that collision 'hot spots' were likely to involve more people from deprived areas. Third, some felt that the underlying causes of the relationship between deprivation and injury were too complex to unravel, and thus effort was more effectively targeted at the outcome (site of collision) than such diffuse behavioural causes as exposure or parental behaviour.

For some engineers, deprivation was an issue that had been 'added on' to an empiricist approach to help prioritisation. In one Outer London borough, the engineer explained that schemes had been prioritised in terms of accident clusters and cost effectiveness, but over the last 5 years, they had become conscious of monitoring investment in terms of deprivation:

> I mean 5 years ago it was straightforward but now we more conscious of the need, at least we are monitoring… what goes into which wards and it's early days in terms of having started the process. So at least as the years go by

> we will be asking ourselves questions as to why investments are not going adequately into deprived areas and that has been very set out in detail as to exactly what we will do, what statistical methods we will use and so forth, are all fully detailed in the LIP, in the chapter that deals with equality… We are very conscious of but …as it is early days we cannot say that we've achieved it but we have set the ball rolling so that we will become more inquisitive of ourselves as to what we are doing with investment. (Engineer, Outer London)

This reflects the TfL LSRU funding approach, in which schemes are funded primarily in terms of data on casualty rates, but with deprivation levels taken into account for prioritising bids with similar rates.

For a few boroughs, an empiricist approach at borough level led to a complete rejection of the issue of deprivation as a salient one, as they felt that there was no clear link between deprivation and injury risk in the data. One Outer London transport planner said that within his borough, accidents were scattered, with no obvious link to deprivation, and that there would be political sensitivities if resources were allocated to some areas and not others (Planning, Outer London).

d) Targeting in terms of deprivation indicators

Road Safety Officers were less likely to report prioritising purely on the basis of casualty data, and more likely to be focusing their work in terms of their local knowledge, available funding streams and their own assessments of what might be the underlying causes of the link between deprivation and injury risk. This sometimes resulted in an explicit approach of attempting to target particular areas or communities in terms of ward level or other indicators of deprivation. For instance, in one borough in which the engineer claimed a purely empiricist approach, the RSO explained his rationale for choosing where to focus:

> Well, we tend to try and look at the social aspects of it as well…. But in doing that we had to identify areas which were socially deprived and use the schools within those areas. And we did identify twelve schools, which we started off with, because we felt, well, this was government pressure really to say we'll treat those schools first, and that's what we did. (RSO, Outer London)

Kerbcraft is one scheme that was widely adopted as a targeted approach, with pedestrian skills training for 5-7 year olds, primarily targeted at deprived areas. As funding for this was coming to end, some boroughs were attempting to mainstream this activity. Other targeted pots of money were reported from schemes such as Neighbourhood Renewal, in which forums sometimes identified road environment issues.

However, there were limits to targeting, including the political difficulties in addressing only certain parts of the borough:

> … you can't just sort of say "Right, okay, that's a deprived area so that sort of area needs that intervention. Well that's a very affluent area and they all travel by car, so they don't need anything." Because at a certain point those needs are going to be the same… (RSO, Inner London)

For those working within boroughs where deprivation was widespread, targeting solely in terms of deprivation indices was not very useful, as this applied to the whole borough. In contrast, in those Outer London boroughs which were in general more affluent, with only small 'pockets' of deprivation, it could be difficult to identify areas to target. Where pockets of deprivation were reported to be widely dispersed, they might not show up on borough analysis.

Tensions between different approaches to addressing deprivation

In summary, although many boroughs have road safety plans that suggest a holistic, road danger reduction approach, at the day to day level of implementing road safety policy, deprivation is addressed in two different ways that do not reflect this strategy. First, is an empirical approach (more typical in engineering teams) based on prioritising schemes primarily in terms of casualty numbers, with deprivation indicators added in to monitor resource allocation. Second, is a pragmatic approach based on targeting and behaviourist assumptions about risk, more typical in the accounts of road safety officers. Although these approaches may be in tension, in practice road safety work happens pragmatically and, as one officer noted when asked how priorities were set, in rather 'holistic' way, with a number of influences feeding in:

> I think partly it has to be data-led … but apart from that I suppose it's pretty much set by what the targets are and what the, you know, the mayor for

> London wants and, …really and truly it's a sort of holistic thing, isn't it? You know, you have a look at what, you know, other people are doing. I mean I don't think there's any one thing that sort of like leads policy, it all, it all sort of feeds in really and truly. (Inner London)

One problem is the level of analysis, given that the 'key issues' look different at London, borough and neighbourhood level. Across London, it might make sense to prioritise resources in those boroughs with high rates of deprivation and casualties, although this would leave out isolated groups in other boroughs. It would also reduce the ability of more affluent boroughs to provide the essential road safety training packages that are needed universally. At borough level, statistical groupings of high risk road users, whether defined by area deprivation scores, ethnicity or some other variable, may make little sense as communities that can be worked with.

Others were sceptical of assumptions made about explanations for relationships between deprivation and risk on the roads. The limitations of a simplistic behavioural model, for instance, were noted by many, given the complex relationships between knowledge, behaviour and risk exposure that are evident even from a cursory consideration:

> You know, you could find that in a deprived area your kids are actually more streetwise and because they are left out on the road perhaps and are having to fend for themselves a little more they actually are more able on the road than those that get ferried in the, in the Jeep to school every day and never actually come into conflict with any, um, traffic. You know, mummy has always got their hand or they're in the car and if they were on the street on their own they wouldn't have the first idea perhaps. So, you know, you could see an opposite (Planning, Outer London)

> I live in middle-class suburbia, you've got kids on the street all the time, they play in the street, they have, they have congregating groups, and they terrify the shopkeepers… so no, I'm not convinced - whether there's the play facilities or not the children behave in the same way. They do the same things. (RSO Inner London)

Addressing ethnicity

One particular area of interest was ethnicity. Although the data on ethnicity and injury risk are less robust than those on deprivation,[4] there are reasonably good grounds for assuming that the decreases in injury rates for children have been much less in Black and Afro-Caribbean groups compared with other groups in the population, and a suggestion that this difference is not accounted for purely by differences in deprivation levels between the different ethnic groups. (The relationships between ethnicity, road traffic injury and deprivation have been investigated further in a separate report.[5])

Slightly more of the RSPs (9) mention ethnicity than deprivation in general as an issue, although this was sometimes in the context of tailoring interventions for particular population groups rather than directly addressing the higher risk in some groups. Again, though, the finding that some groups were at particularly high risk was taken very seriously by some boroughs. In general, the challenges in addressing ethnicity as a factor were similar to those of addressing deprivation in general. These were first a lack of faith in the data, given the difficulties in using STATS19 to identify ethnic groups of casualties.

Second, even if it was accepted that children, in particular, from some ethnic minority groups did seem to be at higher risk, there were difficulties in identifying what it was about ethnicity that might lead to greater rates. As one RSO commented, it is difficult to understand why certain pedestrians might be more at risk than others:

> I can't see why a black child is more likely to be injured than a white one. We've got deprivation across the whole of the borough, the bus, the lorry or whatever isn't going to take any notice, the driver isn't, the driver doesn't actually want to hit and collide with [a child] and so why should there be any differential? … but this is a big overrepresentation and that's why I need to find out more (RSO Inner London)

[4] There are a number of reasons for this. Ethnicity is not a core part of STATS19 data, and although collection of ethnicity data by London police is done, this does not use categories that match those used in the census, which could be used to establish denominators for each group. It is therefore difficult to establish population rates for injury.

[5] Steinbach R, Edwards P, Green J, and Grundy C (2007) Road Safety of London's Black and Asian Minority Ethnic Groups: A report to the London Road Safety Unit. London: LSHTM.

Third, each London borough has a unique mix of communities within its borders, and for many road safety staff, global findings about the relationship between aspects of ethnicity and road safety were not particularly informative for the local level. As one interviewee noted, when the data are examined in detail, there may be very different patterns of injury causation within each group:

> For example the sort of things that we found was that Greek boys tend to have more 'cycle sorts of accidents, because they've got the bikes and they are showing off, Asian women at that time seemed to have more incidents on buses because less of them drove. That has changed slightly now but less of them statistically drove, and from the ones that you can identify as pure refugee sort of people there was a general lack of understanding, and grasping what the dangers were … (RSO Inner London)

Clearly any targeted work with specific communities relies on very detailed local knowledge, and ideally close partnerships with local community organisations if they exist so that problems and solutions are identified within communities, rather than imposed from outside, and possibly based on misunderstandings or speculative anecdotal evidence about 'culture' or behaviour. In many boroughs, road safety staff had good relationships with particular well-established local ethnic or faith communities, but these were not particularly helpful to address the apparently high rate in what STATS19 London collisions dataset defines as 'Afro-Caribbean' groups, which are a large and diverse part of the population of many London boroughs.

A recently commissioned study on the topic of ethnicity and road traffic injuries had caused some disquiet, in part because the findings were not seen as generalisable to all London boroughs, but it had been useful for some local officers in terms of highlighting the issue. In one Inner London borough, for instance, a local school with a largely Muslim intake had used these findings as a spur to developing their School Travel Plan:

> There was a report about black and ethnic minority statistics relating to London … and [local school] picked that out of the Tool Kit and put it in their travel plan…. (School Travel Plan advisor, Inner London)

In some boroughs, there was a real desire for good quality research on the topic, but research that was applicable to the local population, and credible in terms of the explanations offered for the relationship:

> we know from the accident statistics that there is an overrepresentation of black afro-Caribbean children in the stats, and we have a high population. Crudely fifty percent of our child accidents are to that group and whereas thirty percent of the population belong to that grouping, a clear over-representation… so when Transport for London did a report into why this overrepresentation could exist across London I was very interested because it would be useful to me [but] the study didn't help, I still needed the information. [I'm saying] "Look, I really do need this information and here's the sort of things that I need to know about." (RSO Inner London)

However, given the diversity of London's local populations, and the diversity of community organisations, it is unlikely that any London wide study would be very informative at the level of providing explanations for complex relationships. As in addressing deprivation, in practice most teams adopted a pragmatic approach, based on local knowledge, good working relationships with local associations where they existed, and 'common sense' on what might explain the higher risk in some groups.

Two candidate explanations were typically offered to account for the observed differences in casualty rates by ethnic group. The first was the issue of recent immigrants being unfamiliar with the road environment:

> but certainly the new people … coming in, um, they probably find it very difficult just merely because they're not used to the volume of traffic and the speeds of traffic, (Planning, Inner London)

> … and also many cases where people are coming into the country having never lived in an environment where there is traffic on such as scale as here. They do not necessarily know how traffic controls work … (Statutory partner)

As many people pointed out, there are a complex mix of engineering solutions across London, and a bewildering variety of road environments, from Home Zones to heavily engineered roadscapes which attempt to separate road users, and a large range of crossing types. These may be confusing enough for those who have grown up here as these have emerged, and it was felt they could be particularly confusing for the recently arrived. One (Inner London) borough had become

involved with a scheme, initiated by a local community worker, to give talks on road safety to recently arrived women, explaining how to use the variety of crossings in use.

However, it is not credible that recently arrived residents' lack of familiarity with the traffic environment accounts for much of the increased risk for Afro-Caribbean young people, given that most of this group are not recently arrived. It is also equally plausible that recent arrivals unfamiliar traffic systems would be more careful, rather than less careful, in dealing with traffic. However, it is obviously good practice to ensure that those who have recently arrived are offered education and training in road safety. Delivering this is essential to providing a good service to the whole community, but may be unlikely to have much impact on differences in risk between ethnic groups.

The second candidate explanation for higher injury rates in some ethnic groups is a behavioural one, in which some suggested that there were differences in behaviour, particular around child care and in risk taking behaviour in different ethnic groups:

> you know, in some cultures younger children, children are allowed to look after children, whereas in other cultures, perhaps parents more look after children. (Inner London)

What is notable though is that these candidate explanations are offered tentatively, with many 'ums' and 'ers' before potential explanations are offered, and many were explicit that these were speculative explanations. As many interviewees stated, given that there is little research directly addressing the issue, they are reduced to speculating on the mechanisms for potential links, based on local knowledge and common sense ideas about behaviour.

For this reason, it was often felt to be inappropriate to target particular ethnic minority communities, given it was difficult to know exactly what behaviours or risk exposures to target. Further, it was often impossible to identify exactly who 'the high risk community' might actually be. One example was the apparent high rates of injury among Afro-Caribbean residents (as defined by STATS19 London collision data). As this grouping did not represent any 'real' community, but just a statistical collection of people, it was difficult to know how to either target or tailor interventions.

However, many boroughs did work with particular ethnic, faith or local communities, with the aim of providing appropriate services rather than addressing inequalities in injury rates. These partnerships were less common, though, than others: in the survey, only 7 (8%) of RSOs reported working closely and regularly with local community organisation or faith groups, and 39 (47%) reported liaising on specific projects (see Appendix 1). In general, producing information in local community first languages was not seen as particularly productive (given that parents not literate in English may not be literate in their first language), but might be done as part of the overall commitment to making publicity accessible to all local residents. There were some examples of work with well-established ethnic minority communities,:

> TFL funded a Turkish speaking officer within the area … and she's been working with the Turkish community to produce leaflets which are now are available London-wide, TFL gave the money for these … and she says there is a culture, for instance, about things like drink/drive within the Turkish male community… so, you know, that's an issue that needs to be raised with them. We can only do that from inside (Inner London)

Again, such work is perhaps an essential part of providing appropriate local services, but may not have a large impact on addressing differences in injury risk.

In general, when asked about potential causes of differential rates in different ethnic groups, most interviewees were even more tentative about offering speculative explanations for patterns in the data than they were around deprivation. To some extent this reflects the added sensitivities of the topic, but it also reflects the greater lack of solid evidence. As one participant said, when asked about what might account for the differences in observed risk:

> I don't think you'll get anyone to explain what their hunches are…I think it's going to be a very difficult subject to get to grips with. (Engineer, Inner London)

Addressing ethnicity in road safety is perhaps better framed as an issue of developing appropriate road safety programmes for diverse communities, rather than one of trying to tackle perceived deficiencies in the behaviour or attitudes of particular communities.

4. Findings 2: Challenges and Opportunities

The second section of Findings describes the challenges identified in addressing deprivation, and the opportunities that currently exist for taking work forward.

Challenges 1: Inadequate or inappropriate data

In many boroughs, there were individual inadequacies noted in the data they had available. This included data on whether car drivers involved in collisions with borough residents are from out of borough and more detail and credible evidence on rates for different sections of the population. A more fundamental problem, especially in the light of a road danger reduction approach, was the lack of data on exposure. This was first seen as a problem for measuring the effect of deprivation:

> you'll find that all our ethnic accidents are happening in the bottom 2/3 of the Borough which is probably linked to deprivation as well, but what we don't know is the amount of exposure that those children are having to traffic, it might be like the cycling. In fact, per mile walk, a child, is more streetwise if they are deprived because they are out on the streets all the time whereas one of our Range Rover transported kids here comes to a road who hasn't got any savvy what so ever, so in terms of exposure, it might be that our cosseted kids are actually more vulnerable than our deprived kids, but I don't think that piece of work has ever been done anywhere (RSO, Outer London)

Exposure data were also an issue in terms of targets. The Mayor's targets are intended to be a regional target for London as a whole, and although they are perhaps not intended to translate into borough level targets, they have been used in this way, which for many boroughs seems inappropriate. As this engineer comments, the problem is not only that the targets take no account of exposure, but also because crude numbers are small and liable to short term fluctuation:

> some of the targets are statistically quite poorly chosen … statistics which do fluctuate an awful lot so we can't actually say 'the last 2 years have been fantastic'… I have in mind what happened in 92 and 93, by sheer statistical fluke we hit target, we hit figures that are actually better than the national target in 2010…there are some targets about which we seem to be making really no progress. One of these is motorcycles, it is just damn impossible to

> meet it, partly because of the way its defined, there is no notice taken of increasing usage of motorcycles.. and we are being asked to use a raw figure which bears no relation to how many there are on the road (Engineer, Outer London)

This is particularly the case for boroughs with public sector agreement targets for more stringent local targets in casualty reduction.

Challenges 2: How to deal with 'Phase 2'.

London has made huge gains in improving road safety, and many in the boroughs were rightly proud of the achievements they had made. There was a sense that these gains were not widely known by the public, given that the media often focused on the negative perceptions of traffic related issues, such as over zealous traffic wardens, rather than the reductions that had been made in casualties. Overall, there is a challenge in keeping up momentum in what we have called 'Phase 2': those boroughs which feel that they have both addressed the major collision hot spots, and dealt with major issues related to deprivation.

In some of the more affluent Outer London boroughs, interviewees raised the problem of small 'pockets' of deprivation, for which it might be difficult to attract funding, or target resources effectively. Recruitment of all road safety staff was reported as at times difficult in Outer London, with problems attracting school crossing patrols and also experienced officers who have tackled the major issues in the borough, and are now finding it difficult to get funding for any additional schemes, as neither their casualty figures nor the deprivation levels support bids. Some have been lost to 'more challenging' boroughs, or to organisations that pay more (including TfL)

In boroughs across the whole of London, there was some concern about diminishing returns, given that road engineering schemes had now addressed most of the sites with particularly high collision rates, and any new schemes within the borough were likely to be less cost-effective:

> Well, it's becoming more difficult to introduce schemes that have been as effective as they have been in the past … it's the main feeder routes that are having most of the accidents (Engineer, Outer London)

For some boroughs, significant gains were reported in injury reduction, and the targets are on track to be easily met. This presents problems in terms of achieving further reductions, in the context of already low figures, and in accessing funding given the difficulties in making bids based on deprivation. Targets in terms of percentage decreases become inappropriate when figures are already low, and are likely to be counter-productive at borough level. The challenge, then, is one of keeping up momentum in the context of low public awareness and a feeling that, in some areas, the most challenging and immediately effective work has already been done.

Challenges 3: Conflicts between road safety aims with other goals

The most common example of this was dealing with community reactions to traffic calming measures. The only intervention with good evidence for effectiveness in reducing road danger is reducing speed, and most boroughs were increasing the number of 20mph zones in their areas, and were often working intensively around schools to reduce traffic speed. There were, though, wide variations in coverage, ranging from estimates of 2% to 70% of the borough with 20mph zones.

Table 7: Average coverage of 20mph zones reported

	Average number of existing 20mph/Home Zones	**Average Estimate of % of Borough covered**
Inner London boroughs	12	33
Outer London boroughs	10	3

Although these traffic calming schemes might be effective, there were costs to this approach, with the most common engineering solutions (such as road humps) often unpopular with residents:

> I think one of the things that we do need to do is look at how we implement twenty-mile-an-hour zones. … what we do is really blanket humps everywhere and I think we need to be a bit more innovative about how we control traffic speed to the twenty because humps are not universally popular and there are a disadvantage of them, disadvantages of them… the lorries going over the humps claps and bangs can disturb the residents, so they don't like humps. (Engineer Inner London)

This was a view shared widely by those local residents we talked to informally in a number of areas, where traffic calming was perceived to have either added to road danger through changing traffic flows, or increased noise pollution as heavy vehicles went over humps in residential streets. Similar comments were made about parking enforcement around some schools, which had the effect of making traffic flow faster, and thus caused greater road danger. Instigating 'evidence based' interventions to reduce injuries is not straightforward, and required consultation to both ensure that there are no unintended effects and to design interventions in such a way as to involve, rather than alienate, local communities.

The second area of conflict was around prioritising active transport whilst reducing injury rates. As discussed above, RSOs at times were open about the potential conflicts with health agenda. If their primary focus was on reducing casualty numbers, this led to a disinclination to encourage walking and cycling, given that these are more 'risky' modes of transport, and current targets were perceived to relate to decreases that took no account of exposure.

Opportunities 1: Funding, information and organisational resources

The relatively high level of funding for road safety over the last years, and the relative security of longer term five year Local Implementation Plans, rather than year to year budget allocation, has made a significant difference to most boroughs. A study of road safety policy from six years ago (Green 2000a, 2000b) found that resource limitations were a major reported barrier for staff working at local level. Inevitably, when asked directly in the survey, a large number of RSOs (33, 40%) still disagreed that their budget was adequate, but what is more surprising is that 31 (37%) agreed that their budget *was* adequate. In interviews, one RSO was struggling with a very under-resourced department, but in general few people in interviews reported that lack of funding was a major limitation on their work. Inevitably, 'more money' would always help, and for some this would enable much more widespread adoption of 20mph zones, or home zones, but in general there was optimism about the levels of resourcing that were available. In one Inner London borough for instance an RSO reported that:

> you could always do with more posts if you want to expand your programme. I mean we've expanded [considerably] here in [borough] over the last four to five years … We've been extremely lucky getting a lot of external funding, a lot of regeneration funding and we've also utilised other

> skills that we've got to be able to make our remit wider, which has helped. (RSO Inner London)

Overall, participants in the current study were far more positive about financial resources, information resources and organisational support for road safety that they were in a study from six years ago (Green 2000a). The majority, 61 (73%) of RSOs agreed that road safety had a high priority within their Council, with 44 (53%) agreeing that local councillors were supportive. Routine information from Transport for London and the London Accident Analysis Unit was reported as useful and welcome, as was their responsiveness to specific requests for information. Although participants wanted more specific information on some topics, they were in general positive about the level of guidance and data received, and identified a number of useful websites and newsletters. A summary of those sources of information found essential and useful is given in table 8.

Table 8: Information resources used by RSOs

	Essential source of information	**Use occasionally**	**Never use**
Routine information from Transport for London	54	26	0
LARSOA	40	32	2
Other Pan London Road Safety Meetings & conferences	34	32	2
Informal contacts with other RSOs	36	39	4
Dedicated Road Safety web sites	24	47	5
Own searches of the Internet	29	46	4
Conferences	23	47	7
Journals	9	22	16
Analysis of data by in house researchers	25	25	15

This more robust financial and organisational foundation has had a demonstrable effect, with real successes that had been made in terms of reducing injury rates. This shift in attitude was particularly true in Inner London boroughs, where enthusiastic and committed teams were often involved in innovative projects that they were attempting to mainstream. However, accessing relatively small pots of money for additional road safety activities could be time consuming and, as some mentioned, not all boroughs had the kinds of skills needed for bidding for money.

Working in a time of better resourcing also brings its own challenges. These include:

- the gap between financial and human resources (e.g. finding enough suitably qualified engineers and RSOs).

- the increasing difficulty of achieving reductions on top of the substantial ones achieved so far.

- the 'activity imperative' – where there is funding for engineering works, there is a drive to 'do something'.

Opportunities 2: Emerging partnerships

Two recent developments have the potential to address issues of deprivation and risk in a sustainable way as they involve, ideally, local communities in addressing their needs and the opportunity to integrate road safety with other agenda. The first is the development of School Travel Plans, which in many boroughs have brought significant gains not only for the schools involved, but also for the wider community around them.

When done well, work on School Travel Plan can cascade out into the community. In one school (Outer London), for instance, with all sections of the school community involved in developing the plan, work on cycling as part of STP led to setting up a parents' cycling group, with increase in parent cycling as well as children cycling to school. In theory, School Travel plans are a good way of engaging local communities and ensuring that local schemes take residents' concerns into account:

> Since the inception of the school travel plan I think it's just a bit more coordinated. It's not just traffic engineers going out and saying "Well let's have a look where we can spend our money now." It's actually sort of engaging with the public, engaging with schools, finding out exactly what they want [and if] that's either not possible or not viable and that's when we may be able to put in a school crossing patrol, perhaps just extra signage, things like that (Engineer, Inner London)

The process of developing School Travel Plans had been a model of good consultation in this borough, with the engineer above pointing out that the process in a number of local primary schools had involved parents, governors and the

school children in consulting using a 3-D model of the school and its surroundings, on which visitors could stick on cards with issues that they were concerned about, a tool developed by the Neighbourhoods Initiative Foundation.[6] Developing the plans had also involved a number of local partners such as health service, Healthy Schools, emergency services and community forums. In terms of addressing deprivation, these kinds of consultations have real potential, as pointed out:

> In areas where there's a lot of English as a second language … and also people who don't want to shout out loud in a public meeting can just go and stick their card in (Inner London)

These consultations were reported to have had real impact in terms of building up good relationships between parking control staff and local residents in some deprived areas to address areas of problem parking.

However, it is important that the process involved genuine and inclusive consultation. When this did not happen, local residents reported feeling that schemes could reduce rather than enhance road safety, as this residents' association representative commented:

> The consultation was flawed – formulaic - asking 'do you agree with safer routes to school' which you can't disagree with – and then using that to claim everyone agreed. They didn't hold meetings that get to the nub of the issue… Things have got much worse since the road works - [the Council] have used the consultation to do something they wanted to do anyway…. There were zebra crossings with a traffic refuge in the middle and the traffic speeds were slow – cars would slow down when they could see people trying to cross. Now they've installed traffic lights, with a green man. People have been so upset, its made it more dangerous to cross the road – all the old rules of the road have gone – the traffic backs up all down Longridge Road, blocking entrances, and pumping out fumes. The traffic speeds up, because drivers get frustrated waiting at the lights, and there's been rat running in all the local roads. (Inner London, Community Partner organisation)

Certainly some boroughs reported limited consultation processes in general, involving sending out the Road Safety Plan for consultation and receiving few

[6] Details of the 'Planning for Real' consultation model and how to contact the Neighbourhoods Initiative Foundation can be found at http://www.nif.co.uk/planningforreal/

replies. This was reflected in the comments of many local residents, who reported that 'consultation' often meant being asked to respond to surveys in ways that did not capture their views. Involving stakeholders in developing road safety interventions in a meaningful way is, however, challenging, time consuming, resource intensive and requires skills that not all road safety teams have. Clearly full community consultations cannot be done over every intervention. The way forward may be to identify key areas for full consultation, such as around STPs, and ensure that other work within the road safety team is linked in where possible.

The second opportunity for good partnerships to build community orientated road safety work is the development of the Police Safer Neighbourhoods Teams. These are ward level teams headed by a sergeant with four PCs, which are being rolled out across the Metropolitan Police area. The explicit aim of these teams is to:

> .. listen and talk to you, and find out what affects your daily life and feelings of security … they work in partnership with you and other agencies to find a local solution' (MP 2006)

As these teams are envisaged as having a key role in linking between community and those organisations that can address their concerns (such as the LA), they are potentially a crucial link for mediating concerns about road safety, and linking these with other issues such as crime reduction. In a few boroughs, there were good existing links, over programmes such as cycle training, and in the survey 75 (90%) of RSOs reported working with the teams, although only 27 (32%) closely and regularly (see Appendix 1). In other areas, there is great potential for these teams to be a key liaison with local communities, and it would be a worth including the sergeants in training and networks on road safety. Although it would be inappropriate for them to be delivering road safety ETP interventions, ensuring that they are included in networks will raise their awareness of road safety issues and build the local networks needed for them to contact borough staff on community concerns.

In general, there was a very positive view of partnership working across the boroughs, with almost all (75, 90%) of RSOs agreeing that the 'time spent on delivering partnerships enhanced ability to deliver road safety programmes' and both the Boroughs and individual RSOs reporting high levels of partnership involvement, as summarised in the Tables in Appendix 1.

Opportunities 3: The role of the GLA and TfL

Overall, having a London Road Safety Plan and a sense of a regional vision for road safety across London was welcomed. Most were positive about the role of TfL, with most (see table 8) RSOs reported using routine information from TfL in their work. A few felt 'micro-managed' by TfL and would prefer more discretion over funding priorities, given that the process of bidding was seen as 'bureaucratic and arduous'. However, most of those interviewed accepted the need for having to monitor best use of money. In Outer London, some reported seeing TfL as being overly orientated towards Inner London issues.

Having a London wide body could be useful in terms of offsetting local borough politics:

> my group identifies it, it then comes back to a group of us where we discuss it and people may have other bits of knowledge that they want to feed into that before the bid goes in, it might be even political mightn't it … well, councillor obviously represent their people and they might say 'my ward's need this'… but when it all goes to TfL, TfL will ultimately decide what we can have so if councillor X has lobbied really hard and says he wants a subway in the middle of somewhere and TfL, we put that in as part of our bid, and eventually they'll say well that's not viable so there is a political element to it, isn't there? (Outer London)

Finally, a London wide vision offers the possibility of prioritising funding by needs assessment across the capital, although obviously there are political limitations to how far this could be adopted. Central funding has also offered the possibility of commissioning research that is outside the scope of individual boroughs but addresses their needs for information.

5. Discussion

Road safety professionals face considerable challenges in trying to address the issue of deprivation in their work, even if they consider it to be a relevant issue for them. First, they are (justifiably) primarily orientated towards the goal of reducing overall casualties. As in any other area of public policy, strategies designed to achieve global targets may not be the same as those that will redress inequalities. Indeed, efforts to reduce overall levels of risk often tend to exacerbate gradients in inequality. Second, there are a plurality of other policy goals in addition to addressing deprivation that they are also asked to consider.

The most significant challenge, though, is that they are asked to redress the *effects* of deprivation through 'down stream' interventions, whilst having no control over the 'upstream' causes. Addressing the underlying causes of inequalities in outcome, i.e. deprivation itself, is outside the remit of road safety teams, but they are asked to 'take deprivation' into account. There are, broadly, three rather different policy strategies that could be adopted to take deprivation into account:

- In terms of **resource allocation**, by for instance using ward level indicators of deprivation as a measure of need or targeting interventions at those groups at highest risk. This could happen between boroughs (in terms of TfL's allocation by need) or within boroughs.

- By delivering policies for which there is good evidence that they reduce inequalities in outcomes.

- By tailoring interventions carefully at the specific needs of different sectors of the population, to ensure that they are meeting the needs of all equally.

In this study, we found some support for the first strategy, at least in terms of prioritising action on, for instance, road calming measures in those wards with higher levels of deprivation within boroughs. For engineering interventions, there may be some room at the margins to allocate resources differentially in terms of need, at least between boroughs, although this does require local capacity to deliver. Within boroughs, this is more problematic. Although many boroughs have steep gradients in terms of the relationship between deprivation of ward and injury rates (see report for Part A), these are generally the boroughs with large disparities in deprivation across the borough. For those boroughs which are in general more or

less deprived, there is little mileage in allocating in terms of deprivation within borough. Where resources for evidence based approaches have to be prioritised (in, for instance, funding 20mph zones) it might make sense to use deprivation as a criteria for allocation. However, it should be noted that this might have costs in terms of effectiveness in reducing absolute casualty numbers (see Graham *et al* 2002).

Programmes such as Kerbcraft are designed to target ETP resources at those most in need. However, for educational interventions, for which there is little good evidence of their direct impact on injury reduction in general (Duperrex *et al* 2002), targeting is perhaps less credible as a strategy for reducing inequalities. First, the provision of road safety education and training is a necessary part of citizenship education that boroughs have a duty to facilitate, if not provide directly, for their populations. Even if there is no directly observable impact on injury rates, the opportunity to learn about traffic systems, and how to keep safe in them, is perhaps seen as an educational right. As part of a broader equality and diversity strategy, it is therefore necessary to consider how to provide this to diverse population groups, even though this in unlikely to lead directly to impacts on either casualty reduction or inequalities.

Limitations of targeting as a general approach to addressing deprivation include:

- It may be politically unacceptable;
- High risk groups may be statistical aggregations that have no real meaning as 'communities' one could target;
- Most significantly it is likely to have limited effectiveness, particularly if the reasons for high injury rates are not well understood

This was seen as a problem by some RSOs, who were concerned to address deprivation, but aware that it was difficult to do so within current constraints. In the longer term, it may be that RSOs will see their role change from being direct providers of road safety training, to being advocates for a broader strategy of road safety within their communities. Currently, RSOs spend considerable effort and time providing and organising individual orientated training for child pedestrians and cyclists (see Appendix 2, table 1 for summary of activities). It may be that more time will be spent on community advocacy and raising awareness of integrated transport issues, rather than directly providing these services. The challenge will be to provide ETP in ways which are appropriate across the borough, which is

addressing deprivation (and other social goals) in terms of *tailoring* interventions for particular groups, rather than targeting interventions at them.

There are real limitations in adopting the second strategy (delivering policies for which there is good evidence of impact on inequalities) given the limited evidence about the causes of inequalities in injury risk and, following from this, a widely reported lack of evidence on how best to address them. This was reflected in practice and, of necessity, most boroughs adopted a pragmatic approach based on local knowledge and speculation about likely causes. Without a good understanding of underlying causes it is very difficult to design effective programmes, and there is a real danger of designing programmes that do not resonate with community needs, or which are based on misunderstandings of attitudes or behaviour.

The third strategy is potentially the most productive, given that this addresses two of the key challenges: ensuring that road safety activity meshes with other policy goals, and ensuring that road safety interventions are tailored to the needs of those intended to benefit from them. This entails 'tailoring' in the sense of designing interventions (whether road engineering schemes or educational programmes) that are appropriate to particular local communities, rather than targeting in terms of prioritisation.

Policy makers and implementers face particular problems in settings where there is no overall 'vision' of how road safety fits with wider agenda, as particular interventions are then more likely to cause conflict, or at least potential conflict (such as attempting to increase cycle useage whilst reduce cycle injuries). This appeared to be a problem across London, with many RSPs advocating, for instance, a road danger reduction approach, but perhaps little evidence of this informing practice at a day to day level. To some extent this reflects historical service provision: if road safety training has traditionally been provided to schools, it is difficult to reduce provision. Despite a broad view that the effective ways of reducing road danger were reducing speed and volume, inevitably considerable effort went into those activities with less demonstrable impact on road danger reduction. A broad and holistic overview of how road safety aims fit into other goals, such as sustainable transport, promoting health or developing liveable communities, is perhaps a prerequisite of a robust policy to address deprivation.

A second condition is a commitment to meaningful community participation in decision making, so that interventions, whether road engineering works or

education, training and publicity, are tailored closely to the needs of local population. This presents particular challenges:

- London's communities are diverse and multi-layered, in that people in general belong to a number of cross cutting 'communities' based on communalities of faith, occupation, residence, common interests and so on. The statistical aggregates of 'high risk' groups for injury may not reflect communities that are experienced in everyday life. Given the difficulties of addressing these different population groups, a sensible strategy is to address population segments in terms of location, given that road danger is related to where people live and work.

- Consultation is time consuming, and requires skills and resources beyond those in most road safety teams. Deliberative consultation, in which people are invited to contribute to a decision making process that considers evidence and the perspectives of all stakeholders before coming to a consensus, is particularly challenging. However, the gains are that the process can result in better decision making, increased local democracy and greater commitment on the part of all residents.

Work on School Travel Plans in some areas has modelled how this could work, in bringing together all of those with an interest to develop consensus approaches to the problem. Schools are one obvious focus of local consultation around the street environment, but not the only one. The emerging programme of Metropolitan Police Safer Neighbourhood Teams also has potential to be a fulcrum of community consultation, with those involved mediating between community concerns and the LAs to address these with a focus on road safety. Currently, these teams may have little training in road safety, so there may be a need to raise awareness with police sergeants of how road danger reduction can fit into their broader remit of strengthening local security.

Models of partnership working to embed road safety within broader strategic priorities have been documented by the Neighbourhood Road Safety Initiative team, which looked at how the local authorities invited to participate in this initiative have been working. The participating authorities, all from outside London in deprived neighbourhoods, were encouraged to tackle road safety in a multi-disciplinary way, and through broader strategic developments. These include work engaging with communities through regeneration partnerships,

Neighbourhood Renewal and Children and Young People's partnerships (NRSI 2006). In London, some boroughs have the capacity to build on similar partnerships and cross-cutting strategic work, whereas other road safety teams remain fairly isolated and only collaborate on one-off projects.

6. Conclusion

This study identified considerable optimism across London about both the gains that had been made in increasing road safety in the capital in the context of moves towards more sustainable transport policy, and also the possibilities for further gains, given relatively good levels of funding and political commitment. Deprivation was not identified as a major priority for most road safety teams, although many were committed to addressing the issue where they could.

Road safety teams in London face a number of challenges, however, in meeting both their obligations to take deprivation into account and their other statutory obligations. These include:

- trying to 'address deprivation' when there is little consensus about the causes of inequalities in injury risk
- developing services for diverse, and often rapidly shifting, populations
- taking deprivation 'into account' whilst also fulfilling obligations to the whole borough population
- more generally, developing road safety policy which does not compromise other policy goals, such as health.

It may be that the question of 'how to take deprivation into account' is not quite the right question. Those responsible for planning and delivering traffic schemes, education, publicity and training can do little about the underlying causes of deprivation. They can, though, do two things which are likely to move policy in the right direction.

First, they can deliver services in ways are likely to reduce one major cause of inequalities in risk. This is the greater exposure to risk that poorer children, in particular, have because they are more likely to be pedestrians and cyclists. Interventions that both reduce the volume and speed of motorised traffic and increase the amount of active transport will move London closer to the point where the relative risk of being a pedestrian or cyclist is no longer greater than that of being in a car. This is the critical mass effect, in which active transport becomes safer once a larger number of people are doing it (Jacobsen 2003). In the medium to long term, this is likely to reduce one significant factor in risk differentials. In the short term, increasing the number of people walking and cycling may, though, increase the number of injuries. It is also important, then, to have a road safety

strategy which does not narrowly focus on injury rates, but looks at more holistic transport goals, such as increasing the numbers walking and cycling. This would be in line with the London Road Safety Plan.

The second route is through taking deprivation 'into account' in the same way as other population differences are taken into account, through ensuring that services are provided in ways appropriate for the whole population. This entails careful planning for consultation, for instance, to ensure that all sections of local communities can be involved, and working with local communities and their representatives to ensure that services are tailored in appropriate ways.

The recommendations from this section follow on from these points, and are suggestions for realistically addressing the implications of deprivation for road safety in a feasible way that is most likely to integrate with other borough policy goals.

7. Recommendations

To summarise, this project identified continuing inequalities in risk for road traffic injuries across London's population. Those in the most deprived areas are at higher risk of injury, especially as pedestrians. Our data and that from other sources suggests that **differences in exposure** account for the higher risk to those in the most deprived areas and those from black ethnic groups. That is, individuals from these groups are more likely to be travelling as pedestrians or on public transport (entailing some walking) and less likely to be car occupants.

This project also reviewed the evidence for effective interventions. One strategy is to target those interventions which have been shown to be effective in reducing road traffic collisions at those groups at highest risk, in the hope casualty rates will then reduce in these groups at a faster rate than in others. There is some scope here with those engineering solutions which reduce traffic speed and volume. Our first recommendations are therefore to continue to concentrate resources on this strategy, which is likely to both contribute to national and London casualty reduction targets as well as potentially reduce the deprivation gradients.

> **Recommendation 1: To continue focusing resources on interventions which reduce traffic speed and volume.**

> **Recommendation 2: To consider further changes in the allocation of resources between boroughs in terms of need (indicated by deprivation levels and collision rates)**

In the longer term, with a greater proportion of London's population cycling and walking, the relative risks differentials of these transport modes will reduce, as we move towards the critical mass needed to make walking and cycling relatively safer. At this point, a key contributor to risk differentials between population groups will be reduced, and it is likely that deprivation gradients will flatten. However, this leaves a potential short and medium term challenge, in that encouraging walking and cycling might increase crude collision rates. It is therefore essential that road safety teams are working within an integrated transport agenda, and that this in turn articulates with other policy goals. This avoids what otherwise appear to be 'trade-offs' between short term safety goals and other priorities, such as safer roads in the long term, health or sustainability. Our third and fourth recommendations are therefore:

Recommendation 3: For borough teams to work within an integrated framework of road safety, which promotes walking and cycling.

Recommendation 4: For TfL to work with borough teams to develop a shared borough vision of how road safety fits into broader agenda around sustainable, healthy, liveable and safer communities.

Related to this are the selection of appropriate targets for work towards road safety. Although casualty reduction targets are a very useful focus for motivation, activity and advocacy, at both London and borough level, they generate problems if taken in isolation or are interpreted at inappropriate levels. At borough level, fluctuations in small numbers make it difficult to monitor trends over time. Taking exposure (for instance, the amount of walking and cycling activity) into account is difficult, but it might be possible to also include other relevant indicators such as confidence in walking and cycling in the locality.

Recommendation 5: When new targets are agreed for London in 2010, the following issues could be considered:

- How London's targets for reductions in casualties are translated into meaningful borough level targets

- Whether other indicators of the overall safety of the road environment, such as the confidence local people feel in cycling and walking, should be included.

Given the limited evidence for the effectiveness of educational interventions on their own, compared with engineering and legislative interventions, it is doubtful whether targeting these will have an impact on deprivation gradients, although such work is of course essential for several reasons. First, education, training and publicity are part of the statutory work of road safety teams, as part of the general citizenship education to which all are entitled. Second, education and publicity are essential for creating a concern within both the general population and policy actors about road safety as a policy priority. Third, educational interventions are often a prerequisite for public acceptance of such interventions as legislation changes or engineering solutions. ETP thus properly addresses the entire borough population, rather than being targeted at 'high risk' groups. Targeting is not only likely to be ineffective in addressing deprivation, but also potentially damaging if based on inadequate understanding of the mechanisms that link aspects of deprivation to

increased risk. However, in London's diverse boroughs, providing appropriate ETP interventions requires tailoring these to particular audiences. We would therefore recommend an approach of **tailoring**, rather than targeting, with ETP. Given that London's communities are cross cutting, as well as diverse, and that the statistical 'high risk' groups may not coincide with 'real' communities, it may make sense to work with geographic communities (such as those around schools) rather than attempt to identify, for instance, communities in terms of their risk profiles. Tailoring is then best done in consultation with local communities, and requires good partnerships both with other agencies and local community groups. Within this model, the role of the RSO may shift towards one of being an advocate within their communities for road safety issues. The final recommendations relate to these implications for working with local communities:

Recommendation 6. For TfL to develop training in appropriate forms of deliberative community consultation or to identify funds for this to be provided for road safety staff.

Recommendation 7. For borough staff to build on or develop locality based networks (such as those around School Travel Plans or with Safer Neighbourhood Team sergeants) as a potentially vital link between local residents and local authorities on a broader approach to community safety.

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Appendix 1

Table 1: number of RSOs who reported selected partnerships

INTERNAL	**Work together closely and regularly**	**Work together/ liaise on specific projects**	**Intend/ may work together in the future**	**Not a relevant partner Here**
Borough Traffic/ Transport Engineers	36	43	1	1
Borough Equal Opportunities Team	0	9	26	46
Council 'youth' team or equivalent	2	22	30	29
Other key partners within the council - please specify (e.g. education/ community safety)	11	29	10	9
EXTERNAL				
RSOs from other Boroughs	14	49	10	9
Metropolitan Police	27	48	6	2
Police Safer Neighbourhood Teams	12	40	16	11
London Fire Brigade	8	50	17	8
Local Community organisations (e.g. faith groups, residents' associations)	7	39	20	13
Local health visitors	13	32	17	20
Primary Care Trust	19	36	8	18
Local teachers/head teachers	63	18	1	0
Sure Start programmes	11	26	22	19

Appendix 2

Table 1: Number of RSOs who reported selected current activities

	Delivered routinely across the borough	Delivered to selected groups	One-off programmes only	Delivered by partner organisation	No involvement in this activity
Pedestrian skills for under 5s and parents	31	25	11	2	10
Pedestrian education/ training for 5–7 year olds	45	26	7	0	4
Pedestrian education/ training for 7–11 year olds	43	19	8	0	7
General safety training for 7–11s (e.g. Junior Citizen)	55	17	8	0	7
Road safety in Secondary Schools	25	20	28	0	4
Cycling proficiency	63	11	0	6	3
Road safety for older citizens	7	19	27	3	25
Training for young drivers/ pre-drivers	10	23	18	4	24
Training/ education/ publicity for powered two wheeler users.	12	8	18	13	27

Table 2 Number of RSOs reporting ' For those activities that are targeted at selected schools or groups,, how do you select which ones to work with?

	Only or main reason for prioritising	This is taken into account	Not taken into account
Good working relationships with individuals in selected organisations	19	46	11
Rolling programme of organisations each year	23	44	8
Historical links with organisation	8	43	22
Levels of deprivation in locality/group	14	39	20
Community concerns	11	50	12
Injury statistics	24	50	6
Cost/ cost-effectiveness	8	41	23
Other criteria of population or area (e.g. by request, those that have a School Travel plan)	7	8	9