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Informal parental traffic education and children's bicycling behaviour

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ABSTRACT

The aim of this study was to analyze the relation between traffic intensity and traffic hazards in the local traffic environment, the parents´ view of their child´s traffic situation and the actions taken by the parents to cope with these hazards.

58 parents were interviewed. The traffic intesity in the vincinity of the home was estimated.

19% of the parents lived in inner city areas, 62% in suburbs and 19% in the countryside. Suburbian children had a safe traffic environment. Inner city- and countryside children predominately lived in high-intensity traffic environment. Inner city- and suburb children frequently used the bike, in inner city as a tool for play and in the suburbs mainly as a means of transport. Countryside children seldom used their bicycle.

In inner city areas carefulness in traffic and in the other two independence was emphazised. Only 16% reported cooperation between home and school on traffic matters.

Traffic accidents were concentrated to children living in suburbs ($p<0.01$). 81% of accidents were reported by parents having independence as a goal for traffic training ($p<0.01$).

The reasults underline that traffic accident risk is strongly contingent on the local traffic environment and informal parenteral education in traffic safety

INTRODUCTION

About 95% of all traffic accidents in Swedish children involve a bicycle (see e.g., Ekman & Schelp 1994; Gregersen & Nolén, 1994; Johansson, Drott & Åström, 1999). During the past 20 years, a decrease in the rate of severe accidents has taken place, whereas there is a tendency for minor accidents to increase in frequency (see also Briem, 1999). The accidents dealt with in this study are accidents involving bicycles, i.e., mainly minor traffic accidents.

Technical improvements in car safety and urban planning measures are assumed to be two of the principal factors (Briem, 1988) underlying the observed decrease in death accidents and other severe traffic accidents. Whether traffic education in preschools and schools has contributed to this development is a hotly debated issue

(Ampofo-Boateng & Thomson, 1990). In Sweden, some investigators (Spolander, 1979, Björklid, 1985) argue that this training has had a negligible effect, whereas others claim that a well designed training program may lead to substantial improvement in children's traffic safety (Briem, 1999). In these discussions, usually no distinction is made between pedestrian accidents, which often take the form of collisions between child and vehicle, and bicycle accidents, which often are single accidents with no motor vehicle involved.

Only a paucity of investigators has been concerned with the effects of informal parental traffic education on children's traffic accident risk. This circumstance is somewhat surprising considering that this form of education continues during the whole childhood period and continues into early adolescence. It seems reasonable to assume that informal parental education has a considerable impact on both traffic behaviour and attitudes toward traffic. Therefore, this study investigated the links between informal parental traffic education, environmental factors that may influence this education, and traffic accident risk.

An earlier study on traffic accidents in children (Johansson, et al., 1999) demonstrated that traffic accident risk increased as a function of the children's freedom to move about on foot or on bike; it also was found to increase with amount of traffic training given by the parents. One possible explanation of these findings is that training results in child and parent confidence gains that result in increased traffic exposure and hence higher accident risks. The finding that the limits imposed by the parents on their children's cycling behaviour were inversely related to amount of parental training supports this interpretation. However, the above results do not explain why only some parents educated their children in traffic skills . The aim of the present study was to analyze whether factors such as residential area and traffic intensity in the vicinity of the home influenced the amount and type of traffic education given by the parents.

Johansson, et al. (1999) reported that children living in suburbs or the countryside had a broader cycling context than inner city children. The reason for this finding may be that traffic intensity in the child'sneighbourhood determines where the childit is allowed to go by bicycle, amount of bicycling and how the bicycle is used. In other words, inner city children may be allowed to ride only in playgrounds close to the home, whereas children living in suburbs or in the countryside may also use the bicycle as a means of transport. To test this hypothesis, data on the local traffic environment were collected and an analysis was made concerning whether this factor was related to the parents' view of their children's traffic situation, traffic education given, and bicycling restrictions.

The concept of local traffic environment can be defined in various ways. It may be viewed as a geographically delimited area or it may be functionally defined in terms of which destination the child is and is not allowed to visit. The latter definition was used in the present study. Specifically, questions were asked about traffic intensity and the child's freedom to move about in three areas: locations in the vicinity of the child's home, the roads to the child's friends, and the roads to school and nearest shopping center.

One of the studies in Johansson et al. (1999) focused on traffic education goals in

preschool. The results showed that preschool teachers formulated two goals. Some stressed the importance of carefulness and respect for traffic, which means that the child should come to realize that traffic is dangerous and that he or she has to be very careful when bicycling or walking in the streets. Other teachers emphasized independence; i.e., the child should be able to manage on his or her own in traffic. For example, the child should be able to walk or go by bicycle to and from school without having to be accompanied by a parent. In the present study, the parents were asked about their traffic education goal. The aims were to find out whether the parents formulated the carefulness or the independence goal and if the goal selected was related to the local traffic environment and to amount of freedom given to the child to move about in traffic.

According to Björklid (e. g., 1996, 1999), environmental stress in traffic is a major factor determining the parents' actions with regard to their child's traffic situation. Traffic intensity and traffic hazards in the local traffic environment are assumed to trigger traffic environment stress. The parents try to cope with their stress by taking different preventive measures. Some examples mentioned by Björklid (1996) are bussing the child to school, restricting the child's mobility, training the child in safe traffic behaviour, and traffic knowledge. Traffic environment stress was measured (Björklid, 1996) by a parental questionnaire on anxiety. This is a weak measure, however, because the author does not specify the relation between anxiety and stress. Furthermore, the data presented by Björklid do not give unequivocal evidence of a high level of anxiety because of traffic hazards (for a critical analysis of the Björklid study, see Carstensen, Johansson, & Montgomery, 2000). To test Björklid's hypothesis, the parents in the present study were questioned about their anxiety in terms of the child's traffic situation. The purpose was to analyze the relation between traffic intensity and traffic hazards in the local traffic environment, the parents' view of their child's traffic situation, and the actions taken by the parents to cope with these hazards.

METHOD

Sample. A total of 58 parents were interviewed. The parents' children were admitted to the Department of Pediatric Surgery at the University Children's hospital in Uppsala for traffic accidents or abdominal pains. With the diagnosis abdominal pains, a non-selective control group was obtained because almost 100% of these patients are referred to the hospital. Additional criteria were that the children were between 6 to 12 years of age and that the families represented three residential areas: inner city, suburb, and countryside. In all, 83 parents were contacted; of these, 58 agreed to the interview. The chief reasons for abstaining were lack of time (63%) and language difficulties (18%). Thus, immigrant parents are underrepresented in the sample. Of those interviewed, 21 had taken contact with the hospital because their child was the victim of a traffic accident and 37 because of the child's abdominal pain.

Method of data collection. Unstructured interviews (Cohen, Manion, & Morrison, 2000) were used as the data collection method. The interviewers were three nurses at the University Children's hospital that were trained in the method of

unstructured interviewing by the authors. The interview, was to be made according to an interview guide with questions covering the following domains: background data as to the child's age and sex, the parents' educational level, residential area, traffic intensity in the local traffic environment, parental traffic education, and whether the parents focused on the carefulness or the independence goal. Questions were also asked on restrictions as to the child's mobility and anxiety because of traffic hazards. Finally, the parents were asked about their requests of measures to be taken with regard to the child's traffic situation, whether they were informed about the traffic safety training in the child's school, and their view of the cooperation between home and school on traffic matters.

After the completion of the interview, the interviewer, together with the parents, sketched a map of the home and the surrounding traffic environment. On this map the place of the child's home, the streets used to visit friends, and the streets for going to and from school were marked. In addition, traffic intensity (through traffic or residential access streets) on each of these streets was estimated. The interviews were tape-recorded and written out by the interviewer for later analysis by the research team.

Procedure. First, the interviewer contacted the parents and asked them whether they were willing to participate in an interview on their child's traffic safety. The interview, which lasted about one hour, was made in the parent's home. The interviewer tried to create a relaxed atmosphere by giving the parents ample time to elaborate upon their answers and by posing non-directive follow-up questions to gain a fuller understanding of the parent's point of view.

Data analysis. The transcripts of the interviews were read by the researchers and checked against the tape-recorded interviews. Then, categories for coding the answers were evolved. Coding was made separately by the present authors followed by the computation of an index of categorizer agreement (78%). The cases of non-agreement between the authors were discussed until final agreement was reached. The data were analyzed statistically by chi^2-test, followed by cell-chi^2-tests and one-way analyses of variance followed by tests of main effects, level of significans was $p < .05$ (indicated by an * in the tables).

RESULTS

Background data

Eleven (19%) of the parents lived in inner city areas, 36 (62%) in suburbs and 11 (19%) in the countryside. Table 1 shows the demographic data on the interviewed parents.

Only the variable of residential area reached statistical significance. Those living in the countryside all owned a house; this was also the dominating form of habitation in the suburbs (63%), whereas the inner city parents usually lived in an apartment (73%).

Parental educational level, illustrated by fathers with university education in Table 1, was found to be somewhat higher in the inner city areas than in the other two areas. This variable, however, did not reach statistical significance, regardless of

Table 1. Background data on the interviewed parents

	Residential area		
Response category	Inner city	Suburb	Countryside
Residence			
Apartment	73%	36%	0%*
Single-family house	27%	64%	100%
Years in residence	8.2	7.5	6.3
University education (fathers)	63%	33%	27%

gender. Mean number of years living in each area was about the same in all three residential sectors. Almost all families were Swedish-speaking; in only two families the first language of the parents was not Swedish. One of these families lived in an inner city area while the other lived in the countryside. In Table 2 are given the background data on the children.

The results in Table 2 reveal that boys were overrepresented in all residential areas, whereas mean ages of the children did not differ. None of these differences, however, reached statistical significance. All children attended comprehensive school.

In summary, the only significant difference between the three residential areas was that those living in the countryside owned their house, whereas living in an apartment was typical for those in inner city areas. In all other respects the conditions in the three areas were very similar.

Traffic environment

The next step in the data analysis was to obtain measures of traffic intensity in the local traffic environment, i.e., in the vicinity of the home and along the roads to friends and to school. The data used were the parents' estimates of traffic intensity as depicted on the map sketched at the end of the interview. The intensity variable had two levels: through traffic or residential area access traffic. Data on estimated traffic intensity in each of these three traffic areas are summarized in Table 3.

The results demonstrate that the level of traffic intensity varied considerably between residential areas. The children in the suburbs lived in a safe traffic environment, particularly with regard to the roads surrounding the home and the roads to

Table 2. Background data on the children

	Residential area		
Response category	Inner city	Suburb	Countryside
Number of girls	3	14	5
Number of boys	8	22	6
Mean age, years	8.8	9.2	9.1
Age range, years	7–12	6–12	6–12
Mean number of siblings	1.5	1.7	1.4

Table 3. Traffic intensity in the child's local traffic environment

	Estimated traffic intensity	
Response category	Residential area access traffic	Through traffic
Roads surrounding home		
Inner city residents	64%	36%*
Suburb residents	78%	22%*
Countryside residents	36%*	64%
School road		
Inner city residents	18%*	82%
Suburb residents	36%*	64%
Countryside residents	9%*	91%
Roads to closest friend		
Inner city residents	27%*	73%
Suburb residents	67%	33%*
Countryside residents	27%*	73%

closest friend. This finding most probably reflects the fact that traffic separation was the case in most suburbs. The inner city children lived in a high- intensity traffic environment as to school road and road to closest friend, whereas the environment

next to the home was relatively safe. Finally, the children who lived in the countryside had a safe traffic environment close to the home but had risk-filled traffic conditions on roads to school and to closest friend.

Other variables of relevance when depicting the investigated children's traffic situation are the distances from home to school and from home to closest shopping center (Table 4).

As can be seen from the table, the inner city children had a short distance to travel to reach both school and shopping center. In the suburb areas the school was situated quite close, whereas the shopping center was far away. For the countryside children, there was a long distance both to school and to closest shopping center.

Bicycle use and means of transport to and from school

What restrictions as to mobility were in force, and which locations were the children allowed to visit on their own accord? To obtain data about these variables, the parents were asked whether they allowed their children to go unaccompanied by an adult to the shopping center, to a friend living nearby, to school, or to the child's leisure activity. Included in this analysis was also a question on how the child used the bicycle: as a means of transport or as a tool for play.

Table 4. Distance from home to school and from home to shopping center (in km).

	Distance	
Residential area	Home to school	Home to center
Inner city	1.2	2.6
Suburb	1.2	7.4
Countryside	5.7	7.4

Table 5. The children's bicycle use and their freedom to move about by bicycle (the results are given as a percent of yes answers).

	Residential area		
Response category	Inner city	Suburb	Countryside
Using bicycle daily	45	69	27*
Using bike to			
– go to center	27	22	20
– visit friends	64	83	73
– go to school	18	31	9
Using the bicycle			
– mainly for play	55	33	18*
– mainly for transport	45	67	82*
Restrictions on bicycling	91	69	91

A comparison of bicycle use in the three locations demonstrates that inner city children made frequent use of the bicycle, but mainly as a tool for play (see Table 5). They seldom used the bicycle to visit friends or for going to school. The children in the suburb areas also often used the bicycle, but mainly as a means of transport for visiting friends and for going to school. The countryside children used the bicycle seldom and mainly as a means of transport to visit friends.

A common feature for both inner city and countryside children was that their bicycle use was more restricted than for the suburb children.

Thus, the results in Table 5 identify three distinct profiles for bicycle use. In the inner city areas the bicycle was often used for play; when used for transport, it was mainly for visiting friends. In the suburbs the bicycle was often used, but now chiefly as a means of transport. About 17% of the parents living in the countryside reported that their child never used the bicycle, whereas no parents in the other two residential areas reported that their child never used the bicycle.

In Table 6 results, given in percent, are presented about how the children commuted to school. Because some children used more than one means of transport, the sum exceeds 100.

As can be seen from Table 6, the countryside children were usually bussed to school, seldom using any other means of transport. Moreover, the inner city children

Table 6. Means of transport to school.

	Residential area		
Means of transport	Inner city	Suburb	Countryside
Means of transport to school			
– bus	36%	28%	82%*
– on foot/by bike accompanied by adult	18%	22%	0%
– on foot/by bike accompanied by friends	55%	61%	9%*
– on foot/by bike, travels alone	64%	56%	18%*
Travels by bike or goes on foot to leisure activities	27%	28%	9%
Regular use of helmet	82%	75%	81%

Table 7. The parents' views of their children's traffic maturity, education goals on traffic safety, and traffic anxiety.

	Residential area		
Response category	Inner city	Suburb	Countryside
Estimated traffic maturity			
– child is mature (yes answers)	73%	50%	64%
– child is immature (yes answers)	27%	50%	36%
Traffic education goal			
– independence	18%*	64%	73%
– carefulness	82%*	36%	27%
Anxiety because of traffic hazards (yes answers)	18%	9%	0%

were often transported to school, despite that the school was situated at a short distance from home.

These children also went to school by foot – alone or together with friends. The children in the suburb areas were seldom transported to school; instead, they went to school alone or together with friends.

The data in Tables 5 and 6 demonstrate the complexity of the concept of local traffic environment. This environment cannot be defined exclusively in geographical terms: distances, traffic intensity, means of transport used, and type of bicycle use must be considered as well.

The children's traffic maturity, traffic education goals, and parental anxiety because of traffic hazards

This part of the analysis focused on the relation between residential area and the parents' view of their traffic education goals, anxiety because of traffic hazards, and their children's traffic maturity. The results of these analyses are given in Table 7.

The children from the three residential areas were judged to have about the same level of traffic maturity and none of the differences obtained reached statistical significance. Only a few parents reported anxiety because of their concern for traffic hazards. Level of anxiety was considerably lower than that obtained in the Björklid (1999) questionnaire. However, one of Björklid's co-workers (Heurlin-Norinder, 1999), using unstructured interviews as in the present study, obtained comparable results to those reported here. Because so few parents reported traffic anxiety, this variable was not analyzed further.

For traffic education goals, substantial differences were obtained; parents in inner city areas emphasized carefulness, whereas the independence goal dominated in the other two areas. This finding was followed up by an analysis of the relation between traffic intensity close to the home and goals in traffic education.

The results demonstrated that the parents who judged the traffic environment as light tended to report the independence goal (66%); the parents who judged the traffic environment as severe were inclined to report the carefulness goal (63%). These results indicate that traffic intensity in the vicinity of the home is an important factor when selecting educational goals.

Table 8. Parental traffic training

Traffic training	Residential area		
	Inner city	Suburb	Countryside
Frequency of indoor traffic training			
High, relatively high	70%	65%	56%
Low/none	30%	35%	44%
Frequency of outdoor traffic training			
High/relatively high	82%	86%	91%
Low/none	18%	14%	9%
Traffic security requests			
– yes, tunnel, refuge, speed limits, etc.	36%	56%	73%*
– no, none	64%	44%	27%*

Parental traffic training and the parents' view on responsibility for children's traffic education

The analysis focused on the connection between the local traffic environment and traffic training and requests of traffic security measures. The variable of amount of traffic training was partitioned into two categories: once a month or more often (=High, relatively high) versus less than once a month (=Low/none). The results of this analysis are given in Table 8.

Parental traffic education had about the same volume in all three areas, with no relation between residential area and amount of traffic training. The highest number of traffic security requests was obtained from parents in countryside (e.g., parents requesting speed limits or other security measures close to the home or school). Concerning the question about responsibility for traffic education, most parents (97%) indicated that they should have the power to control or influence their child's traffic education; very few (3%) parents remarked that school or some other agency should exercise control over children's traffic education.

Parents' view of traffic education in school and cooperation between parents and school on traffic matters

Sixty percent of the parents were informed about the traffic security education given in the schools. A few (14%) mentioned visits by police or "bicycle driving license exams" as examples but they were not informed about the details of the training. Only 16% of all parents answered that there was some sort of cooperation between home and school on traffic matters. Very few (7%) reported that school staff had displayed interest in their concern for their children's traffic situation. The picture that emerges from these results is that parents view themselves as the primary authority for the traffic education of their offspring and that parental traffic education is almost completely separated from the traffic safety training that takes place in the schools.

Traffic accidents, residential area, and bicycle use

The traffic accidents reported were largely concentrated to the children living in suburbs. Traffic accidents were reported for 50% of the children living in the suburbs, for only 27% of the children in the countryside and for none of the inner city chil-

dren (Chi^2 (2)=9.59, p< .01). No relation could be detected between traffic intensity in the environment of the home and accident frequency; nor was there a relation between estimated traffic maturity and accidents. Many (57%) of the accidents had occurred on yards or bicycle lanes, i.e., in areas protected from car traffic. The remaining accidents had occurred on residential access streets. No relation could be revealed between accident rate and parental traffic training, but there was a strong correlation between accidents and the parents' educational goals. The children whose parents reported the carefulness goal accounted for only 19% of the accidents compared with 81% for the parents reporting the independence goal (Chi^2 (2) = 7.97, p <. 01).

DISCUSSION

The present results show that the local traffic environment is an important factor in determining how much and for what purposes the children were using their bicycle, the parents' traffic education goals, and traffic accident reports. The inner city children mainly used the bicycle for play in restricted areas; these children seldom used the bicycle as a means of transport. No traffic accidents were reported for these inner city children. In contrast, the children in the suburb used the bicycle to a high extent and often as a means of transport. The highest frequency of accident reports was obtained in this subgroup. For the countryside children, the bicycle was used infrequently; when used, it was used as a means of transport rather than as an instrument for play.

Can these three profiles of bicycle use be explained by other mechanisms? One alternative is that the child's level of development is the chief causative factor. According to many traffic researchers (see Thomson, Tolmie, Foot, & McLaren, 1996), level of development, e.g., the ability to perceive traffic events (e.g., Lee, Young & McLaughlin, 1984) or the child's metacognitive skills (Briem, in press; Whitebread & Neilson, 1998) explain the child's traffic behaviour. To consider the impact of level of development for the present results, the variable of age and the parents' estimate of their child's traffic maturity, were used as indicators of developmental level. A check on the variable of age shows that, with increasing age, the use of the bicycle as a means of transport becomes more frequent and that the traffic education goal changes from carefulness to independence. Yet, the correlations reported in the results section remained significant, even when controlled for age. That was the case with the traffic maturity variable, too. Neither variable correlated significantly with the measure of local traffic environment and accident report.

Of course, the child's level of development is of importance for the child's ability to observe and react adequately to the traffic situation, but the present study emphasizes the role of residential area for traffic educational goals, bicycle use, and accident risks. Therefore, an analysis of traffic accidents in children cannot focus on psychological variables alone: measures of contextual factors, as exemplified in the present study, have also to be included.

Finally, an explanation may be sought in the mechanism of environmental stress (Björklid, 1996, 1999), i.e., the present results may depend on the level of environmental stress in traffic as experienced by the parents. A reanalysis of the results

reported by Björklid (Carstensen, et. al., 2000) showed that only a small number of parents was anxious about the various hazards in the traffic environment. It should be added that it can not be taken for granted that the questions on anxiety used by Björklid are valid measures of environmental stress in traffic. The present results indicate that traffic anxiety does not explain the parents' choice of a traffic educational goal, the amount of freedom given to their children to move about in traffic, and traffic accident risks.

Thus, the main finding in this study was the identification of distinct traffic environment profiles in each of the three residential areas, each with a distinguishable way of using the bicycle, which contributed to traffic accident risks as measured by bicycle accident reports. An additional factor was the parents' traffic educational goals, goals that also were related to the local traffic environment. In conclusion, the results underline that traffic accident risk is strongly contingent on the local traffic environment and informal parental education in traffic safety. The implication drawn is that the traffic education given in preschool and school should be closely tailored to the local conditions and planned in cooperation with the parents. The results, however, demonstrate that only a minority of the parents reported that home and school cooperated on traffic matters. In addition, the parents reported that they seldom received any response from the school on their concerns for the traffic education of their child. At the same time, all parents responded that they should function as the primary agency responsible for the traffic education of their children. These results strongly suggest that a prerequisite to improve children's traffic safety is increased cooperation between home and school.

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