

Research Article

The Effect of Parenting Styles on Children's Familiarity with Traffic Signs

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The community, and especially the family, affects children's traffic safety. Parents influence children's current and future traffic behaviors. Numerous studies have demonstrated a relationship between parenting style and children's behavioral problems such as antisocial behaviors and delinquency, so the modification of parenting styles could have a positive impact on the interactions between parents and children. In the literature on children's traffic safety, parental influence has long been recognized as an important aspect of research, but parent-related factors are mostly unknown. In particular, a factor that can affect parents' attitudes and children's views of road safety is parenting style. Therefore, this study aims to examine children's knowledge of traffic signs utilizing a parenting styles' perspective. The determining role of demographic characteristics in traffic skills is critical and is investigated in this study. In this study, 1011 preschool, first-, second-, and third-grade students were interviewed and information about parenting styles and demographic characteristics were collected from questionnaires completed by parents. Through interviews, children's familiarity with law enforcement and informative signs was assessed. Results indicated that older children and those with higher socioeconomic status had better skills in this field. The results also showed that parents could improve their children's understanding of signs by less use of inconsistent discipline and corporal punishments. Parental negligence, contradictory use of corporal punishment, and nonuse of positive behaviors are some factors which are most likely related to children's knowledge of traffic signs and rules. The findings of this study can guide parents and assist relevant authorities to implement policies to more effectively train young children by developing practical and targeted resources.

1. Introduction

Researchers have long found that children's development is influenced by their characteristics, families, and society [1]. Many studies indicate the effects of parental practices and attitudes on children's road safety [2–4]. Parents are most likely the primary source of instruction for children about road safety. Parents' perception of safety is important, and they have frequent opportunities to educate their children. However, parents often lack an understanding on how they affect their children at young ages [2].

Children's road safety research has a number of foci. Some researchers have examined children's safety from a demographic characteristics perspective. Furthermore, the

impact of parents on children's awareness of traffic rules and their road safety is important. Extensive research has shown parenting styles affect a wide range of children's educational, psychological, behavioral, and social contexts [5–7]. Thus, it seems that investigating the effects of different types of parenting on children's traffic behaviors could improve road safety in future. One factor that is likely to affect children's traffic knowledge is parenting styles.

In order to improve safety on the roads and create good habits for future road use, parents should ensure an adequate focus on improving road safety awareness in their children. Improving children's familiarity with traffic safety and identifying significant factors can provide opportunities for policymakers to increase all road users' awareness, reduce

risks, and thus prevent traffic injuries. In the following section, the research that has been done thus far on child safety and the impact of parenting styles on children is briefly discussed.

1.1. Literature Review. Barton and Schwebel [8] considered the effects of children's individual differences in choosing higher-risk pedestrian routes. They found that children from low-income families, ethnic minorities, younger children, and those with less temperamental control were more likely to choose higher-risk pedestrian routes. Tabibi et al. [9] found that children's abilities to identify safe as opposed to dangerous places to cross the road and select a safe travel route were affected by their age, gender, socioeconomic status, and their cognitive developments. The child's mental processing speed was also an effective predictor of identifying safe places to cross the road. Trifunović et al. [10] studied color-related perceptions of children and their awareness of traffic signs. Their study showed that yellow and green colors are clearer for them. Therefore, they concluded that the background color of traffic signs in school areas should be yellow or green. The age of the child and those that live in urban areas were factors that made the children more aware of the meanings of these signs. The results showed that children are able to learn the meaning of traffic signs that they observe every day [10, 11]. Morrongiello et al. [3] found that the best predictor of children's current traffic behaviors was parental teaching and the best predictor of children's future behaviors was parental practices. Muir et al. [4] concluded that raising parents' awareness about their main role as children's traffic safety instructors is important.

Given the role of parents in enhancing the road safety of their children, parenting style may affect this process. Parenting styles are a way of describing the approaches used by parents to raise their children. Baumrind [12] developed a set of parenting styles that included authoritarian, authoritative, permissive, and rejecting-neglecting. Authoritative parenting occurs when parents are very responsive to the requirements of their children but also set appropriate limits [13]. Authoritarian parents control, shape, and evaluate the behavior and attitudes of the child in a manner that is consistent with an absolute standard. In contrast, permissive parents tend to accept and affirm what the child would like to do with minimal punishment. Parents categorized as rejecting-neglecting are noncontrolling but also do not encourage independence or individuality [12]. There are some suggestions that these styles do not adequately represent parenting in different contexts [13]. Research has shown that negative parenting styles lead to children's aggression in future [14] and positive parenting is associated with less behavioral problems in children [15]. A significant body of research has considered the impact of parenting styles on a wide range of outcomes including, for example, academic achievement [16–18], delinquency [19], and substance use [19, 20]. Studies have shown that parenting stress and parenting style have impacts on children behavior problems [21] which could lead to difficulties in later life.

Parenting styles affect children's self-esteem [22], externalizing and internalizing problems [23], sleep habits [24], obesity [25], health risk behaviors [26], and worry [27].

The impact of parents on children's awareness of traffic rules and their road safety is important. Researchers have indicated that parenting styles affect children's driving [28–30]. To investigate the correlations between parenting styles and some children's driving behaviors (seat belt use, angry driving, substance use, telephone use, speeding, and racing), Ginsburg et al. [29] divided parents into four groups (authoritarian, permissive, uninvolved, and authoritative). They found that safe behaviors as a car passenger and driver are among the behaviors influenced by parenting styles. They found that authoritative parents and limited parental supervision influenced adolescents' driving, but permissive parents had little effect on their children's safe driving. Drivers who consider their parents authoritative have half the risk of being involved in crashes when compared to those who consider their parents uninvolved [29].

Knezek et al. [30] examined the effects of a community-based training program, Share the Keys, that had been developed to assist parents and new drivers understand the changes that were made to the New Jersey (USA) graduated driver licensing system. Some of the changes required parents to be more actively involved in the process of their child obtaining a license. The results of their study demonstrated that the program was beneficial parents with all types of parenting style. They also noted that the prevalence of authoritarian and authoritative parenting styles varied throughout the licensing process.

While Ginsburg et al.'s [29] study used a sample of young drivers and Knezek et al.'s [30] study used a sample of parents to examine the effects of parenting style, Bates et al. [28] included a sample of both parents and new drivers within their study to identify if parenting style had an effect on young driver compliance with laws. They identified that parents with high levels of control were associated with higher levels of compliance with licensing restrictions and with the imposition of additional, parental, restrictions on new drivers. While the three studies above have examined parenting styles and their influence on road safety, they have focused on novice drivers rather than younger children. Thus, there is a need for research examining the effect of parenting on encouraging young children to be safe in traffic.

1.2. Research Objectives and Motivation. Despite the significant amount of research regarding parenting styles on a range of outcomes, the consideration of parenting styles within a road safety context is limited. Previous studies have examined the effects of parenting styles on various psychological and behavioral dimensions of children. While other studies have examined the influence of parenting styles on children's road safety, they have focused on adolescents rather than younger children. This is despite parents likely having a greater influence on younger children. This study will address this gap by considering the effect of parenting styles on younger children and their familiarity with traffic

signs. As a secondary purpose, it investigates the effects of demographic characteristics on children's familiarity with these signs.

2. Methodology

2.1. Participants. One thousand eleven children aged 6 to 9 years and one of their parents (the one who was more involved with the child) participated in this study. Questionnaires were provided to parents through 30 schools, selected at random, and short interviews were conducted with their children at school. Schools were selected from different zones of Tehran, the capital of Iran. The Education Department provided permission to interview the children and provide questionnaires to the parents. The choice of students was random, and the schools were selected to ensure the representation of different socioeconomic situations.

2.1.1. Parental Questionnaire. This questionnaire consisted of four main parts

(1) *Personal Information.* The first part of the questionnaire included parents' age, parents' education, household income, child's age, gender, and number of crashes experienced in the past two years. Parents also provided information about whether the child was injured in the crash.

(2) *Children's Exposure to Traffic.* In the second part, parents referred to the children's presence on streets (as pedestrians, cyclists, and occupants of a car, public transport vehicles, and motorcycle) using the Likert scale (5 = almost every day, 4 = some days of a week (more than once a week but not every day), 3 = once or twice in two weeks, 2 = once or twice a month, and 1 = never).

(3) *Training Children.* Parents reported how much their children are taught traffic signs. The training given to the child is classified into two types: parental sources and nonparental sources. Parents referred to the education they teach to their children about traffic signs ranging from 5 (highest score) to 1 (lowest score). They also provided information regarding nonparental resources in educating children, including education in traffic parks, in schools, and through siblings. If the child was educated through any of these nonparental resources, the child would receive another score. Eventually, the scores were aggregated, and the child training index could vary from 1 to 8 so that a higher score indicated higher levels of training.

(4) *Alabama Parenting Questionnaire (APQ).* In the present study, to measure parenting styles, the Alabama Parenting Questionnaire (APQ) was used [31], which includes negative scales (poor monitoring, inconsistent discipline, and corporal punishment) and positive scales (positive parenting and involvement). This questionnaire contained 42 items and was translated from English to Persian. It was then evaluated to ensure conceptual and cultural consistency in a pilot study. The APQ has seven

items which are not scales but provide information regarding the parent's discipline practices. The KMO and Bartlett's test were used to evaluate data for factor analysis, using SPSS software. The KMO ratio for this analysis was 0.821, and the value of Bartlett's test was significant at the level of 0.001. After applying a varimax rotation, the content of the five factors was extracted based on the load factors higher than 0.3. A threshold of 0.3 was considered appropriate for load factors, based on research that translated this questionnaire into another language [32, 33]. Due to limited loading, five questions (5, 8, 26, 29, and 32) were not placed in any categories. The load factors of questions are categorized in Table 1. Cronbach's alpha coefficient was also calculated for the extracted factors and is shown in Table 2. The value obtained for Cronbach's alpha coefficients in the present study corresponds to the coefficient obtained in other research that has translated this parenting questionnaire into other languages [32–34]. Additionally, the low internal consistency of the corporal punishment scale is most likely due to the few items on the scale ($n = 3$).

The interfactor correlations of subscales are also shown in Table 3. As expected, two positive parenting styles (positive parenting and parental involvement) are negatively correlated with the remaining factors.

The goodness-of-fit indices of classifying APQ are reported in Table 4. High values of CFI, GFI, and AGFI indicate that the model explains the variance of the data well. RMSEA represents an error, so the lower the RMSEA and PCLOSE, the better the model fit was.

2.1.2. Interviewing Children. Individual interviews, which took about 10 minutes each, assessed children's knowledge of traffic signs. To estimate children's familiarity with 7 law enforcement signs (no pedestrian crossing, no bicycle crossing, no entry, no parking, no U-turn, one-way traffic, and no honking) and 11 informative signs (metro station, bus station, children crossing, pedestrian crossing, traffic light, men at work, stop, danger, pedestrian bridge, disabled parking, and bicycle path), a banner (70 cm × 100 cm) and some small traffic signs were used. A painted city was printed on the banner which was placed on a large table that matched the children's height, and the signs were placed on it. If a child correctly recognized the meaning of each sign, he/she would receive one point, so that in the category of law enforcement signs, each child would receive a score between 0 and 7 and in the category of informative signs, he/she would receive a score between 0 and 11.

In Iran, some traffic rules and signs are taught to children using a textbook in the third grade of elementary school (10-year-old children). There are also traffic training parks in some cities where schools and parents can take their children if they wish. This study's selection of traffic signs was based on what is taught to children in the textbook and traffic parks. It should be noted that five child psychologists and four safety experts were consulted to ensure that these signs are appropriate and relevant to children's traffic safety.

TABLE 1: Load factors of APQ.

Items	Involvement	Positive parenting	Inconsistent discipline	Poor monitoring	Corporal punishment
7. You play games or do other fun things with your child.	0.607				
4. You volunteer to help with special activities that your child is involved in (such as sports, boy/girl scouts, church youth groups).	0.606				
20. You talk to your child about his/her friends.	0.585				
14. You ask your child what his/her plans are for the coming day.	0.547				
23. Your child helps plan family activities.	0.542				
1. You have a friendly talk with your child.	0.492				
15. You drive your child to a special activity.	0.473				
9. You ask your child about his/her day in school.	0.455				
11. You help your child with his/her homework.	0.416				
13. You compliment your child when he/she does something well.		0.765			
16. You praise your child if he/she behaves well.		0.737			
18. You hug or kiss your child when he/she has done something well.		0.627			
2. You let your child know when he/she is doing a good job with something.		0.624			
27. You tell your child that you like it when he/she helps around the house.		0.551			
22. You let your child out of a punishment early (e.g. lift restrictions earlier than you originally said).			0.683		
3. You threaten to punish your child and then do not actually punish him/her.			0.678		
31. The punishment you give your child depends on your mood.			0.600		
25. Your child is not punished when he/she has done something wrong.			0.447		
12. You feel that getting your child to obey you is more trouble than it's worth.			0.430		
19. Your child goes out without a set time to be home.				0.592	
10. Your child stays out in the evening past the time he/she is supposed to be home.				0.577	
17. Your child is out with friends you don't know.				0.521	
24. You get so busy that you forget where your child is and what he/she is doing.				0.489	
21. Your child is out after dark without an adult with him/her.				0.457	
30. Your child comes home from school more than an hour past the time you expect him/her.				0.431	
6. Your child fails to leave a note or to let you know where he/she is going.				0.407	
28. You don't check that your child comes home from school when she/he is supposed to.				0.331	
35. You slap your child when he/she has done something wrong.					0.724
33. You spank your child with your hand when he/she has done something wrong.					0.676
38. You hit your child with a belt, switch, or other object when he/she has done something wrong.					0.554

3. Modelling

3.1. Hierarchical Clustering. In this research, the hierarchical clustering algorithm was used to classify children into familiar or unfamiliar group with each sign categories. The

Ward linkage algorithm [35] is one of the hierarchical clustering methods which have been used in many studies [36]. In the present study, this method was used for grouping children, so that 38.3% of children were familiar and 61.7% were unfamiliar with law enforcement signs and 68.1% and

TABLE 2: Alpha coefficients.

Subscales of APQ	Alpha coefficients
Involvement	0.73
Positive parenting	0.79
Inconsistent discipline	0.64
Poor monitoring	0.60
Corporal punishment	0.63

TABLE 3: Interfactor correlation.

Subscales of APQ	Involvement	Positive parenting	Inconsistent discipline	Poor monitoring	Corporal punishment
Involvement	1				
Positive parenting	0.512	1			
Inconsistent discipline	-0.153	-0.153	1		
Poor monitoring	-0.137	-0.167	0.114	1	
Corporal punishment	-0.124	-0.137	0.372	0.194	1

($p < 0.01$).

TABLE 4: Fit indices.

Fit indices	
CFI	0.947
GFI	0.962
AGFI	0.948
RMSEA	0.028
PCLOSE	1.000

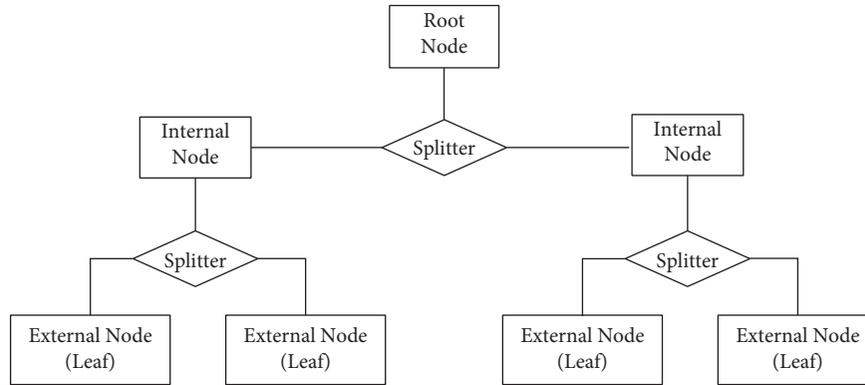


FIGURE 1: Basis of decision tree.

31.9% were familiar and unfamiliar with informative signs, respectively. The classification of children into two groups of familiar and unfamiliar with each category of signs has been used in modelling.

3.2. Decision Tree. The decision tree model is a nonparametric hierarchical segmentation analysis technique that is used to determine the most important parameters affecting children's familiarity with law enforcement signs and informative signs using the recursive dividing method of the predictor space. This model is a very popular statistical tool to examine the relationships and interactions between independent parameters [37–41]. There are various possible cutoff values for each predictor of this division process [42].

Classification and Regression Tree (CART) [43] is one of the decision tree algorithms which have many usages in classification and regression. According to Figure 1, which shows the basis of the CART model, first, the whole data is concentrated in the upper node of the tree (root node) and then is divided by one independent variable that produces the highest purity. This process continues to the extent that the data in each node has the highest purity. It is referred to as the endpoint or the leaf.

The CART model uses a criterion called the Gini index to select tree nodes, which is obtained from the following equations:

$$g(t) = \sum_{i \neq j} p(j|t)p(i|t), \quad (1)$$

where

$$\begin{aligned}
 p(j|t) &= \frac{p(j,t)}{p(t)}, \\
 p(j,t) &= \pi(j) \frac{N_j(t)}{N_j}, \\
 p(t) &= \sum_j p(j,t).
 \end{aligned} \tag{2}$$

The lower the Gini index for an independent variable, the more the information that it provides and it is closer to the root node. This tree uses trial and error to determine the optimal value in selecting the splitter in each variable. In equation (2), $\pi(j)$ is the prior probability value for category j , $N_j(t)$ is the number of records in category j of node t , and N_j is the number of records in category j of the root node. Note that when the Gini index is used to find the improvement for a split during tree growth, only those records in node t and the root node with valid values for the split predictor are used to compute $N_j(t)$ and N_j , respectively. In addition, to prevent decision tree from overfitting, a condition is used to stop continuing and becoming too larger and more complex. One way to prevent overfitting is using a certain number of samples, so that if the number of samples in a subtree is less than the threshold, the branching tree does not continue. Such a threshold can be selected in SPSS software. In the present study, a threshold of 30 was used for the data.

3.3. Importance of Variables. The importance of entered variables in the CART model is defined by a variable X with possible states (x_1, x_2) in the following equation:

$$\text{VIM} = \sum_{i=1}^h nx_j \frac{(I(C|X=x_i) - (c))}{n}, \tag{3}$$

where C is the class variable (sign familiarity status), nx_i is the number of cases in that $X=x_i$, n is the number of total items, and I is the Gini index.

3.4. Model Evaluation. In this study, decision tree models are validated by sample splitting. The data is divided into two parts. 70% of data is used as training data, and 30% of it is used for testing models, so the software output consists of two decision trees for each model. Furthermore, the accuracy and precision of models are measured by dividing data.

The confusion matrix is a table that classifies the dependent variable into two levels, positive (familiar with signs) and negative (unfamiliar with signs). Also, the accuracy and precision of models are calculated by equations (4) and (5), respectively, which are extracted according to the table. The closer these indicators are to one, the stronger the model:

$$\text{accuracy} = \frac{(\text{TP} + \text{TN})}{(P + N)}, \tag{4}$$

$$\text{precision} = \frac{\text{TP}}{(\text{TP} + \text{FP})}. \tag{5}$$

3.5. Variables. In this study, to identify the most important factors affecting children's familiarity with law enforcement and informative signs, two models were developed using decision trees. In this modelling, 16 independent variables were used, which are given in Table 5.

4. Results

4.1. Demographic Characteristics. The participating children included 181 preschool (6-year-olds), 302 first elementary (7-year-olds), 283 second elementary (8-year-olds), and 245 third elementary (9-year-olds) children (mean age: 7.59, variance: 1.086) (Table 6). One of their parents (the one who was more involved with the child) also participated in this study. Within the interviews, 509 girls and 502 boys participated (Table 6). Most parents were females (83%). The age of parents was collected continuously but then categorized into five age groups: 45 years and older (8%), 40 to 44 years (19%), 35 to 39 years (41%), 30 to 34 years (25%), and 23 to 29 years (7%) (mean age: 36.74, variance: 27.27). Parents' education was divided into three groups: master's degree or higher (15%), bachelor's or associate degree (47%), and high school diploma or less (38%). The monthly household income was divided into four categories: affluent (21%), good (33%), average (27%), and poor (19%) (Table 7). This classification was done using different income deciles in Iran. In this way, the tenth and ninth deciles were considered the affluent category, the eighth and seventh deciles as the good income category, the sixth and fifth deciles as the average income category, and the fourth and lower deciles were considered the poor economic class.

Parents were asked about their child's exposure to traffic as pedestrians, cyclists, occupants of a car, public transport vehicles, and motorcycles (Table 8). Within the sample, 58% and 59% of children were almost every day pedestrians and car occupants, respectively.

4.2. Children's Familiarity with Law Enforcement Signs. Figures 2 and 3, respectively, provide training and test data decision trees of children's familiarity with law enforcement signs. These trees are made up of 13 nodes and 7 leaves. The root node is divided into two groups based on the family economic level. Children living in middle- or low-income families are more likely to have lower awareness of law enforcement signs than children with affluent or good economic status (74.9% and 50.5% probability). In affluent

TABLE 5: Independent variables.

Independent variables
Child's grade
Child's gender
Household income
Parents' level of education
Involvement
Positive parenting
Poor monitoring
Inconsistent discipline
Corporal punishment
Transportation by car
Transportation on foot
Transportation by public transport
Transportation by motorcycle
Transportation by bicycle
Training
Number of child accidents

TABLE 6: Children's information.

Variables		Frequency
Child's grade	Grade 0	181
	Grade 1	302
	Grade 2	283
	Grade 3	245
Child's gender	Girl	509
	Boy	502

TABLE 7: Parents' information.

Variables		Percent
Parent's gender	Female	83
	Male	17
Parent's age	23 to 29 years	7
	30 to 34 years	25
	35 to 39 years	41
	40 to 44 years	19
	45 years and older	8
Parent's level of education	High school diploma or less	38
	Bachelor's or associate degree	47
	Master's degree or higher	15
Monthly household income	Poor	19
	Average	27
	Good	33
	Affluent	21

TABLE 8: Children's exposure to traffic.

Mode of transport	Almost every day (%)	Some days of the week (%)	Once or twice in two weeks (%)	Once or twice a month (%)	Never (%)
Pedestrian	58	18	8	11	5
Car	59	28	6	5	2
Public transport	4	5	8	45	38
Motorcycle	6	6	3	10	75
Bicycle	0	3	2	6	89

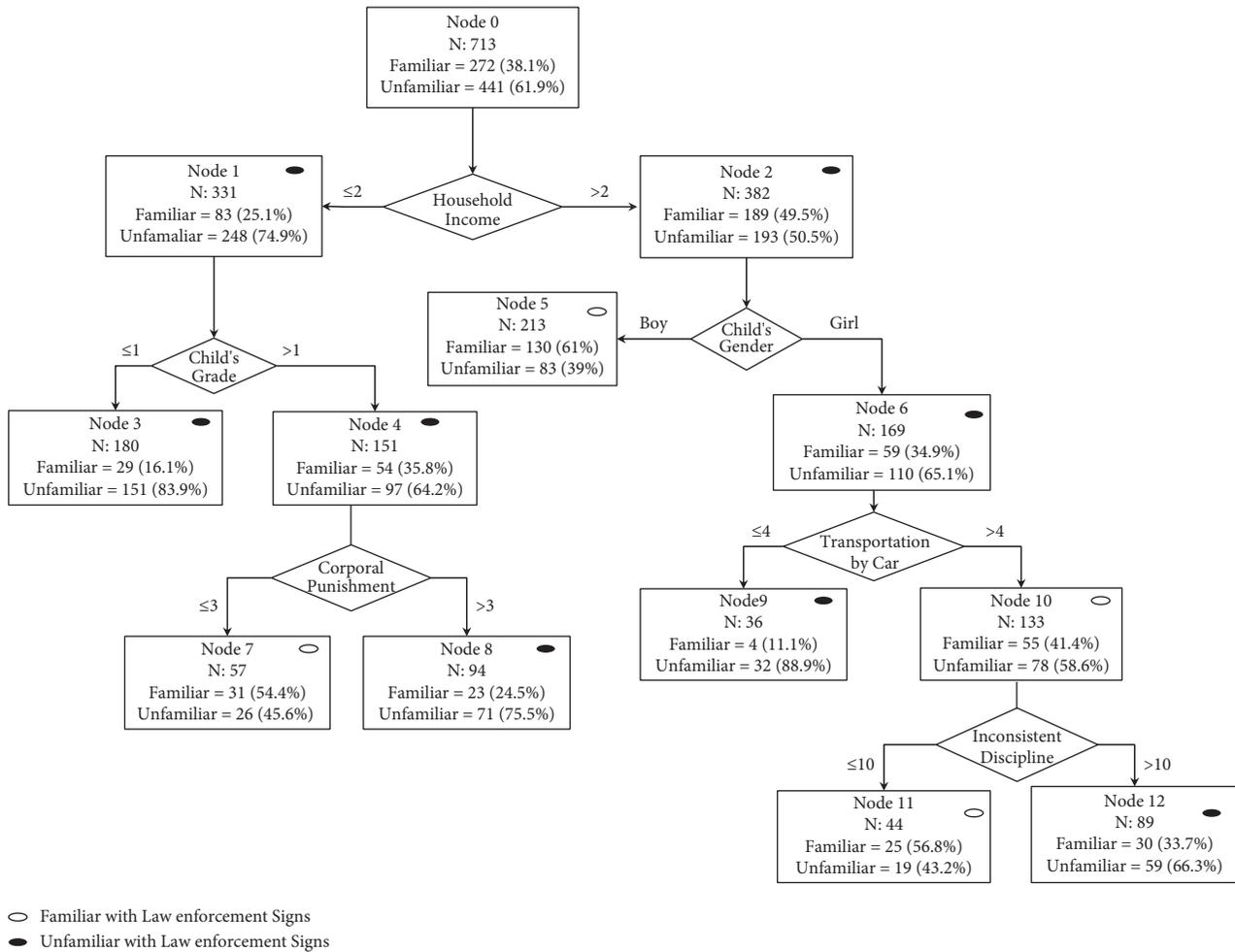


FIGURE 2: Decision tree of the law enforcement sign model (training data).

and economically good families, boys had a probability of 61% to be familiar with the signs. However, girls are likely unfamiliar with the meanings of them (probability of 65.1%). Girls who are almost every day car occupants are familiar with these signs; others are likely to not know the meanings of them with the probability of 88.9% (node 6). At the next node, if the inconsistency in parents' behaviors is higher than 10, children are probably 66.3% unfamiliar with law enforcement concepts; otherwise, they are familiar with them with the probability of 56.8%.

Among children of low- and middle-income families, first-grade and preschool children are likely unfamiliar with law enforcement signs with the probability of 83.9%. In comparison, the probability of unfamiliarity with these signs in children of second and third grades is equal to 64.2%. At node 4, the rate of using corporal punishment splits children, so that children whose index of this parenting style is higher than three (probability 75.5%) do not know the meaning of the law enforcement signs. In comparison, children who are never received corporal punishment are expected to know the correct meaning of these signs (54.4% probability).

The significance of the important parameters of familiarity with the law enforcement sign model was estimated using equation (3). The importance of each data is

normalized, sorted, and provided in Table 9 in the order of importance. Parameters with little importance have been removed from the table. Based on the results, the most important variable in predicting children's familiarity with law enforcement signs is household income, grade, and gender with 100%, 83.3%, and 80.4% degrees of importance, respectively. Parents' level of education with 48.4% degree of importance is the fifth effective parameter. Among parenting styles, the rate of using corporal punishment and inconsistent discipline with 37.2% and 30.2% degree of importance, respectively, influence children's understanding of law enforcement signs. The frequencies of children's transportation on foot and by car are also important parameters in the segregation of children with 31.3% and 68.6% importance, respectively.

As shown in Table 10, the accuracy of the model based on training and test data is, respectively, 70% and 66.1%, and the precision of the training and test model is 0.68 and 0.66, respectively.

4.3. *Children's Familiarity with Informative Signs.* Figures 4 and 5, respectively, provide the training and test model of children's familiarity with informative signs. These

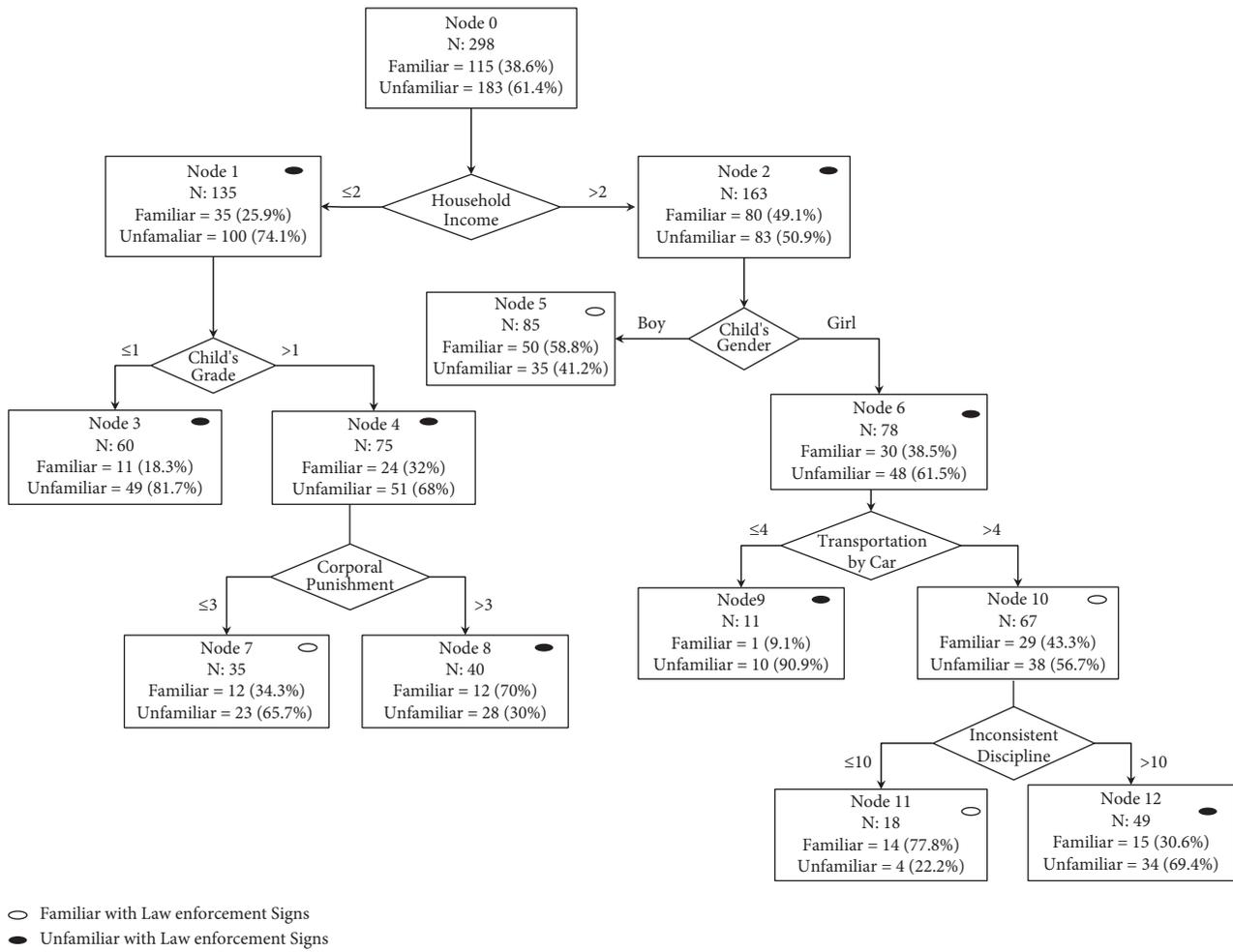


FIGURE 3: Decision tree of the law enforcement sign model (test data).

TABLE 9: Variable significance of the law enforcement sign model.

Variables	Normalized importance	Variables	Normalized importance (%)
Household income	100	Inconsistent discipline	30.2
Child's grade	83.3	Involvement	14.9
Child's gender	80.4	Positive parenting	9.3
Transportation by car	68.6	Training	8.3
Parents' level of education	48.4	Transportation by public transport	5
Corporal punishment	37.2	Poor monitoring	4.1
Transportation on foot	31.3	Number of child accidents	1

TABLE 10: Confusion matrix, accuracy, and precision of the law enforcement sign model.

Observed	Predicted		Accuracy (%)	Precision
	Positive	Negative		
Training data	Positive	186	86	68.4
	Negative	128	313	71
	Overall percentage	44%	56%	70
Test data	Positive	76	39	66.1
	Negative	62	121	66.1
	Overall percentage	46.3%	53.7%	66.1

Note. Positive = familiar with signs; negative = unfamiliar with signs.

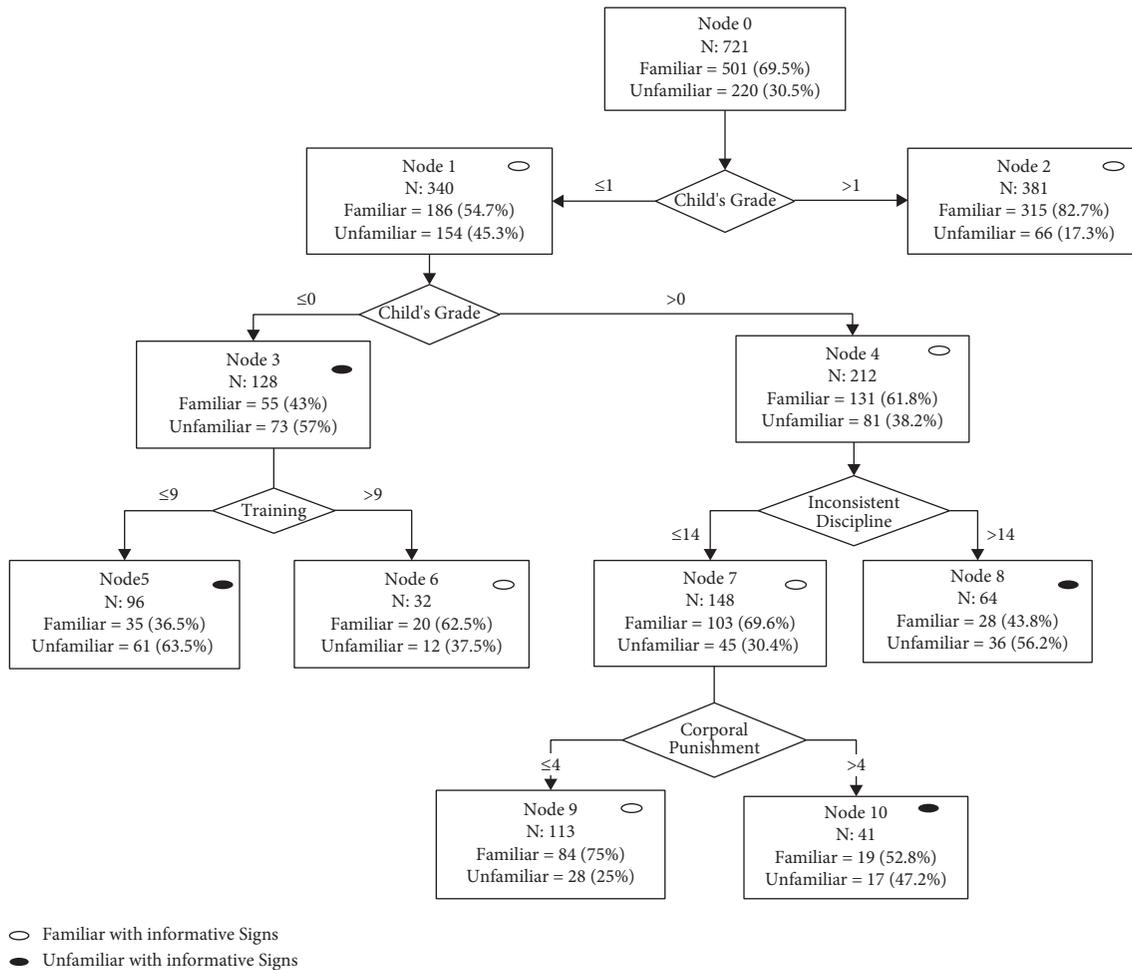


FIGURE 4: Decision tree of the informative sign model (training data).

models are made up of 11 nodes and 6 leaves. In the early segregation (node 0), children's grade is an effective variable. If the child is a second- or third-grade student, he/she is likely to be familiar with the informative signs (82.7% probability). In comparison, first-grade children and preschoolers are less likely (54.7%) to be familiar with these signs. Again, at node 1, the data is divided into two groups, based on the grade, so that the probability of first-grade children's familiarity is 61.8%, while preschoolers (57%) are probably not familiar with these signs.

In the next node, the segregation parameter is parents' inconsistent discipline. If the value of this parenting style is 14 or fewer, children are familiar with the signs with a probability of 69.6%. Corporal punishment segregates children in the next node. If the value of this parameter exceeds 4, the children are most likely not knowledgeable regarding these signs; otherwise, they have a 75% probability of being familiar with them. In node 3, preschoolers whose training levels are more than 9 are likely to have sufficient knowledge about these signs with a probability of 62.5%. If not, the probability is 63.5% in that they are unfamiliar with these signs.

In Table 11, the normalized importance percentage of variables is sorted based on their importance. Ineffective

parameters have also been removed from the table. The first and most important parameter to determine children's familiarity with these signs with 100% importance is their grade at school. The next effective parameter (19%) is the rate of using corporal punishment. The degree of parents' inconsistent discipline is the third important parameter in data segregation (17.8%). The child's training with 16.9% degree of importance is the other variable which influences children's knowledge of informative signs.

According to Table 12, the accuracy of the model is 74.2% based on training data and 67.6% based on test data. The precision of training and test model is 0.87 and 0.82, respectively.

5. Discussion

Research has long identified that parental factors are important in children's traffic safety [2–4]. This study enhances our understanding of parenting styles on younger children and in a different cultural context. Most research examining parenting style, and its impact on road safety, occurs within a first world, western context [28–30]. This study addresses an important gap in the literature by investigating this issue within a non-Western culture. In this study, the impact of

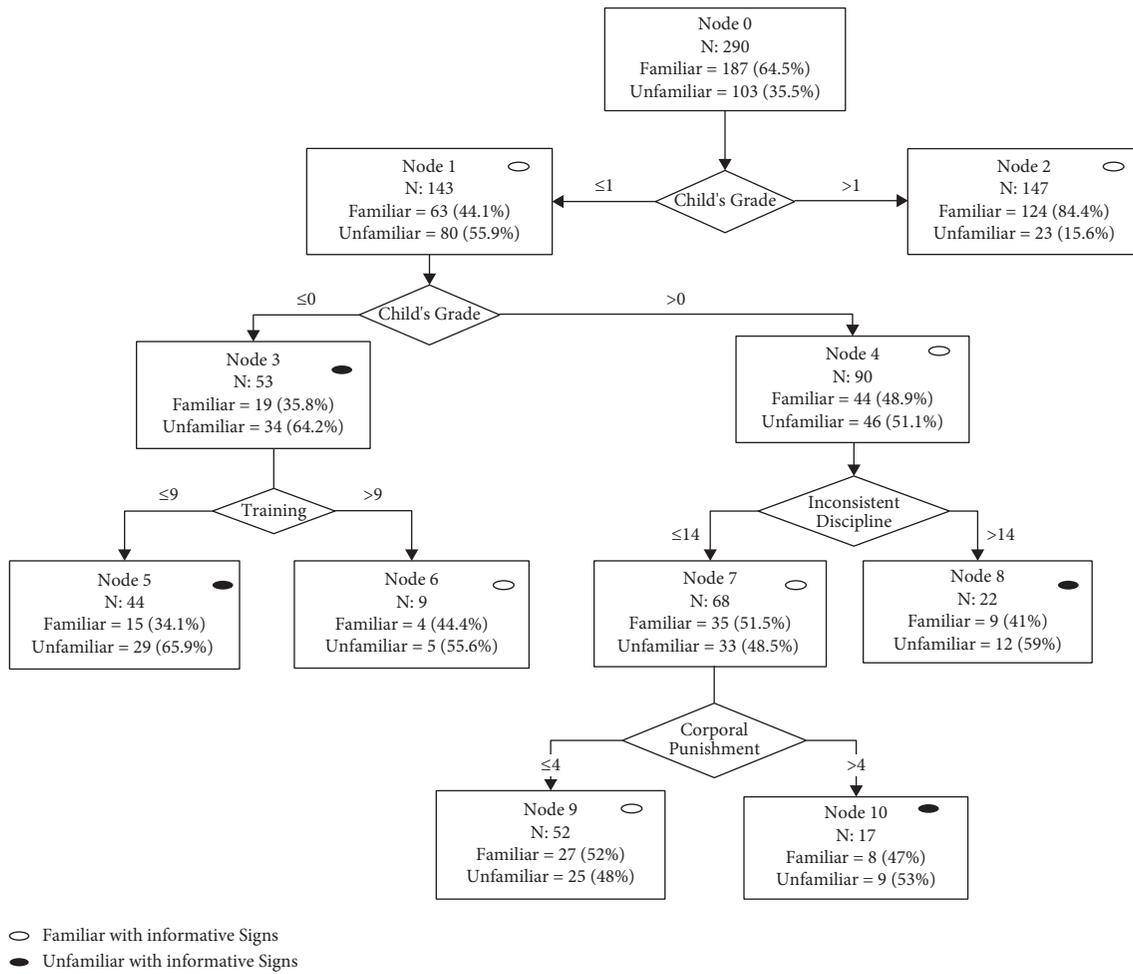


FIGURE 5: Decision tree of the informative sign model (test data).

TABLE 11: Variable significance of the informative sign model.

Variables	Normalized importance (%)	Variables	Normalized importance (%)
Child's grade	100	Poor monitoring	5.1
Corporal punishment	19	Parents' level of education	4.8
Inconsistent discipline	17.8	Positive parenting	4.2
Training	16.9	Transportation on foot	1.4
Household income	12	Number of child accidents	0.3
Transportation by car	8.7	Transportation by public transport	0.1
Involvement	5.4		

TABLE 12: Confusion matrix, accuracy, and precision of the informative sign model.

	Observed	Predicted		Accuracy (%)	Precision
		Positive	Negative		
Training data	Positive	438	63	87.4	0.87
	Negative	123	97	44.1	
	Overall percentage	77.8%	22.2%	74.2	
Test data	Positive	155	32	82.8	0.82
	Negative	62	41	39.8	
	Overall percentage	74.8%	25.2%	67.6	

Note. Positive = familiar with signs; negative = unfamiliar with signs.

different parameters on children's familiarity with signs is described in two sections, including demographic characteristics and parenting styles.

5.1. Effects of Demographic Factors

5.1.1. Socioeconomic Level of the Family. The results indicate that children are more likely to be unfamiliar with law enforcement signs when they come from more economically disadvantaged families. Parents with better socioeconomic status have a greater sense of self-confidence about their role as children's road safety educators possibly because of their higher level of education; also, they have greater access to training sources when compared with other groups [4]. Furthermore, the research evidence indicates that people with better socioeconomic status engage in fewer abnormal and illegal behaviors [44]. Thus, it is inferred that depending on the socioeconomic level, families behave differently as road users. Parents who have higher socioeconomic status are more likely to respect traffic rules. As a result, their children, who generally adopt parents as their role models [2], are more aware of the correct way to behave in traffic. Parents who believe that children learn traffic safety skills primarily from them have higher levels of education, income, and more road safety information [4]. Researchers have indicated that socioeconomic status affects children's readiness for exposure to traffic, and children who live in a better socioeconomic status understand the meaning of the signs more than others [10]. This finding is consistent with other studies in similar fields that have explored the role of economic status in children's road safety skills [8]. Therefore, parents who come from lower socioeconomic contexts may need additional support in enhancing their children's road safety knowledge. This could occur through training workshops and programs aimed at parents.

Compared to children's familiarity with law enforcement signs, the parent's level of education and economic status do not have significant effects on familiarity with informative signs such as pedestrian crossing. Law enforcement signs are mainly relevant for drivers. Thus, those children who come from families with a higher socioeconomic status are therefore more likely to have a car in the family which provides the children with more opportunities to learn about these types of signs. However, informative signs are more likely to be used by all types of road users including pedestrians and bike riders. Thus, children from all socioeconomic levels engage in activities where they are able to view and interact with these signs.

5.1.2. Children's Grade. The results show that children's grade is an important variable in their familiarity with both informative and law enforcement signs. This is consistent with research that has shown the ability to identify safe/dangerous places on roads and build safe routes to cross has a positive correlation with age [8, 9]. Furthermore, studies have shown that as children are growing up, their behaviors become safer in traffic [45–48]. Probably, the importance of age is because older children are more exposed to traffic; as a

result, they have more experience with signs and rules and so may have developed their cognitive skills and traffic-related experiences [9].

5.1.3. Training Children. This study identified that training has a significant effect on children's familiarity with informative signs which is consistent with other studies that have shown that children's pedestrian behaviors improved after simple training [45]. Researchers also found that parents can significantly improve their children's pedestrian skills, even at five [49]. Thus, parents and teachers can effectively teach traffic skills to children.

Generally, children's safety educational resources do not cover law enforcement signs; their topics mainly focus on rules and informative signs. Thus, one reason for the low importance of training in children's familiarity with law enforcement signs is the lack of these topics in educational resources. Due to the effect of training on children's familiarity with informative signs, it is expected that teaching other traffic skills can raise children's traffic knowledge and such topics could be discussed in the education curriculum. However, researchers have identified that parents play a more important role in teaching traffic skills to children when compared with teachers [49, 50]. For this reason, parents need to be made aware of their key role in training their children.

5.1.4. Child's Gender. The results showed that boys were more familiar with law enforcement signs when compared with girls. It seems boys are given more attention in training traffic rules and signs than girls. As observed in this study, the education score of boys was significantly higher than girls and thus boys were more familiar with these signs than girls. Additionally, it seems that boys are more interested in traffic topics than girls, and this can increase their desire to learn traffic signs. On the other hand, law enforcement signs are of greater concern to drivers and, within Iran, the number of male drivers is greater than female drivers [51]. Therefore, more attention needs to be paid to educating girls in this field. This finding is consistent with studies that have examined differences between girls and boys in a similar context. For instance, boys are better than girls in finding safe routes and places for crossing roads [9, 49]. However, in a number of studies from different cultural contexts, no differences were found between boys' and girls' road safety skills [8, 52, 53]. In the present study, the informative signs model did not show a significant difference between the genders. More research is needed to determine why gender differences exist in children's traffic knowledge.

5.1.5. Children's Exposure to Traffic. The frequency of transportation by car plays a significant role in children's familiarity with law enforcement signs. More exposure to traffic enhances children's traffic skills [9]. The present study indicated that children are more likely to be familiar with law enforcement signs if they are passengers within a car almost every day. By observing the drivers' behaviors inside the car,

children can learn about traffic rules and law enforcement signs. Additionally, walking influences familiarity with law enforcement signs. However, the other modes of transport (occupants of public transportation, motorcycle, and bicycle) did not have high degrees of importance in children's familiarity with law enforcement signs. The modes of transport used by the children had little effect in the informative sign model.

5.2. Effects of Parenting Styles. This study has identified that there are two aspects of parenting, inconsistent discipline and corporal punishment, which influence children's understanding of road signs. Parents' poor monitoring, involvement, and positive parenting were not significant. This may be because these parental aspects are not relevant when developing children's awareness of traffic rules and signs. However, further research is needed to confirm this.

5.2.1. Inconsistent Discipline. The results of this study indicate that parents with excessive-inconsistent behaviors have children who have limited knowledge of both law enforcement and informative signs. Social theories have indicated that discipline problems in the parent's behavior increase children's disruptive behavioral problems [54]. For example, studies have shown that the parent's inconsistent application of discipline increase children's antisocial behaviors [55], lead to conducting disorders and delinquencies [56, 57], lead to having negative effects on future behaviors [58, 59], lead to low academic achievements [60], and lead to substance abuse [61, 62]. Consistency in the application of discipline strategies is important because the most successful solutions for children's behavioral problems focus on it [63]. This study has also demonstrated a link to improved children's traffic knowledge.

5.2.2. Corporal Punishment. The results indicate that parents' use of corporal punishment has negative effects on children's familiarity with law enforcement and informative signs. Corporal punishment causes humiliation, internal problems (anxiety, depression, aggression, and physical problems), and behavioral problems such as delinquency in children [64–67]. The greater the use of corporal punishment in families, the more the stress experienced by family members [68]. Corporal punishment reduces children's self-esteem and their desire to participate in class activities. It also increases doubt and hesitation [69–71]. Therefore, this may have a negative effect on the children's ability to answer the interview questions.

In addition, corporal punishments reduce children's motivation and ability to learn [72], destroys their desire to learn, makes them depressed, and causes low scores in exams [73]. As shown in this study, parenting style affects children's ability to learn the meaning of traffic signs. Thus, if strategies were used to improve parental approaches to punishing children, there would be benefits including enhancing children's growth, learning processes, and their traffic skills.

6. Limitations and Strengths

This study had strengths and limitations. The large sample size, using parent-child dyads, and conducting the study in a non-Western cultural context were strengths. Furthermore, in this study, collecting information was through self-report, but there were no names or addresses of children or their parents on the questionnaires. One code was given to each child, which protected their identity. Though the present study provides new insights into factors that influence children's traffic sign information, there are some limitations that could be considered in planning future research on this topic. In this study, the training parameter was examined, but due to time limitations in the schools, children's level of the educability was not assessed using a control group or pretests and posttests. Studying children's ability to learn traffic signs and the role of parenting styles in this process would be a useful future study.

7. Conclusion

This study highlights that parenting styles and demographics influence children's familiarity with two types of traffic signs: law enforcement and informative signs. The findings indicate that child age, family socioeconomic status, and child gender play important roles in children's familiarity with law enforcement signs. The frequency with which the child is transported by car also affects their familiarity with these signs. The results indicated that children's age and training are important factors in their knowledge of informative signs. Two parenting subscales, inconsistent discipline and corporal punishment, influence children's understanding of road signs. If parents have excessive-inconsistent discipline, their children have inadequate understanding of traffic signs. Additionally, children could be more aware of traffic rules and signs if parents do not use corporal punishment. Therefore, authorities should take measures to provide platforms to enhance parenting practices and thus promote children's traffic safety knowledge. The use of courses and other educational resources may make families aware of their main role in children's traffic skills as well as importance of improving traffic behaviors in future.

Data Availability

There is a file which summarized the questionnaire outputs. It can be made available on request.

Conflicts of Interest

The authors declare that they have no conflicts of interest.

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