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Informal Parental Traffic Training and Children's Traffic Accidents

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Abstract

The aims of the present study were (a) to assess the relationship between informal traffic training by parents and their children's involvement in traffic accidents and (b) to identify factors contributing to this relationship.

The first two studies involved questionnaires on informal parental traffic education, the child's exposure to traffic and traffic-related accidents. Both studies showed that rate of accidents increased with training, particularly for outdoor training. An accident analysis indicated that most accidents involved the use of the bicycle, and that the major part of the accidents resulted in light injuries and occurred when the child was practicing the act of manoeuvring the bicycle. An interview study with 10 preschool teachers identified two quite disparate traffic education goals: emphasis on cautiousness versus emphasis on independence. The major implications of the study are that efforts in traffic training should give more emphasis to bicycle use and should be planned and carried out in cooperation with the parents.

Introduction

To improve children's traffic safety various types of educational programs have been designed and tested, including practical training in real traffic, classroom teaching and membership in voluntary traffic safety clubs for children. The major part of these training experiments have been focused on pedestrian skills, such as road crossing (1), while only a few studies have investigated bicycle skills.

According to Thomson et al. (1), traffic education in the classroom or the preschool usually has the form of verbal instruction with only a low degree of transfer to actual traffic behaviour. They consider practical training of specific traffic skills a much more efficient method and refer to a series of studies with supporting results. With parents invited to do the training (2) or with parental training programs (3,4), substantial improvements in the children's traffic behaviour have been reported. Experiments with programs aiming at co-operation between parents and preschool staff show that parents are willing to devote considerable time and effort to training their children (e.g., 5,6). Other researchers, however, express doubts as to the long-term effects of traffic training. Learning may be transient and context

Key words: parental traffic training, children's traffic accidents, bicycle use, traffic education goals.

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specific (7), and long-term improvements in the form of reduced accident rates cannot be taken for granted (8,9).

A neglected research area has been the evaluation of the effects of informal training given by parents. This is somewhat surprising considering that parental training is probably the most stable and influential type of traffic education given to children. In studies of the effects of traffic clubs, spontaneous parental training is indirectly analysed since it is assumed that the parents and their children work with the material jointly. In an early study (10), members were found to have a lower accident rate than non-members. However, unobtrusive observations of members and non-members showed no difference in actual traffic behaviour. This is in line with an evaluation of an English traffic club (The Tufty Club), which demonstrated negligible improvements in traffic behaviour for traffic club members (11). In a study by Gregersen and Nolén (12), it was even found that membership was correlated with an increased rate of traffic accidents. The factors mediating this result, however, remain unknown. The authors speculated that traffic education may result in skill overestimation and thus a higher degree of risk taking, but no empirical evidence was provided. The present study aimed at testing this speculation, focusing not only on traffic club membership, but also on informal parental training and the parent's view of the child's traffic situation and traffic behaviour.

Analyses of children's traffic accidents in Sweden show a substantial reduction in serious traffic accidents during the last 30 years, whereas less severe accidents have remained at a stable level or even increased in frequency (13). A twelve-month study of all traffic accidents in a Swedish municipality (14) revealed that about 75% of all traffic accidents involving children (7–14 years) involved bicycles. This finding is consistent with two earlier large-scale survey questionnaires (15,16), where two thirds of all accidents that occurred to school-aged children were pedal cyclist accidents. In the questionnaire study on traffic accidents by Gregersen and Nolén (12) even higher percentages were obtained, with over 95% of the accidents reported by the parents involved bicycles. If such high figures emerge in the present study as well, the strategy of focusing traffic education research almost exclusively on pedestrian traffic behaviour has to be seriously questioned.

In studies of causes of traffic accidents among 0–14 year-old children, accident rate has been found to be related to factors such as gender (higher among boys), immigrant status, insufficient parental supervision and high traffic intensity in residential areas (17,18). Furthermore, accident rate is positively correlated with traffic exposure (19), measured as mileage of travel by bicycle and with a disordered family lifestyle (17). Because these factors are known to be related to accident rate, it was considered worthwhile to find out whether they were also related to informal parental traffic education.

Investigations of the "where and when" of traffic accidents show that many occur before or after school hours and often take place on the road to school or near the home (13,20). Based on these findings, it was considered important to investigate whether means of transportation to and from school contributed to accident rate. Therefore, the relation between parental training, means of transportation and the child's traffic exposure were analysed.

Exposure to traffic can be measured by various methods (21) though mileage or distance travelled is the preferred method. A disadvantage with this measure is that during play the child can do a considerable amount of transport work within a confined area. It seemed preferable to devise a measure of exposure that reflected actual travel between different areas. Therefore, a new index was constructed, defined as the number of sites the child was allowed to visit unaccompanied by an adult. Sites both close (e. g., a nearby friend, a nearby playground) and far from home (e. g., shopping centre, preschool, school) were enumerated. The parent had to mark the locations the child was allowed to walk or bike on his or her own. It was assumed that exposure was related to the number of sites marked by the parent and means of transportation used by the child.

Exposure is also related to the traffic intensity along the routes the child travels. Therefore two measures of traffic intensity were used. In the first, the parent was asked to estimate traffic intensity along the routes to the sites the child was allowed to visit. In the second, the parent estimated traffic intensity on the roads surrounding the home.

Study 1: The Stockholm preschool study

The first study included preschool children aged 4 to 6 years. One purpose was to obtain data about accident types, in particular the proportion of bicycle accidents. A second purpose was to test earlier findings on the effects of informal parental training. Therefore data were collected on informal parental traffic training, number of sites the child was allowed to visit unaccompanied by an adult, traffic intensity along the routes used by the child and traffic intensity on the roads in the vicinity of the home, the child's means of transportation to and from preschool, and cooperation between home and preschool.

Method

Subjects. The central authority for the Stockholm day-care centres drew a random sample of 630 children attending 60 different preschools in Stockholm. The sample represents about 5% of all children enrolled in Stockholm day-care at the time of the study. The questionnaires were administered by the preschool teachers, who were also responsible for taking notes as to the reasons for failures to return the questionnaires. The response rate was 69%, or 433 returned questionnaires. Descriptive data on the variables are presented in table 1 and the correlation matrix in table 2. The main reasons for non-response included language difficulties (immigrant parents), absenteeism, and that the child had moved from the centre but that this information had not reached the central authority. Thus, rate of non-response was high, with immigrant children and children in families with a less settled lifestyle being underrepresented.

Questionnaire. A preliminary questionnaire was constructed, with most ques-

tions taken from earlier investigations on children's traffic training and traffic accidents (12,22,23). After a pilot test on 220 parents, the final questionnaire was constructed.

*Data analysis***.** The LISREL model (24) was used to analyse the data. LISREL comprises model building of the interrelationships of the variables under study. The prime reason for using LISREL is that it takes measurement errors into account. It is typical for data of the present kind in which fairly severe measurement errors are involved. By introducing latent variables that correspond to the hypothetical constructs and measured variables that serve as indicators of the latent variables, it is possible to offset measurement errors effectively. Here, it is crucial that the measured variables have good measurement properties. This means they should be both reliable and valid measures of the latent variables. By using several indicators for each latent variable, reliability is increased. Then, if the model fits the data, construct validity, the extent to which variables accurately measure the constructs of interest, would be evident.

LISREL is a very flexible and general statistical tool that allows the analysis of many different models as special cases of the general LISREL model. The analysing process proceeded according to the following principle: Initially, a tentative model was generated on the basis of earlier research (10,12) and then the model was estimated by LISREL. Here, LISREL provides several different diagnostics, including measures of model fit and modification indexes that provide suggestions

Table 1. Descriptive data on variables in the Stockholm study

Variable name	Mean	Std	Min	Max
1.Age in years	5.0	.88	3.0	6.0
2.To school by bicycle (proportion)	.80	.05	.75	1.0
3.Traffic intensity (1) on roads in the vicinity of the home	2.8	1.0	1.0 (low)	4.0 (heavy)
4. Traffic intensity (2) on roads the child walked/biked alone	8.2	4.1	0.0 (low)	16.0 (heavy)
5. Outdoor traffic training	1.5	0.6	0.0 (none)	2.0 (frequent)
6. Indoor traffic training	0.9	0.8	0.0 (none)	2.0 (frequent)
7. Home/Preschool cooperation	0.2	0.4	0.0 (none)	1.0 (frequent)
8. No of sites child was allowed to visit alone on foot	1.5	1.4	0.0 (none)	4.0 (many)
9. No of sites child was allowed to visit alone by bike	0.9	1.5	0.0 (none)	4.0 (many)
10.Traffic accident according to parental report	0.1	0.3	0.0 (none)	1.0 (one)

Table 2. Correlation matrix analysed by LISREL, Stockholm study

	1	2	3	4	5	6	7	8	9	10
1 Age	1.00									
2 To school by bike	.10	1.00								
3 Traffic intensity 1	-.06	-.36	1.00							
4 Traffic intensity 2	.00	-.13	.27	1.00						
5 Outdoor traffic training	.31	.31	-.11	.05	1.00					
6 Indoor traffic training	-.01	.06	.05	-.02	0.12	1.00				
7 Hone/Preschool cooperation	.06	.06	-.06	.01	-.06	-.02	1.00			
8 Sites visited on foot	.32	.22	-.41	-.18	0.23	-.06	.05	1.00		
9 Sites visited by bike	.33	.13	-.36	-.13	0.31	.06	.10	.76	1.00	
10 Traffic accidents	.05	.30	-.09	.01	0.31	.20	-.12	.17	.30	1.00

on how to improve the model. It is, however, important that the modifications are reasonable also from a substantive aspect. This procedure can be repeated until a model has been obtained that is acceptable, both with respect to statistical and substantial properties.

Results

First, an analysis of accident types revealed that about 95% of the accidents reported by the parents were bicycle accidents. About the same figures were given by Gregersen and Nolén (12), implicating that the vast majority of the accidents reported involved bicycles. It may be added that bicycles are widely used in Sweden. The number of cyclists is about 6 million of a population of some 9 million inhabitants (25).

To further analyse the data the LISREL technique was used. A series of tentative models were tested until the one shown in Figure 1 was obtained. This one was found statistically acceptable, as may be seen from the fit statistics presented in Table 1.

Following the standard LISREL notational system, latent variables are enclosed in ovals and observed variables in rectangles. With only one indicator (e. g., Traffic Accident and Outdoor Training) of the latent variable the measurement error cannot be estimated. In these cases measurement error was set to zero and the corresponding coefficient becomes 1.0 (for more details about LISREL model building and testing, see Jöreskog & Sörbom, 1993 (24)).

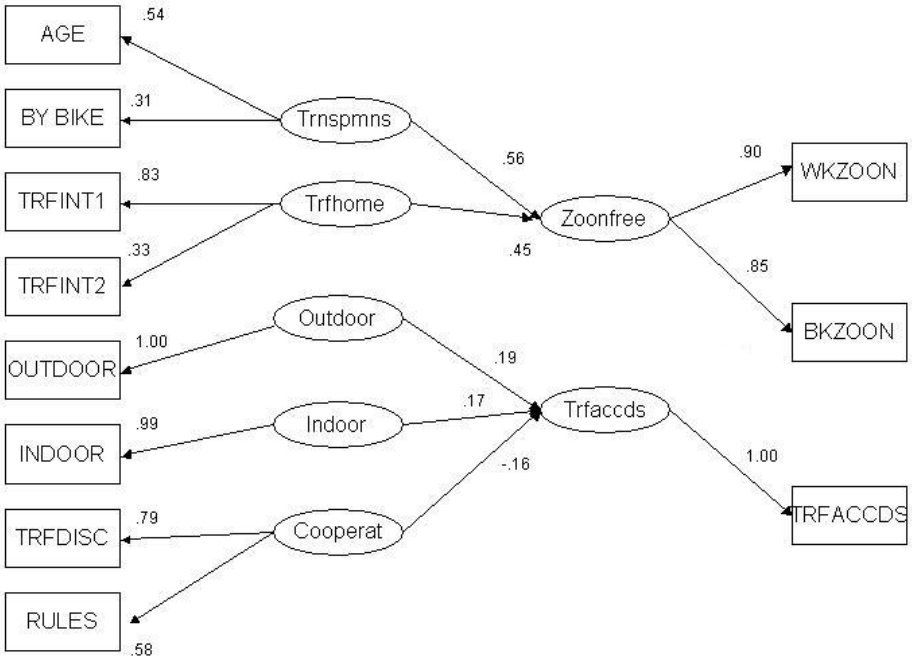

Figure 1. The LISREL model for the data collected in Study 1. Boxes represent measured variables and ovals latent or hypothetical constructs. The indexes along the arrows from the latent variable to the measured variables are indexes of the reliabilities of the respective measured variables, whereas the indexes along the arrows between the latent variables estimate the strength of the relationship (min-1.0, max +1.0). These correspond to regression coefficients.

Before discussing the findings, a brief description of the variables and the corresponding operational definitions is given. In addition to demographic data these were the questions to be answered by the parents.

Means of transport = means of transportation between home and preschool. A series of alternatives were presented (walking alone or with parent; bicycling alone or with parent; going by bus or taxi) and the parent was to mark how often each means of transport had been used the last 5 days. The measures used were proportion of times the child went unaccompanied to school on bicycle (To School by Bicycle) and the child's age (Age).

Traffic intensity = intensity of traffic in the child's neighbourhood. The answers to two different questions were used. In the first (Traffic Intensity 1) the parent was asked to categorize the roads in the vicinity of the home with regard to traffic intensity (main roads; local roads with heavy traffic; local roads with light traffic, living in a traffic segregated area). In the second (Traffic Intensity 2), the parents were first asked to mark the locations the child was allowed to walk or bike on his or her own (e.g., nearby friend, nearby playground, shopping centre, preschool, school,

etc.), and then asked to estimate road traffic intensity, using a 4-point scale, if the child visited these different locations.

Outdoor training = the parent was asked whether he/she had practiced traffic skills, e.g., how to walk or ride the bicycle in the street or how to cross a street, with the child in real traffic situations (Outdoor Training).

Indoor training = the parent was asked about traffic education in the home, in the form of verbal education about traffic matters, including membership in a children's traffic club (Indoor Training). If the questions on outdoor and/or indoor training were answered in the affirmative, the parent was asked to note how many times such training had taken place during the last 12 months.

Home/preschool cooperation = cooperation between home and preschool on traffic matters. The parent was asked about mutually agreed upon rules, such as helmet and reflex tag use (Traffic Rules) and teacher-to-parent information and discussions about traffic matters (Teacher/Parents Discussions).

Sites allowed to visit = locations the child was allowed to walk or bicycle without the accompaniment of an adult (Sites allowed to visit walking and Sites allowed to visit bicycling). The parent was presented the same locations as in the question about Traffic intensity 2 (see above).

Traffic accident = traffic accidents as based on the parents reports about traffic accidents during the last six months (Traffic Accident).

As can be seen from the fit data presented below, the model has an acceptably good fit with the data. All relationships in the model were significant at the .05 level.

Of main interest is that parental traffic training was related to an increase in number of traffic accidents reported. This was the case for both indoor and outdoor training. The result for indoor training, which includes traffic club membership, replicates the findings of Gregersen and Nolén (12), but it may be observed that outdoor training predicted an increase in accident reports also.

The results indicate a positive relation between traffic exposure and accident reports. As can be seen from Figure 1, traffic exposure, measured by the sites the child was allowed to visit, was also dependent on traffic intensity and the use of the bike as a means of transportation between home and preschool, despite that it

Table 3. Fit statistics for the model depicted in Figure 1.

Chi-square with 28 degrees of freedom = 54.89 (p=.0018)
Root mean square error of proximation (RMSEA) = .055
90 percent confidence interval for RMSEA = (.033;.076)
p-value for test of close fit (RMSEA<0.05) = 0.33

was prohibited by the preschool authorities The finding that accident rate could be related to bicycle use indicates that a factor contributing to the accidents is the use of the bicycle before the child is able to handle it adequately.

Continuing with exposure, it was found to be inversely related to traffic intensity in the vicinity of the home. This means that the parents living in areas with high traffic intensity allowed their children to visit very few sites unaccompanied by an adult, which reduced the risk of a traffic accident. The result is in accord with the suggestion that a major factor underlying the decrease in child causalities from the 1970s is a dramatic reduction in exposure to traffic, mainly caused by increased parental anxiety towards their children's safety (26).

Returning to the variable of traffic accidents, the analysis revealed that cooperation between parents and preschool resulted in a decrease in accident reports. This relationship indicates that shared rules about helmet use, which sites the child is allowed to visit, etc. were related to a low rate of reported accidents, in line with earlier findings of beneficial effects of parent – preschool co-operation (6). Thus, a distinction has to be made between informal parental traffic education linked to a high rate of traffic accidents, and co-operation between parents and preschool staff combined with a low accident rate.

The main finding was that increased parental training was associated with an increased frequency of bicycle accidents. How should this finding be interpreted? Should it be interpreted as revealing a causal link between training and accidents or as an artefact because training is over reported by parents reporting accidents? An optimal strategy seemed to be to repeat and extend the study with an operational definition of accidents that is not based on parental reports. Hospital records seem to provide such a definition.

Study 2: The Uppsala University Hospital study

The major purpose of Study 2 was to determine whether the findings of Study 1 could be extended to children a few years older. Of primary interest was the relation between parental traffic education and rate of traffic accidents. A further purpose was to investigate whether accident rate was dependent upon such factors as exposure, means of transportation between home and preschool/school, socio-economic background and residential area. To test the Gregersen and Nolén (12) speculation that club membership may result in skill overestimation, the parents were asked to estimate their child's bicycling and traffic skills.

A second purpose was to collect and analyse data about the children-related traffic accidents. The parents were asked to describe the following events: (a) the accident and where it occurred, (b) if the child was alone or accompanied by an adult or other children, and (c) what was the purpose of the child's travel. Hospital records were used to obtain accident severity data. These data were to be used to test the conclusion from Study 1 that inadequate bicycling skills may be a factor contributing to the accidents.

Method

Although this study also comprised a parent questionnaire, the present sample included children admitted to hospital for traffic accidents and children admitted to hospital for abdominal pain. The latter group of children was a non-selected diagnostic group since almost 100% of the patients who suffer from abdominal pain are referred to the hospital. Furthermore abdominal pain, as traffic accidents, are acute in nature and occurs in whole age group selected. Thus, the sample and the operational definition of traffic accidents were different from Study 1, but if the relationships detected in Study 1 are significant they should be obtained in the present study as well.

Subjects. The subjects, who were children aged 6 to 16 years, were admitted to the University Children's Hospital of Uppsala because of an accident injury or abdominal pain. The questionnaires were sent to the children's parents. A reminder was sent to the non-responders, and parents who did not return the questionnaire after being sent a remainder were contacted by telephone. This way the non-response rate was kept to a minimum, and data could be obtained from all respondents except one. Thus, 219 questionnaires were collected, with children admitted sequentially. Descriptive data on the different variables are presented in table 4 and the correlation matrix in table 5.

Only accidents in which the child played an active role were included in the analyses. Consequently, car or bicycle accidents in which the child was a passenger were excluded.

Questionnaire. The same questions as in Study 1 were used. Based on the analysis of the results in Study 1, the wording of a few questions, such as those concerning means of transportation to and from preschool/school and about traffic education in the home, was slightly revised. Questions about socio-economic background

Table 4. Descriptive data on variables in the Uppsala study

Variable name				
Ordinal variable				
1. Residential area (%)	19 (inner city)	54 (suburb)	28 (countryside)	
Interval variables	Mean	Std	Min	Max
2. Traffic intensity	2.75	.86	1.0 (low)	4.0 (high)
3. Outdoor training	2.38	1.45	0 (none)	4.0 (frequent)
4. To school by bicycle	0.09	0.18	0 (never)	1.0 (frequent)
5. Immigrant status (proportion Swedish speaking) 0.94	0.24	0 (other)	1.0 (Swedish)	
6. Traffic accident	0.45	0.50	0 (none)	1.0 (1 accident)

Table 5. Correlation matrix analysed by LISREL, the Uppsala study

	1	2	3	4	5	6
1. Residential area	1.00					
2. Traffic intensity	-.06	1.00				
3. Outdoor training	.19	.10	1.00			
4. To school by bicycle	-.41	-.08	-.11	1.00		
5. Immigrant status	.25	.16	.30	.22	1.00	
6. Traffic accident	-.42	-.05	.31	.33	-.46	1.00

(educational level, housing standard, immigrant status) and residential area were added. Two questions were included to have the parents estimate their child's skills as a bicycle rider and as a road user.

Data analysis. As in Study 1, the results were analysed by means of LISREL, now made directly on the observed variables.

Results

Traffic training

Preliminary analyses indicated that the functional relations differed between the 6 to 10 year-olds (93 children) and the 11 to 16 year-olds (126 children). The remaining data analyses were therefore confined to the children 6 to 10 years of age; that is, children with the closest resemblance in terms of age to those in Study 1. Another reason for concentrating the analysis to this age group is that the use of the bicycle as a means of transportation to and from preschool or school is prohibited by the school authorities until grade 4.

Initially, the LISREL model found in Study 1 was tested. However, this model did not fit the data and therefore a revised model was tested and found statistically acceptable (Figure 2). Because that model does not comprise all variables from the model in Study 1, the results are presented in two steps: first, the result of the LISREL analysis is summarized and then the results from the correlation analyses of the remaining variables are given.

The variables in the model were defined as follows:

Residential area = Traffic near the home as measured by a question of residential area (inner city, suburb or countryside).

Traffic intensity = Traffic intensity in the neighbourhood of the home, measured as in Study 1.

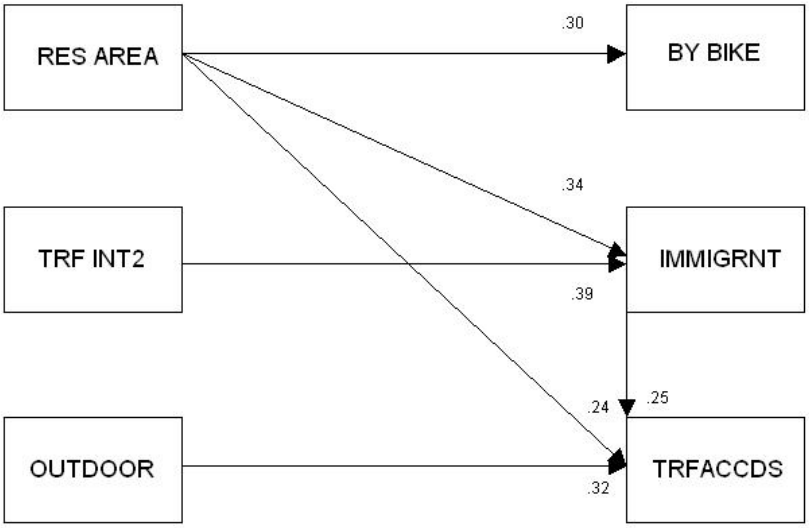

Figure 2. The LISREL model for the data in study 2. Boxes represent measured variables and the indexes along the arrows the estimated strength of the relationships, which correspond to regression coefficients.

Outdoor training = Outdoor training in real traffic, measured as in Study 1.

To school by bicycle = The use of the bicycle, without the accompaniment of an adult, as the means of transportation between home and preschool/school.

Immigrant status = The answer to the question as to the language spoken in the home (Swedish versus some other language).

Traffic accident = Traffic accident versus abdominal pain.

As can be seen from Table 2, the fit between model and data was acceptable.

The basic finding from Study 1 was replicated, namely that a significant relation from outdoor traffic training to traffic accidents was observed. Moreover, a positive correlation ($r = .16$) between indoor training and number of accidents (correlations $> .18$ are significant at the .05 level) was noted, but because the coefficient was not significant it was excluded from the model.

The variable of traffic exposure, which was measured in terms of number of sites the child was allowed to visit, did not fit into the model. These measures were positively correlated with age ($.29 <= r <= .55$), but zero-correlated with the use of the bicycle as a means of transportation to preschool/school. Although a nonsignificant positive correlation was observed between bicycling to school and accidents ($r = .15$), that path could not be fitted into the model. One possible explanation may be that the present sample of children was from the county of Uppsala, including

Table 6. Fit statistics for the model depicted in Figure 2.

Chi-square with 6 degrees of freedom = 5.32 (p= .50)
Root mean square error of approximation (RMSEA) = .0
90 percent confidence interval for RMSEA = (.0;.13)
p-value for test of close fit (RMSEA<.05) = .63

not only children living in the city but also children living in the countryside. A negative correlation between bicycle use and distance from school (r = -.25) supports the relationship depicted in Figure 2 that mainly children living close to school used the bicycle as a means of transportation. Thus, the traffic exposure relationship found in Study 1 may be true for samples of only inner city children.

The differences in residential area may also explain why Study 1 demonstrated that number of accidents decreased with increasing traffic intensity, whereas the present study indicated a positive relation. The results of Study 1 showed that, at least for children living in inner city locations, the relation between traffic intensity and traffic accidents was mediated by the exposure variable. The results from Study 2, demonstrating that accident rate was highest for inner city children, reflect a difference between children living in traffic intensive inner city areas as opposed to children living in the countryside.

In the present study, the parents were asked to report the first language that was spoken in the home. Using the responses to that question as an indicator of immigrant status, a substantive relation was obtained with number of accidents. The results also disclosed that residential area and traffic intensity near the home might contribute in that immigrant parents were over represented in these areas.

The parents were also asked to estimate their child's skills as a bicycle rider and road user. The answers to the two questions were strongly interrelated (r = .62), but negatively correlated with number of accidents (r = -.32 and -.13, respectively), indicating that accidents were over represented among children given low skill estimates by their parents.

The skill estimates correlated poorly with the answers to the questions about traffic training, except for the correlation between the parents' estimate of the child as a road user and amount of practical training (r = -.42). This means low estimates of the child, as a road user may be one factor underlying the parents' decision to train the child. Taken together, the skill measures do not support the suggestion that parental traffic training is correlated with a high estimate of the child's traffic skills (12); rather, the opposite relation may be the case. It remains to investigate whether training results in skill overestimation in the child.

Accident analysis

Hospital records were used to classify the accidents according to the AIS-scale (27). AIS 1 was judged as a light injury, AIS 2 as an intermediate injury and AIS 3

and higher as a severe injury. Of the 93 children studied, about half were accident victims. One case was a pedestrian accident while the remaining were bicycle accidents. Of these, 43% had been subject to light injury, 45% to intermediate injury and 13% to severe injury. The distribution of injuries is in accordance with results reported by Kroon (28), Wallin (29) and Wahlberg, Wahlberg and Björnstig (30), showing an overrepresentation of light and intermediate injuries. Seven patients were treated as in-patients, observed, and treated at least over night; median treatment time was one day.

The major proportion (75%) of the accidents was single in nature and the collisions reported took place between bicycle riders. About 83% of the accidents occurred on bicycle lanes, playgrounds or backyards; only 17% occurred on roads with car traffic. About 60% of the children were accompanied by a friend when the accident took place; 21% was accompanied by an adult; and 19% travelled alone. Only a minor proportion (10%) of the accidents occurred when travelling to or from school. Usually, the accident took place when the child was visiting a nearby friend, bicycling to or from the playground, or was bicycling with no particular goal.

In their descriptions of the accidents, the parents often commented that some obstacle led to the child losing control over the bicycle. For example, the child made too sharp a turn, the bike skidded due to gravel, stones or holes in the ground, the child hit the wall of a tunnel below the railway, or was bicycling on the lawn and could not control the bike.

Thus, the accident analysis showed that a main contributing factor was insufficient coordination of perception and action. The descriptions of the accidents indicate that they may be partitioned into (a) those occurring when the child was using the bicycle as a means of transportation and (b) those occurring when the child was practicing the act of manoeuvring the bicycle. Although sufficient detail is lacking for the classification of some of the accidents, available data indicate that the major portion of the accidents belong to the latter category.

This raises the question as to why some parents practice traffic skills with their children while others do not. The data from both our studies showed nonsignificant correlations between amount of practical traffic training and traffic intensity near the home, findings consistent with those of Gregersen and Nolén (12). The present results, which are also in agreement with Gregersen and Nolén (12), indicate that those training their children assigned somewhat more weight on the use of helmets (r=.13 and r=. 30, respectively). Thus, amount of parental training was zero-correlated with the traffic situation near the home, but weakly related to an increased emphasis on the use of such protective equipment as helmets.

Evidently, an important part of the problem is to determine why some parents train their children and the motives underlying this training. To obtain a preliminary overview of these motives, an interview was made with preschool teachers responsible for the traffic education at their centres. It was assumed that the teachers could present well-articulated goals that might facilitate the identification of goals held by the parents.

Study 3: The preschool teacher interview study

The main purpose of the study was to identify the goals for traffic education held by experienced preschool teachers. A secondary purpose was to discern if there was a relation between goals and educational content on the one hand, and goals and the traffic environment of the centre on the other.

Method

Sample. After careful deliberation, it was resolved to select 10 preschool centres and conduct in-depth interviews with the teachers responsible for traffic education. One teacher at each centre was interviewed. All teachers interviewed had at least two years of experience in traffic education. To obtain a variation of the traffic surroundings of the centres, both inner city and suburb centres were chosen. To reach the required sample size, 15 different centres had to be contacted. Low priority for traffic education was given as the prime reason for not participating in the study.

Data collection. A semi-structured interview technique was used to gather information about participants' experience with traffic education, educational goals, content of traffic education, traffic intensity in the vicinity of the preschool and cooperation with parents. After the interview, the interviewer inspected the streets near the preschool to draw her conclusions regarding traffic intensity.

Procedure. The participants, who were contacted by telephone, were informed about the purpose of the interview and an agreement was reached about participation and time and place of the interview. All interviews took place in the preschool centres. The conversations during the interviews were tape recorded and transcribed for later analysis.

Results

An analysis of the educational goals expressed by the teachers showed that they fell on a continuum with independence and cautiousness as endpoints. Goals for those stressing independence included having the children (a) cope safely with traffic and (b) know how to behave in traffic and not to be afraid of different traffic situations. The teachers on the cautiousness end of the continuum stressed that the children should have (a) great respect for traffic, (b) be afraid of traffic and (c) understand that there are rules that have to be strictly followed.

Of the 10 teachers, four expressed the cautiousness goal, three the independence goal and the remaining three mixtures of the two.

An analysis of the relation between traffic environment and traffic goal revealed that the cautiousness goal dominated among teachers working in centres in low traffic-intensity areas, whereas the independence goal dominated among teachers in centres located in high traffic-intensity areas. In fact, the correlation between traffic intensity and expressed goal was strongly significant, both when correlated against the teacher estimation ($r = .72$, $p < .05$) and the interviewer estimation ($r = .80$, $p < .01$) of traffic intensity.

Educational content was analysed in various ways, but it was found that, irrespective of expressed goal, all teachers stressed the practical training of walking and crossing roads.

No relation was detected between educational goal and cooperation with parents. Generally, level of cooperation with parents was low, which the teachers attributed to lack of time and interest in the parent group. An analysis was also made to determine the relation between the educational goal and traffic intensity near the centre; no significant correlation was found, however.

The major finding in Study 3 was the identification of two distinctively different goals for traffic education, and that these goals were related to traffic density in the neighbourhood of the centres. It was somewhat surprising to uncover that the independence goal was stressed by teachers working in traffic intensive environments, whereas the cautiousness goal was emphasized by teachers in the traffic calm areas. Some of the teachers in the traffic intensive environments accentuated the independence goal because the children had to know how to behave in traffic when they entered school.

General discussion

The two first studies showed that, in accordance with others (14,16), almost all accidents studied involved bicycles, demonstrating that the bicycle accident is the dominating child-related traffic casualty. Study 2, which allowed an analysis of the circumstances of the accident, showed that only a minor proportion of the accidents occurred in an ordinary traffic environment, i.e. on streets with car traffic. This finding raises the question as to how these accidents should be categorized. For instance, should they be classified as regular traffic accidents when the child is using the bicycle for transport or as play-related accidents occurring when the child is practicing handling the bicycle. Since both types of accidents have a common factor, namely informal parental training, the preliminary conclusion is that the two types of accident are related and hence should be treated accordingly.

This conclusion points out informal parental training as a crucial factor to be explained. Why then was increased parental training associated with an increase in the frequency of bicycle accidents? In Study 1, accident information, as well as data about parental training, was entirely based on self-reports. In Study 2, on the other hand, hospital records were used to define accident status and self-reports to measure informal parental training. Despite these two operational definitions, both studies indicated the same relation between training and accidents. This finding strongly indicates that the results are valid, and that possible explanations of the obtained results can be brought into discussion.

First, the present data do not support the Gregersen and Nolén (12) skill overestimation hypothesis. Instead, the results indicate that parental training was coupled to low skill estimates.

Second, the results from Study 1 indicate that accident reports were related to

insufficient bicycling skills. This conclusion won strong support from the accident analysis in Study 2, which demonstrated that inability to handle the bicycle was a contributing factor to many of the accidents.

Third, in both the present investigation and that by Gregersen and Nolén (12), no relation was found between traffic intensity in the neighbourhood and amount of traffic training. This failure to find a relation, however, does not mean that the variable of traffic intensity is of no importance. It may be that the traffic intensity along the routes to the child's playmates and to preschool or school is a decisive factor. Further investigations are needed regarding the traffic intensity variable.

An important finding in Study 1 was the relation between the rate of traffic accidents and the use of the bicycle to go to and from school or preschool. A possible explanation may be that some parents training their children do not impose clear limits on the use of the bicycle as a means of transportation. Therefore, some of the accidents may be related to the combination of informal parental training and permissive rules for bicycle use. . Anecdotal evidence acquired through interviewing preschool children revealed that a few children bicycled to their preschool, hiding the bike outside the centre so that the teachers would not detect it. The implication of this argument is not that these parents are uninterested in the traffic safety of their children. The finding, in both the present report and in Gregersen and Nolén (12), that informal parental training was positively correlated with helmet use, demonstrates that parents training their children also take active protective measures. However, helmet use only reduces accident severity not accident rate.

To understand why some parents train their children while others do not, it is necessary to have information about the parents' view of their children's traffic activities and traffic safety. Thus far, data on parents' views have not been collected, but the results from the interview with the preschool teachers resulted in the identification of the two goals cautiousness and independence. It remains for further investigation to determine whether these goals are also relevant for the parents.

Putting the above pieces together, the following picture seems to emerge. The parents' judgment of the child's skill level as a bicycle and road user is a main reason for the quantity of traffic training given. This training may make the child use the bicycle more than untrained mates, which results in an increased rate of accidents due to insufficient bicycling skills. In addition, if the parents do not establish clear limits regarding the use of the bicycle as a means of transportation, the training may result in an increased exposure to dangerous traffic situations, and hence an increased accident rate. Support for this travel-limit hypothesis is found in Study 1, which demonstrated that cooperation between home and preschool as to helmet use and where the child is allowed to travel was correlated with a low number of reported accidents. Admittedly, since the above line of reasoning is sketchy, it has to be tested in future studies.

Two major findings emerged. First, most accidents involved bicycles indicating that efforts in traffic training should give more weight to bicycle use. Second, informal parental traffic training was related to an increased accident rate, whereas parent – preschool staff co-operation was related to a decrease. This finding argues

for further investigations of the factors determining informal parental traffic training and how it is related to traffic accidents.

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