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Chapter

Parenting in the Digital Contexts: Are Parents Ready to Use Automated Vehicles to Transport Children?

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Abstract

Autonomous vehicles (AVs) or automated driving systems (ADSs) are projected to be widely available in the coming years. Prior research has documented the reasoned benefits and concerns about this prospect, especially from the perspectives of mobility and safety. However, little work has focused on the prospect of using AVs to enhance children's mobility as well as the AV features that are needed for safety. An online survey was used to collect the opinions of parents within the United States on their willingness to use AVs to transport children. Results showed that parents' concerns, assurance-related car features, parents' technology readiness, child restraint system use (as a proxy for child age), and parent sex were important variables for modeling parents' willingness. These findings highlight potential users' needs and requirements as they consider AV ridership and use scenarios in the context of children's mobility. More research is critically needed to guide the development of AV features, safety evaluations, and regulatory policies, as child passengers are likely part of AV ridership scenarios in the perceivable future.

Keywords: children's mobility, children's safety, autonomous vehicle, ridership context, parents, vulnerable road users

1. Introduction

Parenting in the digital contexts may involve utilizing digital devices and mechanisms in the caring of children and the supporting of child development. This chapter will discuss parenting in the era of automated (or autonomous, self-driving) vehicles (AVs) and parents' perspective on using AVs to transport children and ridership scenarios.

US Department of Transportation has released its Vision 2.0, 3.0, and 4.0 on the future of transportation and the importance of safety in the deployment of motor vehicle driving automation systems [1–3]. These are vehicles that are capable of sensing their environment and performing dynamic driving tasks according to the level of automation equipped [4]. There are six levels of driving automation, ranging from no driving automation (level 0) to full driving automation (level 5), in the context of motor vehicles and their operation on roadways. Vehicles that are equipped with levels 3–5 of automation that can perform crash avoidance and complete dynamic driving tasks are also colloquially referred to as automated or autonomous vehicles (AVs). Currently, most car companies design and manufacture their own versions of AVs, and optimists believe that AVs will be sufficiently reliable and affordable to replace conventional, human-driven vehicles by 2030 [5].

Undoubtedly, AVs are expected to shift the mobility practices, transit systems, and the infrastructure while impacting road users' everyday transportation needs. AV companies and government agencies project the benefits of AVs being enhanced safety, efficiency, convenience, and mobility. In fact, enhanced mobility is considered one of the major motivations for vehicle automation [6, 7]. Even though conventional vehicles can also achieve this purpose, AVs can improve mobility for those who cannot legally drive or do not drive due to age, disability, or incapacitation [1, 8–10]. Prior research on the impact of AV has indicated enhanced mobility (in the ranges of 10–40%) of underserved populations, such as adult non-drivers, the elderly without medical conditions, and adults with a travel restrictive medical condition [8, 11, 12], suggesting the potentials of AVs on improving independent mobility.

However, the above-mentioned studies focused on adults and senior populations and their transportation needs and did not include teenagers or younger children (age 16 and younger) in the analyses. Traditionally, children who have not reached the legal driving age depend on parents or older siblings for their mobility needs [13]. In addition, they are required by law to use a child restraint system (e.g., car seat, booster seat) or a vehicle seat belt during transit. AVs can potentially enhance and supplement mobility needs of young children and teenagers [8, 14], just like the projected positive impact of AVs on adult nondrivers; however, safety features and regulations of AVs, supporting infrastructure, legal requirements, and policies are still being discussed and developed [6, 15, 16]. Better understanding of AV ridership scenarios that involve children is critically needed.

To date, a few studies have examined the prospect of using AVs to enhance children's mobility. Participants were asked about the occasions they would like to use AVs in a 2015 study: 11% of participants indicated transporting children as a potential use, which was much lower than not using AVs at all (22%) [17]. In a 2017 study, 13 and 53% of participants were comfortable sending empty AVs to pick up children from school and get groceries, respectively [18]. Lee and Mirman in a 2018 study [19] investigated parents' perceived concerns and benefits about child occupants in AVs alone or with parents. Results indicated that parents could imagine the potential benefits (such as freeing up time from manual driving and potential carpool arrangements) but were concerned about losing active vehicle control. Mothers and parents with younger children had higher levels of concern and rated the benefits lower than their counterparts [19]. A 2019 study explored the minimum age for children riding in AVs alone, ridership scenarios, and vehicle features needed to support such uses [20]. Upon experiencing a short simulated autonomous ride, 63% of parents thought they would be willing to be alone or be with their child in an AV, but only 21% would let their child ride alone. Most study participants would let their children be alone in AVs when they reach age 16 [20]. A recent study showed that communication between children and parents during an autonomous school bus ride was important for both parties [21]. A 2020 study also found communication mechanisms (having a camera and microphone inside AVs) to be important [22].

There are two sources of potential concerns and hesitations in using AVs for children's mobility. One is in general related to concerns about driving automation systems and the lack of personal experience [23]. Some road users and drivers are ready to try new technologies, but others are not. AV-related accidents reported in the media [24] might also discourage potential users from buying AVs. Another source is more directly related to parenting. When own children are involved, people become less comfortable, trusting, and willing to use automation or anything they are unfamiliar with, due to the primal instinct to protect own offspring [25] and family members [26]. Lack of knowledge and personal experience with AVs plus the parental instinct to care for own children may lead to mental barriers and decrease the willingness to explore AV use scenarios. More investigations are needed to better understand the sources of hesitations and how they can be lowered for the purpose of enhancing children's mobility.

Given the fast pace of AV-technology advancement and the large proportion of American adults wanting to have children or have had children [27], having child passengers in AVs would be a likely ridership scenario in the coming years. Therefore, this chapter was designed to address the lack of research on parenting in the age of AVs by examining factors that model parents' willingness to use AVs to transport children. The modeling framework was developed to answer these principal research questions: (1) What are the profiles of parents who are relatively higher and lower on willingness? (2) Which variables are important in differentiating high vs. low willingness?

Of note, this chapter is the secondary data analysis on an online survey study. A copy of the survey items can be found in [22]. The former analysis used a machine learning-based modeling approach, and the current analysis focused on a logistic regression approach.

2. Method

2.1 Data collection

The survey was hosted on Qualtrics and distributed by Amazon Mechanical Turk. Verified Mechanical Turk workers who met the inclusion criteria (age 18 and older, being a parent or legal guardian, owning or leasing a vehicle, and residing within the US) were invited to participate and the compensation was 25 cents for each valid participation. Data were stored on Qualtrics and later downloaded for analysis. This research project received approval from the Institutional Review Board of the author's university.

Of the initial 1893 respondents, 287 were removed because they did not reside in the United States. An additional 296 respondents were further removed due to invalid responses to attention check questions. Some gave an incorrect answer when prompted to provide the current year, others reported that their age was a value outside the age range they had provided earlier. At the end of data cleaning, a total of 1310 valid responses remained.

2.2 Questionnaire development

2.2.1 Demographics of participants and their children

The demographic questions in the survey included age group (9 year ranges starting from 18 to 64 with additional groups for under 18 and over 64), current age (compared against age group response for data validation purposes), sex at birth, primary residence (urban, suburban, rural, other), US state of residence, race and ethnicity, education level, and annual household income. Participants were also asked whether they were a parent or legal guardian of a child between the age of 0 and 14 years, and if so asked to provide demographics about one of the children (e.g., age, sex). This chosen child age range was to ensure that these parents and legal guardians had the experience of transporting children as their children have not reached the minimum age for independent driving [13] and were required to use a car seat, a booster seat, or a seat belt. A total of 14 demographic questions were included.

2.2.2 Vehicle use of participants and their children

Driving history-related questions included whether participants own or lease a vehicle, monthly frequency of driving and mileage, number of major or minor accidents in the past year, as well as, the use of vehicles by their children, if they had any living with them (weekly frequency, seat belt/car seat use). Six driving history questions were included.

2.2.3 Technology readiness and familiarity with autonomous vehicles

Consistent with prior research [19, 22], four statements (out of 16, due to usability concerns) from the Technology Readiness Index [28, 29] were used to assess participants' propensity toward adopting new technologies. Additionally, participants were asked to indicate whether they have heard of AVs and the year they believe that AVs would be fully integrated into modern roadways. As familiarity with a technology can influence attitudes toward that technology [30, 31]; these questions were expected to play a role in the association between a priori acceptability and willingness to use AVs to transport children. Three questions were included.

2.2.4 Willingness to use autonomous vehicles to transport children unaccompanied

Participants were asked twice to indicate their willingness to use a fully AV to transport their child unaccompanied. This question was presented before and again after (pre- and post-willingness) the survey asked about the concerns and car features (details in sections 2.2.5 and 2.2.6). The wording of the question and the options were identical between the pre- and post-willingness; the options were presented on a 4-level scale (1 = I would never, 2 = I would be hesitant, 3 = I might, 4 = I would definitely). This pre- and post-design was used to assess participants' a priori acceptability of AVs and if participants' willingness changed after being exposed to potential concerns and car features for this prospect of use.

2.2.5 Potential concerns related to transporting children

Potential concerns were derived from literature on child restraint systems, safety, and parent-child mobility practices [19, 32–36]. These items reflected overall categories that were further explored in the following section on car features. Participants rated their level of agreement on these items on a 5-level Likert scale (1 = strongly disagree, 5 = strongly agree). A total of 12 potential concerns were included.

2.2.6 Importance of car features

Potential car features were derived from the potential concerns (Section 2.2.5), literature on car features in the context of ride sharing, users with disabilities, and smart systems [20, 37–39], and brainstorming sessions with parents from a prior qualitative study and analysis [40]. Four categories of car features about route control, assurance, child safety, and comfort included various aspects of the operation of AV, child restraint system, communication from/to the child/adult, access to the AV, support mechanism, and emergency situations. Participants rated the importance of these features on a 4-level scale (1 = unnecessary to have, 2 = would like to have, 3 = important to have, 4 = required to have). A total of 26 car features were included.

2.3 Analytic plan

The analytic plan included profiling and modeling ratings of willingness to use AVs to transport children. Even though there were four response options (would never, would be hesitant, might, would definitely) on the willingness item, only a small number of respondents chose "would definitely"; therefore, the four responses were dichotomized to reflect relatively higher vs. lower in willingness. Test of normality was then checked; due to the asymmetric distribution of the data, Shapiro-Wilk test was used [41], $p < 0.001$, skewness = 0.60, kurtosis = −0.61. Data were not normally distributed; therefore, nonparametric tests, Mann-Whitney U test and Chi-Square test, were used to compare the response distributions between individuals having high vs. low willingness. Then, binary logistic regression was selected for the modeling work due to its strong performance in classification applications. SPSS was used for data visualization, calculations, and modeling.

2.3.1 Methodology for modeling

Binary logistic regression was used to model the relationship between several exploratory variables and willingness to use AV to transport children. The exploratory variables were entered in three blocks: block 1 included the averaged ratings of concerns and four categories of AV features; block 2 included characteristics of the child occupant, including current use of restraint system, child sex, and number of days in a week riding in vehicles; block 3 included characteristics of the parents/legal guardians, including RTI items, annual mileage, frequency of driving, prior accidents, parent sex, parent age, age at which first obtained license, race, education, income, and residence.

3. Results

3.1 Sample characteristics

The sample was geographically represented: there were participants from each state of the US, with 16.7% from the Northeast region, 21.6% from the Midwest, 41.3% from the South, and 20.5% from the West. The sample was demographically balanced, although there were relatively more females and individuals in the 25–34 and 35–44 age groups, with the average age being 36.56 (SD = 11.16) years. The majority of participants identified themselves as White, lived in suburban areas, had a college degree, and drove every day in the past month (**Table 1**). Most participants did not have any major or minor (85.6%) accidents in the past years (mode and median = 0). About 60.4% was the parent of at least one child between the ages of 0 and 14, and 90.5% had heard of AVs. When asked about the year AVs would be fully integrated into modern roadways, 79.6% indicated 2030 or sooner.

The reported child profile included slightly more boys (56.7%). As for riding in a vehicle as a passenger, 36.6% of them rode for 6–7 days a week, 41.1% rode for 3–5 days, and 22.3% rode for 1–2 days. Seat belt was used in 44.2% of the responses, followed by car seat (32.5%) and then booster seat (17.5%); however, 59 responses (5.8%) did not use any of the three above restraint systems.

	All	High willingness	Low willingness	p-value for high vs. low willingness
Age				
18–24	139	49	90	0.22
25–34	541	145	396	
35–44	354	89	265	
45–54	164	39	125	
55–64	73	17	56	
65+	38	9	29	
Sex				
Male	554	196	358	<0.001
Female	755	153	602	
Race and ethnicity				
White	1006	258	748	<0.01
Black	105	24	81	
Hispanic/Latino/Spanish origin	55	11	44	
American Indian/Alaska native	14	5	9	
Asian	109	45	64	
Native Hawaiian/Other Pacific Islander	0	0	0	
Some other race or origin	19	6	13	
Residence				
Urban	363	115	248	<0.01
Suburban	665	175	490	
Rural	267	53	214	
Other	13	6	7	
Highest level of education				
Less than 9th grade	1	0	1	0.21
Some high school	12	3	9	
High school graduate	106	20	86	
Some college degree	326	83	243	
College (associate or bachelor's) degree	616	164	452	
Graduate degree	249	79	170	
Annual household income				
< $25,000	172	39	133	0.37
$25,000–$44,999	325	83	242	
$45,000–$69,999	330	87	243	
$70,000–$109,999	331	91	240	
> $110,000	148	48	100	
Parent of a child between 0 and 14 years of age				
Yes	791	179	612	<0.001
No	514	168	346	

	All	High willingness	Low willingness	p-value for high vs. low willingness
Weekly driving frequency in past month				
Never	14	1	13	0.13
Once a week	48	20	28	
Two to four times a week	277	74	203	
Every weekday	226	61	165	
Weekend only	9	2	7	
Every day (including weekend)	735	191	544	
Mileage in past month				
0	13	3	10	0.54
1–1000	842	221	621	
1001–2000	321	82	239	
2001–3000	93	33	60	
3001–4000	24	6	18	
4001 and more	15	4	11	
Child sex				
Male	565	156	409	0.02
Female	432	91	341	
Days child rode in vehicle as passenger				
1–2 days	221	63	158	0.10
3–5 days	406	105	301	
6–7 days	362	76	286	
Child restraint system				
Car seat	331	58	273	<0.001
Booster seat	178	37	141	
Seat belt	450	139	311	
None	59	13	46	
Have heard of AV				
Yes	1186	322	864	0.24
No	124	27	97	

Table 1.
Demographic characteristics of the sample (N = 1310) and profiles of high vs. low willingness for nominal variables; data are n.

Participants' technology readiness is presented in **Table 2**. Most participants agreed or strongly agreed with the Optimism and Insecurity items, but rated the Innovativeness and Discomfort items more moderately.

3.2 Profiling willingness

The response distributions were similar between pre- and post-willingness (**Figure 1**), with roughly 21.1% of respondents changing their ratings in post-willingness: 169 respondents (12.9% of total respondents) became more willing and 107 (8.2%) respondents became less willing at post-willingness. Regardless,

	1 (Strongly disagree)	2	3	4	5 (Strongly agree)
Optimism	10	39	117	759	384
Innovativeness	145	348	305	383	128
Discomfort	130	376	303	402	99
Insecurity	48	192	237	556	277

Note: Items from the Technology Readiness Index (TRI). Optimism: New technologies contribute to a better quality of life; Innovativeness: In general, I am among the first in my circle of friends to acquire new technology when it appears; Discomfort: Sometimes, I think that technology systems are not designed for use by ordinary people; Insecurity: People are too dependent on technology to do things for them.

Table 2.
Agreement on technology readiness (N = 1310); data are n.

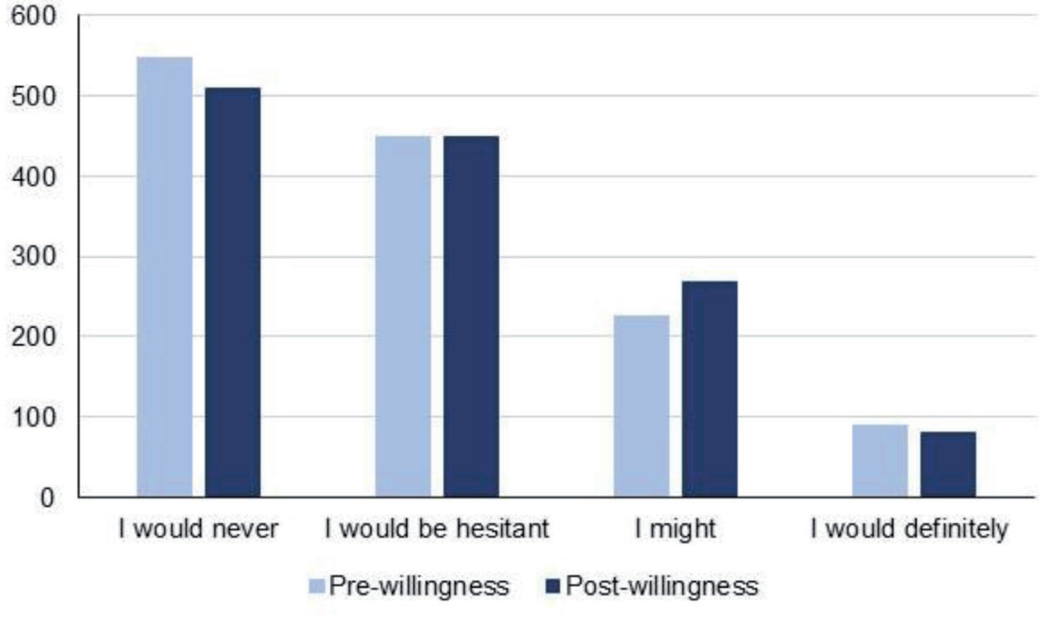

Figure 1.
Frequency of willingness.

the number of respondents who chose 4, "I would definitely," remained low for pre- and post-willingness (6.7 and 6.2%, respectively). Given the similar response distributions at pre- and post-willingness, ratings at post-willingness were used for subsequent analyses.

Given the small proportion of participants who indicated "I would definitely" use an AV to transport own child unaccompanied, responses on post-willingness were further dichotomized: "I might" and "I would definitely" were re-categorized as relatively high in willingness and "I would never" and "I would be hesitant" were re-categorized as relatively low in willingness. This dichotomized willingness was tabulated across stated concerns, importance of car features (four categories), TRI items, respondent demographic variables and driving history, child demographic variables, and whether or not respondents had heard of AV. Mann-Whitney two-sample tests (two-tailed) were used to examine response distributions from ordinal or scale variables; Chi-square tests were used for nominal or categorical variables (see **Tables 1** and **3**).

As expected, respondents who were relatively more willing had lower levels of concerns, rated car features to be more optional (as opposed to being required), were more pro-technology, and were relatively younger.

	High willingness	Low willingness	Z-score	Sig. (2-tailed)
Concerns (averaged across 12 items)	3.71 (0.91)	4.27 (0.79)	−10.91	<0.001
Car feature: **Route Control** (averaged across 5 items)	3.44 (0.57)	3.66 (0.50)	−7.38	<0.001
Car feature: **Assurance** (averaged across 9 items)	3.16 (0.64)	3.52 (0.56)	−9.63	<0.001
Car feature: **Child Safety** (averaged across 8 items)	3.56 (0.53)	3.74 (0.48)	−7.86	<0.001
Car feature: **Comfort** (averaged across 4 items)	2.66 (0.86)	2.96 (0.80)	−5.65	<0.001
TRI: **Optimism**	4.32 (0.70)	4.05 (0.75)	−6.24	<0.001
TRI: **Innovativeness**	3.33 (1.13)	2.88 (1.18)	−6.11	<0.001
TRI: **Discomfort**	2.89 (1.21)	3.00 (1.11)	−1.52	0.13
TRI: **Insecurity**	3.31 (1.16)	3.74 (1.03)	−6.12	<0.001
Respondent: **Age**	35.51 (11.07)	36.93 (11.17)	−2.38	0.02
Respondent: **Licensed age**	17.74 (3.40)	17.35 (2.68)	−1.62	0.11
Respondent: **Accidents in past year**	0.23 (0.52)	0.16 (0.49)	−3.04	<0.01

Note: Equal variances not assumed for calculating Z-scores.

Table 3.
Profiles of high vs. low willingness among ordinal and scale variables; data are mean (sd).

3.3 Modeling willingness

Binary logistic regression was used to model the effects of concerns, car features, child characteristics, and parent characteristics on the dichotomized post-willingness ratings. Based on findings in **Tables 1** and **3**, variables that significantly differentiated high and low willingness were initially included in the model (with the exception of the licensed age variable, as prior analysis showed that this was an important variable for differentiating willingness [22]). Then, insignificant variables were removed. An interaction term of parent sex and concerns was added to the model, as suggested by prior work [19]. The resulting model (model 1) showed that parents' concerns, assurance-related car features, child restraint system, three of the TRI items, parent sex, interaction of parent sex and concerns, and licensed age were significant (child safety-related car features marginally significant) in classifying high vs. low willingness (**Table 4**): With one unit higher on the concerns, respondents were 2.22 times less likely to use AV for child transportation. With one unit more requiring having assurance-related car features, individuals were 2.63 times less likely to use AV for child transportation. Individuals who appraised optimism and innovativeness were 1.62 and 1.37 times more willing to use AV for child transportation. Respondents who agreed with the insecurity item were 1.28 times less willing. Female parents were 7.69 times less willing. The significant interaction suggested that female parents with higher levels of concerns were (log odds of −2.04 + 0.41 and odds ratio of 0.19) 5.10 times less willing. By comparison to car seat users, parents whose children used seat belts were 2.07 times more willing. Respondents who first obtained their driver's license at a later age were 1.06 times more willing.

Model 1 correctly classified 77.3% of the responses, could explain 27.1% of the variance (Nagelkerke R^2), and was considered an adequate fit to the data (Hosmer and Lemeshow goodness of fit χ^2 (8, N = 1011) = 6.43, p = 0.59).

Using model 1 as the base, four more models were further developed that included respondents who had heard of AVs (model 2), who thought AVs would be fully integrated by 2030 or sooner (model 3), who indicated being a parent of a child between 0 and 14 years of age (model 4), and who met the above three criteria (model 5) (**Table 5**). The results from models 1, 2, 3, and 4 were very similar: the signs and the significance testing of the regression coefficients remained the same. Model 5 showed that child safety-related car feature, child restraint system, parent sex, and parent sex by concerns were no longer significant. This model also had the highest classification accuracy among the five models and was considered a good fit to the data, χ^2 (8, N = 552) = 10.83, p = 0.21.

When plotting the probability of being high on willingness across the averaged ratings of concerns (**Figure 2**) using model 5, the negative relationship suggests that among parents who had heard of AVs, believed AVs would become fully integrated in modern roadways by 2030, and had young children (younger than age 15), their level of willingness decreased as concerns about AV use increased.

Predictor	**B**	**Wald χ^2**	***p***	**Odds ratio**
Concerns	−.80	30.32	< 0.001	0.45
Car feature: **Assurance**	−0.96	21.08	<0.001	0.38
Car feature: **Child Safety**	0.45	3.48	0.06	1.56
Child restraint system		15.74	<0.005	
Booster seat	0.19	0.56	0.46	1.21
Seat belt	0.73	13.53	<0.001	2.07
None	0.11	0.08	0.78	1.12
TRI: **Optimism**	0.49	14.29	<0.001	1.62
TRI: **Innovativeness**	0.32	15.82	<0.001	1.37
TRI: **Insecurity**	−0.25	10.64	<0.005	0.78
Parent Sex	−2.04	7.46	<0.01	0.13
Parent Sex by **Concerns**	0.41	4.89	0.03	1.51
Respondent: **Licensed age**	0.06	5.11	0.02	1.06

Note: Car seat was the reference group for Child restraint system; Male was the reference group for Parent sex.

Table 4.
Variables in model 1 logistic regression.

	Model 1 (base)	**Model 2 (heard of AV)**	**Model 3 (AV year <= 2030)**	**Model 4 (had a child 0–14)**	**Model 5 (model 2–4's criteria)**
Included in analysis (n)	1011	902	802	782	552
Nagelkerke R^2	0.271	0.279	0.277	0.253	0.290
Classification accuracy (%)	77.3	76.9	77.1	78.6	78.8

Table 5.
Model comparisons.

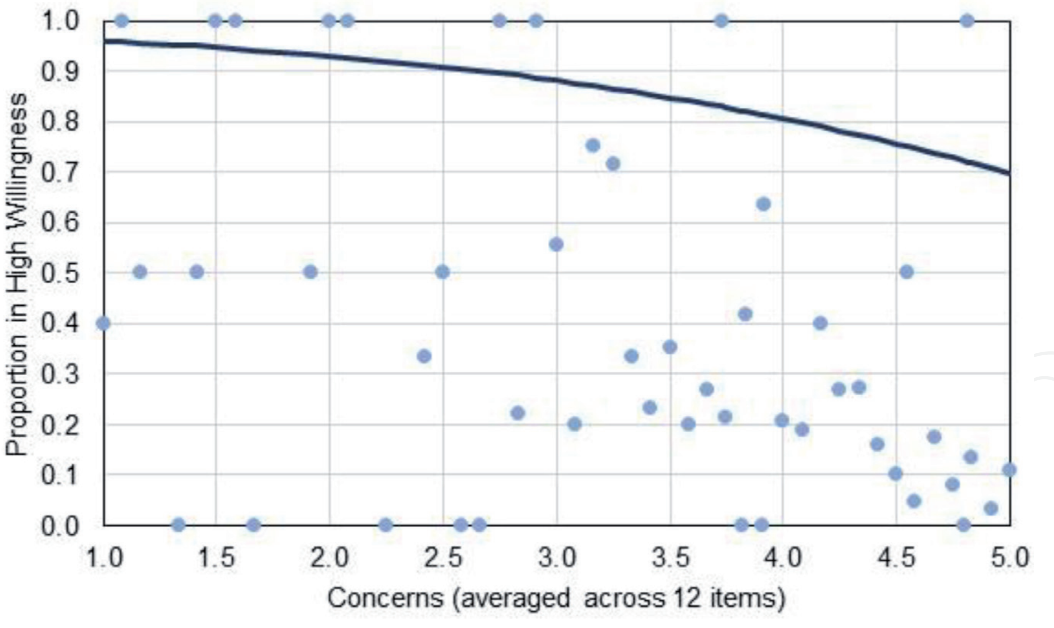

Figure 2.
Proportion in high willingness across averaged concerns in model 5. Note: Dots depict the predicted willingness given the averaged concerns; the line depicts the model.

4. Discussion

The current analysis focused on profiling and modeling parents' willingness to use AVs to transport children unaccompanied. According to model 1 (all survey responses), individuals who rated their willingness higher were those who were pro-technology, more ready to embrace innovative technologies, and males (as opposed to females), and had lower levels of concern about this prospect of AV use. These findings are consistent with the literature on general AV acceptance about the early adopters being males [42], technology-savvy individuals [17], such as drivers who are already using advanced car features, and those who are less concerned about safety risks associated with AVs [18].

The current finding also suggests that parents who were relatively more willing to use AVs in the context of child mobility regarded assurance-related AV features as relatively optional (as opposed to required). These car features were about having mechanisms for on-time pick-up, communication from/to child, having an adult waiting at destination, and two-way audio and video communications. This is largely consistent with the previous machine learning-based analysis on the same data [22]: specific car features about having a designated adult waiting at destination, a camera that lets the child see parent, and a microphone that lets the child hear parent were important variables in differentiating high vs. low willingness.

In terms of restraint system use, parents higher on willingness had relatively older children who used seat belts (as opposed to car seat users). This is consistent with prior finding that parents whose children use car seats have significantly more concerns than parents whose children use seat belts [19]. Children's age as well as the required restraint systems are both important determinants. One explanation is that younger children need more support and supervision during transit as they may not have the physical ability or cognitive understanding for safety practices. Also, parents are likely to be more worried about community and roadway safety when children are younger [43, 44]. These factors likely influence the degree to which parents grant children independent mobility [45].

Females are less ready to embrace AV technology [42, 46]. The significant interaction term of parent sex and ratings of concerns from the current analysis further suggests that mothers and mothers with higher levels of concerns are less willing to put children in AVs alone.

Current finding also shows that individuals who obtained their first license at a relatively older age were more willing to use AVs to transport children unaccompanied. Even though literature has suggested that being older at licensure is related to fewer risky driving behaviors [47] and delayed licensure is associated with lower fatal crash rate [48], it is unclear how this association translates to an AV context.

When including only about half of the data (model 5), that is, parents who had heard of AVs, believed AVs would become fully integrated in modern roadways by 2030, and had young children, similar relationships between willingness and exploratory variables remained, even though child restraint system and parent sex were no longer significant. These individuals are likely to be more concerned about AV use from a family perspective as they believe AVs would become a reality for them soon.

As previously stated, this study and the nature of data collection had led to several limitations [22]. AVs and car features were broadly defined and described in the survey; participants' interpretations of the depicted AV and car features might differ. Also, even though 90.5% of the participants indicated having heard of AVs, the sources of knowledge and the degree of personal experience were unknown [24]. Therefore, this study could not directly quantify the association between AV exposure and willingness to use AV in a specific family perspective. In addition, the cross-sectional design of the study only allowed one-time evaluation of parents' imagined AV use. Their willingness might change with time, knowledge, and personal experience, as a previous study showed that experience with a travel mode may alter one's perception and future use of it [49]. Although our participants' willingness did not differ much from pre- to post-willingness, their perception of AV capability and hypothetical use might have changed and should be assessed in future studies.

5. Conclusion

This book chapter addresses issues related to parenting in the age of automated vehicles. The analysis shows that parents' concerns, assurance-related car features, parents' technology readiness, child restraint system use (as a proxy for child age), and parent sex are important variables for modeling parents' willingness to use AVs in the context of children's mobility. Future studies should continue to investigate the public's willingness, perceptions, and attitudes about AV use scenarios from multiple perspectives while taking into account personal and family characteristics. Similarly, children's perspectives about the use of AVs for mobility and transportation needs should also be examined. For example, future studies can compare the perceptions and perceived safety between riding a human-driver school bus vs. an automated school bus and being a passenger in an AV alone vs. having parents as passengers together. AV manufactures and regulatory agencies should carefully consider adding and evaluating car features, restraint systems, and support mechanisms that have the potentials to ensure child passenger safety, ease parents' concerns, and ultimately enhance children's mobility.

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Conflict of interest

There is no known conflict of interest to disclose.

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