1. **Introduction (Word count: 3,300)**

The first car a teenager drives represents a unique opportunity for intervention. We know that teenagers tend to drive smaller, older cars, which offer poor crash protection,1 and close to half of all teenagers will crash in their first two years of driving.2,3 Therefore, the vehicle that newly licensed teenagers drive could play an important role in minimizing their risk of injury or death. Newer vehicles have safety technologies that can warn drivers of a hazard, take corrective action to avoid or reduce the severity of a crash, and protect occupants in the event of a crash.4 These technologies can be divided into two categories: those currently required in new vehicles by law, and optional features, which can be purchased when buying a new vehicle. For example, Electronic Stability Control (ESC), has been required in new vehicles since 20125 and is installed in half of registered vehicles.6 This technology has reduced single-vehicle crashes by 32%7 and fatal single-vehicle rollovers by 72%8 - crash types for which teenage drivers are overrepresented.9 In contrast. lane-departure and blind-spot detection systems are optional features that warn drivers when they're drifting out of their lane or changing lanes dangerously close to other vehicles. These have reduced injury crashes by 21% and total collisions by 11% 10 but are available in fewer than 10% of new vehicles.11

Short of asking people to list the specific safety technologies in their vehicle, vehicle age becomes a useful proxy for determining their presence. In a 2014 survey, the majority of teenagers (60%) reported driving a vehicle that was 10 or more years old.1 Most parents (57%) said that they plan to provide teenagers with an existing vehicle from the household. In instances where a vehicle would be purchased for the teenager, 83% of parents intended to buy it used, and only a third (33.9%) of parents were planning to provide their teenager with a vehicle that was less than five years old.1

Parents are the primary decision-makers about the vehicle their teenagers will drive,12 but little is known about their decision making process and motivation that leads the majority to provide older, less safe vehicles for their teenagers. Addressing this underexplored area is the primary focus of this research.

1. **Materials and Methods:**

*2.1. Sample and Recruitment Procedures:* Participants were recruited from a driving school in Maryland, USA, between April 2018 and July 2018. We purposefully sampled three driver education classes based on the number of students who were enrolled in the classes and their location. Classes were in Baltimore County, Howard County, and Anne Arundel County in Maryland. These counties range widely in their economic and social indicators, but are above average for U.S. household income and education.13 While participant demographics were not collected, county averages of household income, education, and racial makeup are presented in Table 1. Parents were eligible to participate in this study if they had a teenager who was 16- or 17-years of age who was enrolled in the driver education course, and if they spoke English. Light refreshments were served during the focus groups. This study employed a qualitative research design to explore parental decision making when selecting a vehicle for their teenage driver. This study was approved by the Institutional Review Board at the Johns Hopkins Bloomberg School of Public Health.

**Table 1: 2010 US Census Focus Group County Location Demographics**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **County** | **Baltimore** | **Howard** | **Anne Arundel** | **Nation** |
| **Household Income** | 71,810 | 115,576 | 94,502 | 56,516 |
| **Education Level** |  |  |  |  |
| High School Diploma | 91.1 | 95.3 | 92.0 | 90.0 |
| Bachelor's Degree | 37.8 | 61.2 | 40.1 | 33.4 |
| **Racial Demographics** |  |  |  |  |
| White | 61.4 | 57.3 | 74.7 | 76.6 |
| African American | 29.2 | 19.5 | 17.5 | 13.4 |
| Asian | 6.4 | 18.9 | 4.1 | 5.8 |
| Household income is the average household income reported in US dollars. Education level is the percentage of residents with the degree indicated or higher. The Nation column has the averages for the United States of America. (US Census, 2010) | | | | |

*2.2. Data collection:* We conducted three focus groups with parents of teenagers enrolled in a driver education class. Parents were asked to describe the age and features of the vehicle that their teenager would drive. They were then asked to describe their rationale for choosing that vehicle, including the factors they had considered. Open-ended questions were pre-tested in a convenience sample of parents of teenage drivers prior to the study and are listed in Table 2. MLD, JPE, and WS facilitated the discussions. On average, focus groups lasted around 40 minutes. Focus groups were audio-recorded and transcribed verbatim by a professional transcription service and research assistants. In situations where the audio file or transcription were not clear, authors MLD, JPE, and AH reviewed the audio files together to assess accuracy.

**Table 2: Focus Group Guide**

Describe the age and features of the vehicle that your teen will drive as their first car.

Can you tell us about your thinking behind that choice of vehicle and the factors you are considering?

Describe the safety features these vehicles have. (Probe is meant when they say safety).

*2.3. Data Analysis:* Focus group data were stored, managed, and analyzed using Microsoft Excel and Word. We employed a thematic analysis technique to examine the content. Authors MLD, JPE, and AH read all transcripts for immersion and independently developed codes and corresponding themes using the three focus group transcripts. Following this, authors MLD, JPE, and AH met to confer on codes and themes and developed a consensus codebook. The codebook offered the theme name, description of the theme, theme-related codes, and contextual excerpts for each code. Author AH recoded all transcripts per the codebook to ensure consistency. Quality assurance was conducted by JPE who reviewed the codes. Disagreements in coding were resolved by AH and JPE re-examining the content and coming to consensus.

1. **Results**

Our three focus groups consisted of a total of 16 participants (5 males, 11 females). The first focus group consisted of 8 parents; the second focus group consisted of 3 parents; and the third focus group consisted of 5 parents. Most parents said they would provide a vehicle for their teenager, either by giving them access to an existing household vehicle or purchasing one.

Three themes emerged as parents described how they would decide the vehicle their teenager would drive: (1) The likelihood their teenage driver will crash and the associated costs; (2) Misconceptions about vehicle safety; (3) Mixed feelings toward safety technologies. Most parents drew from their personal experience of learning to drive as a teenager to inform their approach towards vehicle selection for their own children. The themes emerged in the first focus group and were present in the subsequent two focus groups.

* 1. *The likelihood their teenage driver will crash and the associated costs:*

Many parents reported crashing a vehicle as a teenager and knew of other teenagers who crashed their first vehicle. This led them to believe their teenager would also crash their first vehicle. As one participant stated, “I know I did [crash my first car]. Most teenagers crash their first car...” This led to a preference among many parents towards providing an older, less expensive vehicle for their teenager to drive. Some parents stated they would either provide their teenager with the oldest vehicle they already had or purchase an inexpensive car for their teenager. One participant stated, “I was thinking, look for a little [cheap car]. Get something out there just a beater, where if she dings a pole or something, no big deal.”

Several parents stated that the purchase price and damage repair expenses were the most important factors in deciding which vehicle their teenager would drive. Among this group, there was a tendency to downplay or underestimate the risk of injury that teenage drivers face in the event of a crash. One participant stated, “…and if something were to happen, hopefully it’s not serious, they get in a car accident or something like that…hopefully it won't be too much damage to the car.” Discussing the vehicle they would provide, another participant stated, “[It] is a Honda Accord and it’s a bigger car…and it’s going on 12 years old. So, she’s going to get that car because it’s still running technically, and if it gets messed up, we just don't care.”

Some parents also mentioned concerns about the costs related to vehicle insurance. When discussing the impact of adding a child to an existing automobile-insurance policy, one participant stated, “Don’t forget, when you start adding your children on insurance…woah! It costs a lot. So, if you have an older car… [it is cheaper]”

*3.2. Misconceptions about vehicle safety:*

Most parents emphasized the importance of large vehicle size and strong build quality over safety technologies such as airbags or blind spot detection systems. One participant explained, “Yeah, the bigger, older car, my '69 Impala I had, like seven eight feet behind me before the other car got to me. So… I felt a lot safer. You know?” Another participant stated:

“I think about my little Chevy Chevette, that was like a steel drum. And if somebody hit me, I might have felt something, but…I didn't get hurt.... And the cars they make lately, they say, "Safety, safety, safety," but some of their stuff is a hindrance more than it is a safety feature.”

Another design feature that parents mentioned was the good visibility of the roadway from within the vehicle. Parents felt these vehicles were objectively safer: “We had an extra car that I purposefully kept, it’s a little bit older and has really good visibility all the way around and that was really the reason that I kept it.” Several parents perceived older vehicles to be stronger and therefore safer than the newer vehicles. One participant stated, “You know, nowadays I've seen so many accidents on the road now. The plastic car just scrunches up. It's like a comic.” Apart from vehicle size, some parents equated mechanical reliability with safety. For one parent, because their vehicle was, “working fine,” it would be a safe vehicle for use by his daughter.

* 1. *Mixed feelings toward safety technologies*

Most participants were skeptical about assistive safety technologies, such as blind spot monitoring or lane departure warning systems, while a minority of participants expressed positive sentiment towards these technologies. Most often, the concept of over-reliance on the technologies was the main cause of parents’ concern. They felt that their teenager would become dependent on these features and this would impede their skill development.

Participants expressed concern that the new technologies might make their teenage driver complacent: “I don’t want him to get too comfortable with all the bells and whistles so that he doesn’t feel like he has to think for himself.” Another parent followed up, stating, “The thing that concerns me a bit is, is the car doing the driving or is my son doing the driving?” One participant went as far to say teenagers should learn to drive without any assistive safety technologies, comparing the learning to drive like learning mathematics: “They tend to …. rely on [the safety features] …You know it’s like being able to do the math handwritten on the paper before you get to use a calculator…” These parents felt the assistance of advanced vehicle safety features would be detrimental for their teenage drivers learning experience. One participant described how, in their opinion, overreliance on safety technologies could be potentially detrimental, stating “We weren't brought up with all of this stuff, computers. And so, I feel like if they could learn that and build their confidence off [the basics], that’s as much safety as you can get. Rather than rely on a computer.”

Many participants distrusted safety technologies such as forward collision warnings or adaptive cruise control and expressed concerns that they may fail and result in a crash. One participant explained: “So, for myself I don’t trust the sensors and the technology…I don’t trust [them].” Another participant stated, “[Newer cars have] more safety features, but it kind of gives you a false sense of security on some of them.” Other parents expressed skepticism about the safety of airbags. One participant mentioned “…the airbags are not safe…” and another participant stated, “The airbags and stuff won't do a whole lot…”

A small group of parents raised concerns about distractions from safety technologies and other vehicle systems. One parent explained that their blind spot detection system aggravates them while driving on the highway. Another parent described their concern about teenage drivers being distracted while trying to use infotainment systems, stating, “Kids are so busy playing with some of those [infotainment systems]. Most of us probably learned on those old basic cars, and we survived, and we are still driving. The kids are pushing all those buttons and trying to use the phone and the fancy radio. That’s where accidents happen…”

A minority of parents expressed the view that safety technologies found in newer vehicles help improve safety. For example, one parent felt that blind spot monitoring was a useful safety feature: “We also have a minivan. It's a Toyota Sienna. And those are pretty safe. It tells you, ‘Hey, there's a car right next to you in the blind spot.’ So it's got that little light. I like that, because, yeah, I can't see the car, but, hey, it says it's there.” Another parent was concerned that their teenager will be more vulnerable when they drive an older vehicle that lacks modern safety features: “I do think later…when he wants his own car, that's when he’ll probably get an older vehicle. So then I would be more worried about safety features that might not be up-to-date.” One parent described researching the safety ratings of different vehicles, prioritizing vehicles that held good safety ratings, stating: “So, I started looking, okay, what are the cars out there? And started going to like Consumer Reports, and test ratings…I'm like, ‘Okay, when we're ready for a car, that's what we'll do. Look at like the safest cars and see what I can afford.’

This was the only instance of a parent describing reliable, external sources of information to guide their decision making in vehicle selection for their teenager.

1. **Discussion:**

Parents are the primary decision-makers when it comes to the vehicle their teenager will drive.12 In the majority of instances, they shoulder the costs of financing the vehicle and paying for ongoing costs such as maintenance and insurance.1 Our findings suggest that financial costs associated with providing a vehicle for their teenager and repairing it following a crash were their primary reasons they selected older vehicles for their teenagers. Most parents minimized the possibility that their teenager might be injured in a crash and therefore, safety features did not motivate their vehicle choice. Rather, optional safety features were described as a nuisance and something that might impede the development of their teenager’s driving skills.

The human tendency to disproportionately weigh immediate costs against the future, low likelihood events such as an injury resulting from a crash has been described by as temporal discounting.14 Experimental studies suggest it is possible to influence temporal discounting in a health-promoting direction by reframing the benefits of the long-term consequences of the specific behavior.15 To the best of our knowledge, the question of whether framing effects could be employed to encourage parental investment in safer vehicles for teenagers has not been tested. One approach may be to present individual-level lifetime costs associated with motor vehicle crash injuries alongside the costs of vehicles with adequate safety features for teenage drivers.

Parental knowledge of vehicle safety ranged widely, with some notable gaps about the relationship between vehicle age and occupant protection in the event of a crash. While they correctly recognized that larger vehicles were likely to be safer than smaller ones in the event of a crash,16 they also conflated older vehicles’ with offering superior crash protection. This latter point is contradicted by epidemiological data indicating that occupants in newer vehicles are far less likely to be fatally injured than occupants of vehicles driving vehicles that are older.17 One reason may be that few parents sought safety information from reputable and objective sources, but drew primarily on their own knowledge and experiences of driving as a teenager. Though they did not mention the Takata airbag recall,18 a number of parents also expressed skepticism about the effectiveness of airbags. These findings highlight the need to develop a better understanding of parents’ sources of safety knowledge and practices in relation to driving, and point to an opportunity for continued education efforts by the automotive industry and safety groups to address these misconceptions.

The concerns raised by parents about assistive safety features impacting driving skill development for their teenagers reflect a belief that a certain set of core skills are fundamental to driving safely and that these cannot be replaced by technology. While this may feel intuitively true to parents, evidence that a certain group of skills confers a safety benefit for teenage drivers has proven to be elusive.19 Studies from aviation suggests that over-reliance on safety systems can lead to a loss of skills,20 yet there is also ample evidence that safety technologies can prevent crashes or minimize their severity.10 The question of when certain types of advanced safety technologies should be introduced to novice teenager drivers is an important area for future work.

A limitation is this study is the small convenience sample of the participants recruited from a limited geographic area. We recorded self-reported behaviors and perceptions and did not observe the vehicles that parents provided for their children. Qualitative research also has the potential for imposed investigator bias, 23 which we sought to compensate for by pre-testing the items. Our key finding that vehicle costs were the primary concern for parents may be specific to this sample of participants or may reflect the fact that the focus group format allowed parents to articulate their concerns in a more nuanced way than surveys allow. As the majority of 16 and 17-year-olds in the U.S. who receive their license come from affluent households22, it is likely that our study participants were from households with above average income.

1. **Conclusions:**

Understanding why parents tend provide older vehicles for their teenagers to drive is an important pre-requisite for intervention development. In this study, we learned that parents disproportionately weighed the immediate costs of a vehicle against the possibility of future injury risk for their teenager. Presenting the average costs of an injury resulting from a crash alongside vehicle safety features may allow parents to balance immediate and future costs when making deciding which vehicle their teenager will drive. Addressing misconceptions about vehicle age and crash-worthiness in population-based education campaigns could be a further opportunity to increase the safety of teenage drivers.

**Acknowledgements:**

The authors would like to thank David Resnick for his ongoing support of their research. We are also grateful to Ariane Sharifi and Edward Llinas for their assistance with the focus groups and for transcribing audio recordings.

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