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Children aged 9–14 living in disadvantaged areas in England: Opportunities and barriers for cycling

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ABSTRACT

The aim of this paper is to take a holistic perspective to explore levels of cycling and opportunities and barriers to increase children's safer cycling in disadvantaged areas in England. The study was one part of a larger study which explored the factors underlying the high level of road traffic casualties especially among children in the most disadvantaged areas of England and to explore how this impacts on mobility and quality of life. The methods involved a cross sectional survey comprising school based questionnaire surveys with children aged 9–14 and focus groups with parents who had children within this age range. The surveys were conducted in 2007 and the focus groups during 2008. 4286 children completed the survey and eight focus groups were held. Bike ownership (77%) was high, use in previous week moderate (39%) but only 2% cycled to school. Ownership was significantly lower in minority ethnic groups. Despite young children's strong preference to travel by cycle (30%) than walk or go by car, most parents felt it was too hazardous. It is unlikely that these findings would be any different from the rest of England, however the combination of environmental and social factors may elevate the risks for young cyclists in these areas. This paper concludes that a number of barriers exist to increasing levels of cycling among children living in disadvantaged areas particularly amongst ethnic groups. These barriers could be addressed by environmental modifications to reduce speeds and by reducing the levels of antisocial driving and riding in residential areas and around destinations where children travel, by providing cycle training to improve children's skills and parent's confidence, and by providing secure storage facilities for bikes. Until these barriers are addressed it is unlikely that cycling will increase despite the strong preferences children have to travel by bike. Such preferences to cycle provide an opportunity for local authorities to act on.

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1. Introduction

Both within England and many other high income countries, governments have responded to growing concerns about obesity in the population with initiatives to increase physical activity as part of

everyday activity, especially by encouraging more walking and cycling. If these modal shifts do occur, there will be an even greater reason for concentrating on the safety of these vulnerable road users. Increasing cycling levels would impact on a number of government agendas by helping to improve health and reducing obesity, providing sustainable transport and reducing carbon emissions (Sustainable Development Commission, 2007). Cycling is promoted by the government in an attempt to transform the way we travel to create a greener, healthier nation (Cycling England, 2009).

Arguably, trying to increase the levels of cycling in disadvantaged areas is more important than in more affluent areas because obesity levels tend to be highest in the lower socioeconomic groups (Law et al., 2007). However, there is clearly a balance to be struck between the benefits of increased physical activity and the risks of injury because whilst all people are exposed to the risk of injury on the road as part of their everyday life, the burden of these injuries is not evenly spread across our society (Hayes

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et al., 2008). Road traffic casualties disproportionately affect some groups. Disadvantaged people and those living in disadvantaged neighbourhoods are much more affected than those living in more affluent areas; some age groups of vulnerable road users, such as children, young adults and older people, bear a greater burden (Graham et al., 2005; Lyons et al., 2003). For children the risks of injury as a cyclist are not equal across society: children from the lowest social class are 26 times more likely to be killed compared to their more affluent peers in the highest social class (Edwards et al., 2006). This is not surprising given that the traffic environments in which people in disadvantaged areas live are some of the most hazardous (Christie et al., 2007a) and this combined with the poor quality of the built environment contributes to obesity by deterring people from active travel in England (Law et al., 2007).

The risk of injury as a road user also appears to be higher for people from the disadvantaged Black, Asian and Minority Ethnic (BAME) population. There is a small but growing body of evidence on the link between socioeconomic status, ethnicity, and road traffic injury. Ethnic minority children are at increased risk of road traffic injury as pedestrians (Christie, 1995a; Thomson et al., 2001) though little is known about their risk as cyclists. There is also some evidence to suggest that BAME groups are less likely to adopt safety behaviours such as wearing a seat belt (Christie et al., 2008). However, one of the most difficult problems in understanding the injury risk of children is to differentiate the effects of socioeconomic status and ethnicity because many minority ethnic residents tend to be the most disadvantaged in society (Thomson et al., 2001). To add to the complexity, people from minority ethnic groups tend to cluster in specific areas, which are often areas of multiple disadvantage, that is areas that are characterised by having higher than average proportion of people unemployed or on low incomes; lone parent families; with lower educational achievement, poorer health outcomes and lower life expectancy (Owen, 1992, 1994). It is the environment that influences behaviour and risks that lead to poor health outcomes in disadvantaged areas (Macintyre et al., 1993; Sloggett and Joshi, 1994).

It has been argued that a holistic approach is particularly useful in trying to explain the complex factors that underlie road user behaviour (Crawford, 2008). In understanding health inequalities a holistic approach is represented by the model proposed by Dahlgren and Whitehead (1991) whereby an individual's health is determined not only by their individual characteristics but the wider social, economic and environmental factors.

The evidence (Brussoni et al., unpublished data) suggests that a range of multifaceted and interrelated factors are associated with children's risk as vulnerable road users in disadvantaged areas. Children living in overcrowded accommodation where there is limited play space may mean that children play out in the street. The streets are often the most convenient and cheapest place for children to play as often parents may not be able to pay for or transport their children to supervised activities after school. Economic factors limit parent's ability to purchase safety equipment such as cycle helmets. Factors related to low parental age and low education may influence parents understanding of the risks that their children face and how to give their children information to avoid risk. In addition, the ability of parents/carers to supervise children may be influenced by being a single parent in families where often there are several children and where depression and family illness can also influence a parent's ability to safeguard their children.

Environmental risks include speed of traffic, housing type and density, kerb parking and road density, traffic volume, and lack of safe crossing sites and play areas. Different housing types are also associated with different child casualty rates. Many of these factors are highly correlated with low socioeconomic status. These road environments are associated with older residen-

tial areas developed between the early 1900s to late 1950s before mass car ownership and are characterised by long straight roads which give rise to high vehicle speeds and tend to have considerable on street parking because there are few facilities for off road parking. These residential areas were built before 1960 after which road safety became an integral part of the housing development guidance (Christie, 1995a; Sharples et al., 1990; Ward et al., 1994). Disadvantaged children are also more likely to spend time in these hazardous road environments playing unsupervised or spending time in the street and are much less likely to go to clubs after school compared to their more advantaged counterparts (Christie, 1995b).

England could become safer for cyclists because other countries have achieved this. For example, taking exposure into account, child cyclists in the UK are much more likely to be killed than their counterparts in other European countries such as: The Netherlands, Germany and Sweden (Christie et al., 2007b). Particularly for young children, parents are the gatekeepers of their child's independence but have to make a judgement about the 'trade off' between independence and safety. Parents have a key responsibility for keeping children safe but also wish to allow children some independent mobility in order to develop social networks and to learn about the external environment through interacting with it (Bjorklied, 1992; The Children's Society, 2007). All too often parent's safety fears means that children are not permitted to cycle on the road (Lorenc et al., 2008; Christie et al., 2007b). These fears are not without foundation. Analysis of UK national fatality data shows that drivers from more disadvantaged areas are over represented in crashes involving reckless driving (driving at speed) and alcohol (Clarke et al., 2008) and are much more likely to drive unlicensed, untaxed and uninsured which are also predictors of collision involvement (Knox et al., 2003). In this situation it is hard to imagine that 'safety in numbers' will be achieved, the phenomenon whereby increasing prevalence is associated with proportionally greater safety (Jacobsen, 2003).

In 2004, the flagship Neighbourhood Road Safety Initiative (NRSI) was set up by the UK Department for Transport (DfT), in response to the Government's commitment to take into account the significantly higher incidence of casualties in disadvantaged communities whilst improving people's mobility and accessibility to local services. The NRSI focused on fifteen of the 15% most disadvantaged local authorities in England (based on the Indices of Multiple Deprivation) and which also had the highest child casualty rates. This study on cycling was part of a larger study funded by the DfT to increase understanding of the links between mobility, safety and quality of life in disadvantaged communities.

The aim of this study was to inform our understanding of the opportunities and barriers for cycling in disadvantaged areas from a holistic perspective exploring the role of individual, social and environmental factors. The specific research objectives of this study were:

- To explore children's travel in disadvantaged areas to help understand whether their exposure is different from national patterns particularly in relation to cycling.
- To explore how children vary in their self reported cycling behaviour in relation to age, gender and ethnicity.
- To explore opportunities and barriers for children's cycling including their desire to cycle and their parents views about this.

2. Method

2.1. Quantitative methods

Questionnaire surveys were arranged in primary and secondary schools in all the 15 NRSI areas. The NRSI areas were

relatively small and schools were selected within these areas. Table 1 shows the town and region of England where the NRSI areas are located.

Quantitative surveys were conducted among school children (aged 9–14). This age range was chosen because it represents the ages where children become independent travellers marking the transition between primary and secondary school. Class teachers administered the self-completion questionnaire to pupils in their schools. In multi-lingual schools translators were used to assist with questionnaire administration.

The questionnaire sought information on the places children had travelled to in the last week, what transport they had used and sociodemographic information on age, gender and ethnicity.

2.2. Qualitative methods

Eight focus groups were conducted during 2008 with parents of school children aged 9–14 and who lived in NRSI areas. These were conducted in selected areas which had high levels of disadvantage and child road casualty levels. These areas were largely in the northern areas of England:

- Bolton.
- Bradford.
- Blackburn with Darwen.
- Blackpool.
- Oldham.
- Salford.
- Stoke on Trent.
- Wigan.

One focus group was conducted exclusively among Sikh and Muslim women. The participants represented their local population and requested that the group only involved members of their own community as a condition of their participation. Another was conducted among parents where at least one child had special needs such as autism, Down's syndrome or deafness.

Participants were provided with information sheets and consent forms. The consent form also sought agreement for the proceedings to be taped. Parents were recruited through a variety of means; through residents associations, via liaison with schools and through other community based initiatives such as regeneration projects. Participants were paid a cash incentive to attend the focus groups.

All focus groups were taped and transcribed and emergent themes were identified using thematic content analysis (Gibbs, 1997). Data were also examined by a second coder to ensure consistency in approach. Quotes presented in this paper are used to exemplify themes that arose. Ethical approval for the study was granted by University of the West of England Ethics Committee.

Table 1
Location of the schools involved in the NRSI school based questionnaire survey.

Region of England	NRSI areas
North West	Bolton, Bradford, Blackburn with Darwen, Blackpool, Bury, Liverpool, Manchester, Oldham, Rochdale, Salford, Tameside, Wigan
Yorkshire and the Humber	Bradford
East Midlands	Nottingham
West Midlands	Sandwell, Stoke on Trent

3. Results

3.1. Quantitative data

3.1.1. Where children go and how they travel

The self-completion questionnaire was completed by 4286 children aged 9–14 from 37 schools; 51% were boys; 38.8% were aged 9–10, 48.5% aged 11–12 and 12.7% aged 13–14. Based on School Census (2007) figures for average class sizes in Key Stage 2 (primary school for children aged 5–11) (27.2:1) and Key Stage 3 (secondary school for children aged 11–16 years old) (21.3:1) this targeted, purposive, sampling approach yielded a response rate of 98%.

Children were asked to indicate on the questionnaire, from a specified list, which places they had been to in the last week and how they had travelled from a specified list of destinations. This data showed that cycling is the least used mode. When children do cycle they are more likely to do so when travelling to parks and play areas (Table 2).

A comparison of responses of survey participants aged 11–14 with those in the National Travel Survey (conducted in England in 2007) aged 11–16 (the nearest comparable age range) showed that children in disadvantaged areas were significantly more likely to walk to school (Chi squared = 19.2, $P < 0.0001$), significantly less likely to cycle (Chi squared = 7.35, $P = 0.007$) or travel by bus (Chi squared = 18.17, $P < 0.0001$) compared to children in the national sample (Table 3).

Table 2
Children aged 9–14 living in disadvantaged areas in England where they go and how they travel.

Destinations (specified list)	Number	Car (%)	Walk (%)	Bike (%)	Taxi (%)	Bus (%)
To school	4286	31	52	1	1	14
From school	4286	25	56	1	1	14
Local shop	3155	34	58	3	2	4
Town shop	2767	44	21	1	4	29
Sports clubs	1830	48	43	5	1	4
Cinema	1618	54	17	2	7	21
Parks	1495	14	76	9	0	1
Burger bars (i.e. fast food outlets)	1327	49	35	4	3	9
Travel to places of worship	1115	41	53	2	1	2
Play area	987	21	67	1	1	1
Youth club	803	30	60	5	2	4
Uniformed clubs (scouts, brownies etc.)	580	50	36	4	3	6
Music	504	38	48	6	3	5
Skate board park	416	18	54	24	2	2

Table 3
Percentage of participants by mode of transport to/from school: NRSI School survey (2007) compared with National Travel Survey data 2007^a.

	NRSI Children aged 11–14 (N = 2614) %	National Travel Survey Children aged 11–16 (N = 1545) %
Car	21	22
Walk	50	43
Bike	1	2
All bus	24	30
Other: motorbike, train, metro; skates/skateboard	4	4

^a National Travel Survey, 2008. <http://www.dft.gov.uk/pgr/statistics/datatables-publications/personal/mainresults/nts2008/>.

3.1.2. Prevalence of cycle use, safety behaviour and travel preferences

Table 4 shows prevalence of cycling, safety behaviours and travel preferences by age group.

The majority of children owned a bike, and over half of these said they had cycled in the last week; but only 2% cycled to school. Only 40% of all students sampled had received cycle proficiency training. Around half of those who owned a cycle helmet said they had worn their helmet last time they cycled. As children get older they are less likely to report owning or wearing a helmet a pattern that is shown nationally (Sharratt et al., 2009). The number who own or have access to a bike is very similar to the national average, for children aged 11–16 years which is 76% (<http://www.dft.gov.uk/pgr/statistics/datatablespublications/nts/>).

Children were asked on the questionnaire “If you could change the way you travelled to school, would you prefer to travel by: “Car”, “Walk”, “Bike”, “School Bus”, “Public bus”, “Taxi”, “Motorbike”, “Train/Metro” “Skateboard/skates”? Children were asked to tick one box only. Around a third of children aged 9–10 years at the primary stage of education would prefer to change to cycling, a larger percentage than for any other mode. There is a clear tail off in preferences to cycle as children get older marking the transition from primary to secondary school.

3.1.3. Ethnicity

The population was ethnically diverse, with 72% reporting that they were white, 11% Pakistani, 4% black, 3% Indian, 3% Bangladeshi and 4% of mixed ethnicity. This distribution is not typical of the UK as a whole but is a typical pattern in disadvantaged wards (Dorsett, 1998). Table 5 shows that young people who define themselves as black African, Indian Pakistani and Bangladeshi are less likely to own a bicycle than those who are white or black Caribbean. Similar trends appear in terms of those young people reporting that they have never ridden a bicycle. Only 1 in 10 young white and black Caribbean reported having never ridden a bike compared to over 1 in 4 Indian, Pakistani and Bangladeshi young people.

Table 4
Children aged 9–14 living in disadvantaged areas in England: Prevalence (%) of cycling, safety behaviour and travel preference by age group.

	9–10 years (N = 1362) %	11–12 years (N = 1891) %	13–14 years (N = 510) %
Own a bike	80	79	73
Received cycle training	43	43	36
Own a cycle helmet	39	30	19
Wore a helmet last time on bike	26	16	9
Cycled in last week	39	40	37
Prefer to travel by car	20	30	32
Prefer to walk	25	25	26
Prefer to cycle	30	16	15

Table 5
Prevalence of bike ownership and cycling experience by ethnic group.

Ethnic group	Number	Percentage who own a bike	Percentage who have never ridden a bike
White	2870	84	11
Black Asian	50	75	17
Black Caribbean	10		60
Black African	74	63	18
Indian	90	62	33
Pakistani	499	62	25
Bangladeshi	154	55	29
Mixed	150	82	13
Other	47	62	28

3.2. Qualitative themes

The eight focus groups engaged a total of 67 participants. On average, there were eight participants per group with 90% being mothers. The qualitative research was used to explore parent's views of children's travel and safety to help identify opportunities and barriers for children's active travel. A number of key themes emerged.

3.2.1. The safety of the road traffic environment

Clear barriers to children's cycling are parent's fears about the danger posed by their local traffic environment. The narratives of parents revealed that they had considerable concerns about safety in their neighbourhoods. It is concerns like these that have led Play England (2010) to launch a manifesto for play to address the serious consequences that parental anxieties have for the health and happiness of children. Several of our participants had known about collisions in their neighbourhood thus increasing their anxieties about the safety of the roads. There were feelings that many drivers drove too fast in their neighbourhoods and many young people, as drivers and motorbike riders, were antisocial in their use of the roads:

“The thing about that estate there is a lot of the people who are speeding round on mopeds and things at the minute. They are people who live there who they know there are kids there, they know the kids. Mine are not allowed to play on the street even the 9 year old is just not allowed.” (Focus group with parents, Town of Wigan, 2008)

Parents made judgements about allowing their children to cycle on the roads based on how safe they felt the traffic was. Many parents mentioned that both they and their children wanted to cycle but that they prevented them doing so because they felt it was too dangerous:

Interpreter “No they wouldn't want to ride a bicycle and they feel that the road is too busy and they would not like to see their children on the bicycles because of this. That is why.” (Focus group with Sikh and Muslim parents, Town of Bradford, 2008)

3.2.2. Children's skills as cyclists

Many parents felt that their children did not have sufficient skills as cyclists to deal with the road traffic environment and this meant they were not confident that their children could cope on the roads:

“My little boy one day came in and he said to me “Mum can I ride the bike to school”, I said “No chance” he said “Why I have got lights I will be all right” then he said “When am I supposed to stop on the road.” . . .Do you really think I am going to let my son on a road with a bike, no chance whether he is walking it, biking it, it is dangerous, end of.” (Focus group with parents, Town of Oldham, 2008)

Given the documented and perceived poorer safety records in these areas, these parental anxieties are undermining hitherto normal childhood experiences. Growth of risk aversion and its intrusion into every aspect of children's lives restricts children's play, limits their freedom of movement, corrodes their relationships with adults and constrains their exploration of physical, social and virtual worlds (Gill, 2007).

3.2.3. Concerns about cycle theft

Another barrier for children cycling to school was parent's perception that if children took their bikes to school they were likely to be stolen:

“It is no good with bicycles because they get nicked when they go to school on them, do you know what I mean, be lucky if you have got a wheel there” (Focus group with parents, Town of Stoke, 2008)

3.2.4. Children would like to cycle more

Moreover some parents felt that there was a great unmet need among children to be able to ride their bikes and use them as part of their leisure activities:

“A lot of the kids do always ask about somewhere safe to ride their bikes because I don't think it is particularly safe to ride bikes round here. ...like waste ground opposite our building which is where they have been doing an awful lot of bike riding making jumps and making ramps because there isn't anywhere that provide that for them.” (Focus with parents, Town of Stoke, 2008)

4. Discussion

Our study suffers from the usual limitations of employing a self completion survey method with children from disadvantaged multi-ethnic backgrounds where literacy levels may be low. Despite piloting the questionnaire, it is quite clear that some children struggled with completing it and for some questions there were missing values where the questionnaire had been partially or incorrectly completed. This was a particular problem in the schools where multiple primary languages were spoken amongst the children.

A major strength of this study is that it engaged a large number of participants, recruiting hard to reach groups such as those from ethnic minority groups and parents of children with special needs. Although the voluntary and self selecting sampling technique may mean we were more likely to engage with families that are less excluded than others our experience of recruiting through people who work with the community suggests that we have been able to include a broad range of families from varying social and cultural backgrounds from different districts. Given the diversity among the focus groups, the recurrent themes across different groups and districts suggests that the issues raised in this research are common problems and are relevant to disadvantaged communities across England and more widely. A further strength of this study is that it integrates data from quantitative and qualitative methodologies providing evidence about the opportunities and barriers to facilitate cycling in disadvantaged areas which engaged with both children and their parent's perspectives.

This research adopted a holistic approach to explore the role of social, economic and environmental factors in children's cycling behaviour in disadvantaged areas in England. This study has shown that whilst bike ownership is relatively high, suggesting there are few economic barriers to accessing a cycle, cycling on journeys to school still remains minimal at around 2%, similar to the national average. However, almost half of children aged 9–14 from disadvantaged areas cycle in their leisure time. This study has shown for the first time that whilst cycling is relatively common and popular amongst 9–14 year old children in these areas there are considerable differences between ethnic groups, with much lower bike ownership in Asian and African families. Young Asians and Africans are more likely to report that they do not own or have never ridden a bicycle. It is not entirely clear what social, economic or environmental factors explain these differences or how this should be addressed; a social marketing approach may be best suited to understand the issues that underpin this finding (Smith, 2006).

Our research and that of others (e.g. Kamphuis et al., 2007) clearly shows that social factors such as parental perception of risk

combine with poor quality environments to create a barrier against children cycling. Parent's fears for their children's safety are strongly held and whilst they acknowledged their children's desire to cycle they felt they could not allow this because of hazardous traffic environments and the perception that their children were not skilled enough to cope with these hazards. Furthermore, cycling to school was not encouraged for the reasons above and because it was felt that there were not enough secure cycle storage facilities at school to deter theft. Such parental concerns about safety have also been shown to influence modal choice for school journeys in other countries (Lang et al., 2010). These findings echo the results of other studies which show that parental fears of safety combine with young people's own perceptions and produce a barrier to cycling as a means of active transport (Carver et al., 2008).

However, there are opportunities to consider a holistic approach to improving the prevalence and safety of cycling in disadvantaged areas addressing the role of wider social, economic, and environmental factors. Around a third of younger children (aged 9–10) said they would prefer to cycle to school than use any other mode. This opportunity to increase cycling is unlikely to be realised unless parental fears are addressed by improving the safety of the road environment. Within residential areas the speed and volume of traffic needs to be reduced so that they become less hostile for cyclists, this needs to be addressed through engineering and enforcement. There is evidence that the rates of child casualties are reduced by area wide traffic-calming (Clope et al., 1999; Mackie et al., 1990; Wheeler and Taylor, 2000; Jones et al., 2005) and that 20mph zones may reduce child road casualty rates for both child pedestrians and child pedal cyclists (Grundy et al., 2008; Webster and Layfield, 2003; Grayling et al., 2002; Webster and Mackie, 1996; Layfield et al., 2005; Tilly et al., 2005; Webster et al., 2005). There is also evidence from USA that safe routes to school (SRTS) programmes based on engineering measures may reduce child casualty rates as pedestrians or cyclists (Gutierrez et al., 2008; Blomberg et al., 2008). Children want to take their bikes to parks and play areas so more could be done to ensure that there are accessible and safe cycle routes to these destinations. These could also be good venues to deliver cycle maintenance or safety initiatives such as promoting cycle helmet wearing which have been shown to reduce head injuries among children (Sethi, 2008). Also, within these areas it may be possible to create cycle paths or circuits to encourage cycling, especially by the younger children.

One social factor that needs to be addressed relates to the anti-social behaviour of drivers and riders in local neighbourhoods. Research to reduce child pedestrian casualties has showed that interventions that combine both engineering measures and enforcement show the greatest impact on child casualties (Van Houten and Malenfant, 2004). Given the high levels of anti social driving in disadvantaged areas (Clarke et al., 2008; Knox et al., 2003) police enforcement is critical to improving the safety of neighbourhoods for children as cyclists and pedestrians. Another social factor that needs to be addressed is improving the skills of children as cyclists which may help to improve parent's confidence in their children's ability to deal with the traffic environment. The cycling behaviour of children could be improved by cycle skills training delivered through schools. A targeted approach is needed to deliver cycling skills courses such as the national scheme Bikeability (<http://www.dft.gov.uk/bikeability/>) in areas of disadvantage in the same way that pedestrian training skills (<http://www.kerbcraft.org/>) have been successfully delivered in these areas (Whelan et al., 2008). However, currently there is a charge for this cycle course and this may provide an economic barrier to uptake amongst disadvantaged children. There may be opportunities to provide family bike training to encourage a shared approach to safety. Similarly, if parents are concerned about cycle theft then

secure cycle storage facilities need to be available near the key destinations where children travel (i.e. school and shops). This would address an economic barrier for cycling to school.

From a holistic perspective addressing the opportunities and barriers for children as cyclists in disadvantaged areas will need a range of stakeholders to work in partnership. These need to include road safety departments, those with a responsibility for providing safe and secure parks, the police, youth workers, schools and those responsible for promoting active transport for health and environmental sustainability. Most importantly, these stakeholders need to engage with the community, including hearing the voices and views of the children who wish to cycle. It is partnership approaches involving a range of agencies that have been identified as being the most effective in reducing injuries (Crombie, 2002).

Finally, to fully understand the impact of any of these suggested interventions there needs to a systematic approach to monitoring and evaluation (NICE, 2010) so that the costs (injuries) and benefits (improved health and access to facilities) of increasing cycling activity among children in disadvantaged neighbourhoods can be understood, exploring the differential effects among ethnic groups.

5. Conclusions

A holistic approach has proved useful in understanding the opportunities and barriers for cycling in disadvantaged areas and in terms of economic, social and environmental factors. There is no clear evidence that children in disadvantaged areas cycle more or less than children in the rest of England so this does not explain high levels of casualties in these areas. However, this report shows that cycling does vary with ethnic origin with around a third of children from an Asian background having never ridden a bike. The greatest opportunity for increasing cycling is that young children want to cycle. The greatest barriers to increasing cycling is the hazardous traffic environment and antisocial driving and riding in disadvantaged neighbourhoods. This can be mitigated by taking a multiagency approach involving education, enforcement and engineering. This study provides information for local authorities in disadvantaged areas to show where children use their cycles so that they can help improve safe access to these destinations for cyclists. Until the real and perceived safety of the road environment is addressed it is unlikely that levels of cycling will increase in these areas, despite the strong preferences of children to travel by bike. The scale of the inequality in bicycle ownership and use among children from different ethnic groups is another important public health issue. The issues underlying these differences need to be explored further.

References

- Bjorklid, P., 1992. Children's traffic environment and road safety education from the perspective of environmental and developmental psychology. In: FERSI Conference, Berlin, Germany.
- Blomberg, R.D., Cleven, A.M., Thomas, F.D., Peck, Sr., R.C., 2008. Evaluation of the Safety Benefits of Legacy Safe Routes to School Programs, Dunlap and Associates, Incorporated. National Highway Traffic Safety Administration, Report No. HS-811 013.
- Brussoni, M., Towner, E., Christie, N., Ward, H., unpublished data. Evaluation of the Department for Transport Neighbourhood Road Safety Initiative. Literature Review: Deprivation and Road Traffic Injury Risk: Vulnerable Groups. Department for Transport.
- Carver, A., Timperio, A., Crawford, D., 2008. Playing it safe: the influence of neighbourhood safety on children's physical activity – a review. *Health & Place* 14, 217–227.
- Christie, N., 1995a. The High Risk Child Pedestrian: Socio-economic and Environmental Factors in Their Accidents. Transport Research Laboratory, Report 117, TRL, Crowthorne.
- Christie, N., 1995b. Social, Economic and Environmental Factors in Child Pedestrian Accidents: A Research Review. Transport Research Laboratory Project Report 116, TRL, Crowthorne.
- Christie, N., Ward, H., Kimberlee, R., Towner, E., Sloney, J., 2007a. Understanding High Traffic Injury Risks for Children in Low Socioeconomic Areas: A Qualitative Study of Parents' Views. *Injury Prevention* 13, 394–397. doi:10.1136/ip.2007.016659.
- Christie, N., Cairns, S., Towner, E., Ward, H., 2007b. How exposure information can enhance our understanding of child traffic "death leagues". *Injury Prevention* 13, 125–129.
- Christie, N., Kimberlee, R., Lyons, R.A., Towner, E.M.L., Ward, H., 2008. Ethnicity, deprivation and road traffic injury risk: a survey of risk and road safety and implications for injury prevention. *International Journal of Health Promotion and Education* 46 (4), 133–138.
- Clarke, D., Ward, P., Truman, W., Bartle, C., 2008. A Poor Way to Die: Social Deprivation and Road Traffic Fatalities. Paper Presented at the Department for Transport Behavioural Studies Seminar 2008.
- Cloke, J., Webster, D., Boulter, P., Harris, G., Stait, R., Abbott, P., Chinn, L., 1999. Traffic Calming: Environmental Assessment of the Leigh Park Area Safety Scheme in Havant. Report No. 397, Transport Research Laboratory, Wokingham, Berks.
- Crawford, E., 2008. Beyond 2010 – A Holistic Approach to Road Safety in Great Britain. Parliamentary Advisory Council for Transport Safety.
- Crombie, H., 2002. The Impact of Transport and Road Traffic Speed on Health. Health Development Agency, London. <<http://www.publichealth.nice.org.uk/page.aspx?o=502321>> (accessed 22.05.06).
- Cycling England, 2009. <<http://www.dft.gov.uk/cyclingengland/who-we-are/>> (accessed 25.09.09).
- Dahlgren, G., Whitehead, M., 1991. Policies and Strategies to Promote Social Equity in Health. Institute for Futures Studies, Stockholm, Sweden.
- Dorsett, R., 1998. Ethnic Minorities in the Inner City, Findings 1998. Joseph Rowntree Foundation, York.
- Edwards, P., Roberts, I., Green, J., Lutchmun, S., 2006. Deaths from injury in children and employment status in family: analysis of trends in class specific death rates. *British Medical Journal* 333, 119.
- Gibbs, A., 1997. Focus Groups: Social Research Online, Winter 1997.
- Gill, T., 2007. No Fear: Growing Up in A Risk Averse Society. Calouste Gulbenkian Foundation, London.
- Graham, D., Glaister, S., Anderson, R., 2005. The effects of area deprivation on the incidence of child and adult pedestrian casualties in England. *Accident Analysis and Prevention* 37, 125–135.
- Grayling, T., Hallam, K., Graham, D., Anderson, R., Glaister, S., 2002. Streets Ahead: Safe and Liveable Streets for Children. Institute for Public Policy Research.
- Grundy, C., Steinbach, R., Edwards, P., Wilkinson, P., Green, J., 2008. 20 mph Zones and Road Safety in London: A report to the London Road Safety Unit, London Road Safety Unit.
- Gutierrez, N., Orenstein, M.R., Cooper, J.F., Rice, T.M., Ragland D.R., 2008. Pedestrian and bicyclist safety effects of California safe routes to school program. In: Transportation Research Board 87th Annual Meeting, Transportation Research Board, p. 15.
- Hayes, M., Towner, E., Towner, J., Pilkington, P., Ward, H., 2008. Widening the Reach of Road Safety – Emerging Practice in Road Safety in Disadvantaged Communities: Practitioners' Guide Road Safety Research Report No. 97, Department for Transport, London.
- Jacobsen, P.L., 2003. Safety in numbers: more walkers and bicyclists, safer walking and bicycling. *Injury Prevention* 9, 205–209. doi:10.1136/ip.9.3.205.
- Jones, S.J., Lyons, R.A., John, A., Palmer, S.R., 2005. Traffic calming policy can reduce inequalities in child pedestrian injuries: database study. *Injury Prevention* 11 (3), 152–156.
- Kamphuis, C.B.M., van Lenthe, F.J., Giskes, K., Brug, J., Mackenbach, J.P., 2007. Perceived environmental determinants of physical activity and fruit and vegetable consumption among high and low socioeconomic groups in the Netherlands. *Health & Place* 13 (2), 493–503.
- Knox, D., Turner, B., Silcock, D., Silcock, B.R., Beuret, K., 2003. Research into Unlicensed Driving. Road Safety Research Report No. 48, Department for Transport (November).
- Lang, D. et al., 2010. Understanding modal choice for the trip to school. *Journal of Transport Geography*. doi:10.1016/j.jtrangeo.2010.05.005.
- Law, C., Power, C., Graham, H., Merrick, D., 2007. Obesity and health inequalities. *Obesity Reviews* 8 (1), 19–22.
- Layfield, R., Webster, D., Buttress, S., 2005. Pilot Home Zone Schemes: Evaluation of Magor Village, Monmouthshire. Report No. 633, Transport Research Laboratory, Wokingham, Berks.
- Lorenz, T., Brunton, G., Oliver, S., Oliver, K., Oakley, A., 2008. Attitudes to walking and cycling among children, young people and parents: a systematic review. *Journal of Epidemiology and Community Health* 62, 852–857. doi:10.1136/jech.2007.070250.
- Lyons, R.A., Jones, S.J., Deacon, T., Heaven, M., 2003. Socio-economic variation in injury in children and older people: a population based study. *Injury Prevention* 9, 33–37.
- Macintyre, S., Maciver, S., Soomans, A., 1993. Area, class, and health: should we be focusing on places or people? *Journal of Social Policy* 22, 213–234.
- Mackie, A., Ward, H., Walker, R., 1990. Urban Safety Project. 3. Overall Evaluation of Area Wide Schemes. Report No. 263, Transport and Road Research Laboratory, Crowthorne, Berks.
- NICE, 2010. Strategies to Prevent Unintentional Injuries Among Under-15 s. <<http://www.nice.org.uk/guidance/index.jsp?action=byID&o=13272>>.

- Owen, D. 1992. Ethnic Minorities in Great Britain: Settlement Patterns, National Ethnic Minority Data Archive 1991. Census Statistical Paper No. 1. University of Warwick, Centre for Research in Ethnic Relations, Warwick.
- Owen, D., 1994. Spatial variations in ethnic minority group populations in Great Britain. *Population Trends* 78, 23–33.
- Play England, 2010. <<http://www.playengland.org.uk/media/228872/101021%20csr%20briefing.pdf>>.
- Sethi, D., Towner, E., Vincenten, J., Segui Gomez, M., Racioppi, F., 2008. European Report on Child Injury Prevention. WHO Regional Office for Europe, Copenhagen.
- Sharples, P., Storey, A., et al., 1990. Causes of fatal childhood accidents involving head injury in Northern region, 1979–1986. *British Medical Journal* 301 (24), 1193–1197.
- Sharratt, C., Walter, L., Anjum, O., 2009. Cycle Helmet Wearing in 2008. TRL Report PPR420, TRL, Crowthorne, Berkshire.
- Sloggett, A., Joshi, H., 1994. Higher mortality in deprived areas: community or personal disadvantage. *British Medical Journal* 309, 1470–1474.
- Smith, W.A., 2006. Social marketing: an overview of approach and effects. *Injury Prevention* 12, i38–i43.
- Sustainable Development Commission, 2007. *Healthy Futures: The Natural Environment, Health and Well-being*. SDC, London.
- The Children's Society, 2007. <www.goodchildhood.org.uk>.
- Thomson, J.A., Tolmie, A.K., Mamoon, T.P., 2001. Road Accident Involvement of Children from Ethnic Minorities. Report No. 19, Department for Transport, London. <http://www.dft.gov.uk/stellent/groups/dft_rdsafety/documents/page/dft_rdsafety_504597.hcsp> (accessed 16.08.04).
- Tilly, A., Webster, D., Buttress, S., 2005. Pilot Home Zone Schemes: Evaluation of Northmoor, Manchester. Report No. 625, Transport Research Laboratory, Wokingham, Berks.
- Van Houten, R., Malenfant, J.E.L., 2004. Effects of a driver enforcement program on yielding to pedestrians. *Journal of Applied Behavior Analysis* 37 (3), 351–363.
- Ward, H., Cave, B.L., Morrison, A., Allsop, R., Evans, A., 1994. Pedestrian Activity and Accident Risk. AA Foundation for Road Safety Research, Basingstoke.
- Webster, D.C., Layfield, R.E., 2003. Review of 20 mph Zones in London Boroughs. Report No. PPR243, Transport Research Laboratory, Wokingham, Berks.
- Webster, D.C., Mackie, A.M., 1996. Review of Traffic Calming Schemes in 20 mph Zones. TRL Report 215, TRL Limited, Crowthorne.
- Webster, D., Tilly, A., Buttress, S., 2005. Pilot Home Zone Schemes: Evaluation of Cavell Way, Sittingbourne. Report No. 626, Transport Research Laboratory, Wokingham, Berks.
- Wheeler, A.H., Taylor, M.C., 2000. Changes in Accident Frequency Following the Introduction of Traffic Calming in Villages. TRL Report 452, TRL Limited, Crowthorne.
- Whelan, K., Towner, E., Errington, G., Powell, J., 2008. Evaluation of the National Child Pedestrian Training Pilot Projects. Department for Transport.