SJSU SAN JOSÉ STATE UNIVERSITY

MTI MINETA TRANSPORTATION INSTITUTE

Understanding the Safety and Usability of Personal Vehicles for Non-Driving Individuals with Disabilities and their Families/Care Providers

Anil R. Kumar, PhD
Hannah Bowman

Project 2110
October 2022

Introduction

Radical changes are happening in the commercial vehicle industry including the introduction of autonomous vehicles on the road, and cars that are digitally connected to the outside world. This automotive sector paradigm shift raises questions regarding which populations, and whose unique needs, ought to be considered when creating and refining such vehicles. One population that could greatly benefit from up-and-coming technologies is the group of non-driving individuals with disabilities (IWDs).

Though contemporary and future technologies may significantly improve the transport methods of IWDs, there is little public-facing foundational research on the work-system dynamics available. This prevents an intimate understanding of IWDs' journeys in general, and especially trips taken in personal vehicles. Given the importance of personal vehicles for households with non-driving IWDs, the noted safety risks, and the potential for current and future technologies to better serve the aforementioned actors, it is essential to address the research gap pertaining to understanding the work-systems of personal vehicles for this largely overlooked community.

This exploratory research explored how the sociotechnical elements of work-systems impact the personal vehicle safety of non-driving individuals with disabilities, their household family members, and non-related caregivers. Results from this study can inform future product designs, thus lending to the safety and well-being of disabled individuals and others, while calling attention to the need for more widespread research in the field of accessible vehicles.

Study Methods

A qualitative mixed methods approach using surveys and interviews was used to collect data in this study. The research studied three cohorts to understand vehicle accessibility from multiple perspectives. The first cohort was non-driving IWDs whose main mode of transportation was a private family vehicle. The second cohort was family members who lived with a non-driving IWD, and the third was paid non-relative care providers who had at least one non-driving IWD client. Only adults, aged 18 or over, who could communicate in English were included in this study. For the non-driving IWD group, participants were excluded if they identified as having an intellectual disability (e.g., autism spectrum disorder, social communication disorder) due to resource constraints for potential accommodations.

Qualtrics software was used to create the accessible web-based survey, which was distributed to all three cohorts, with research candidates recruited via community-based organization websites and newsletters, Craigslist, and social media. Participants who identified as a member of one of the three cohorts of interest were presented with a consent form, and then channeled into the surveys for their respective groups. Each of the surveys captured demographic data and insights related to the work-systems and sentiments of each respective cohort per the categories that are a part of the SEIPS model. The research team also included survey questions to understand participants' current vehicle modifications, and sentiments toward their modifications. Surveys were anticipated to be completed in fifteen minutes or less.

One-hour semi-structured interviews were conducted with all the three cohorts over Zoom teleconferencing software. Questions posed to participants centered

around their vehicles and vehicle modifications, along with elements of the SEIPS framework, including the environment and work-systems. The team conducted qualitative data analysis on the collected data using NVivo software, and conducted quantitative data analysis using appropriate statistical methods depending on the normality of the data.

Findings

A two-month open survey window yielded thirty-five total responses, with five responses removed due to insufficiently filled out questions, and/or participants being outside of the cohorts of interest. Due to the small sample size and largely incomplete responses of care providers, their responses were removed from statistical analysis. The final sample size was 25 (14 IWDs, 11 family members, and 3 caregivers).

The main results from the surveys indicate that family members are more aware of who to contact to adjust the vehicle. Family members, more so than IWDs, feel they have been in an unsafe situation due to the modifications made to the vehicle, and older individuals tend to feel safer about the modifications made to the vehicle. A regression test between Socioeconomic Status (SES) and the average safety score confirms the expectation of SES having a positive influence on the safety level perceived both by individuals with disabilities and their family members. Analysis also indicated that family members who identify as male were more likely to receive assistance from an occupational specialist for the vehicle versus family members who identify as female ($p = 0.0212$). It was also noted that siblings of IWDs felt the least safe with the vehicle modifications of all the family member subgroups, and felt most strongly that they could afford modifications to vehicles. The qualitative analysis identified several areas of concern expressed by the participants such as unsafe vehicle modification, need for planning between family members, resource knowledge as an epistemological barrier.

Policy Recommendations

This study yielded some interesting insights, and further research is recommended. Several concerns related to monetary issues suggest that the federal, regional and local governments may need to develop or adjust current policies and programs to improve outreach for IWDs and their families, in particular those in non-suburban areas, to be better informed about vehicle (modification) funding options and timelines. Current public vehicle designs were noted as concerns by the participants. As such, purely on the socioeconomic basis of IWDs and families, it may be more prudent to investigate design interventions for public transportation vehicles—specifically related to seating positions of IWDs—to create a sense of integration with other passengers. In sum, the findings highlight the need for improved access to government funding, more reliable modification equipment, and interior vehicle designs that consider better social integration for IWDs.

About the Authors

Anil R. Kumar, PhD

Dr. Kumar is currently working as an Associate Professor in the Department of Industrial and Systems Engineering (ISE) at San Jose State University at San Jose, CA. He is also the Director of the Master's Program in Human Factors and Ergonomics in the ISE department of San Jose State University.

Hannah Bowman

Hannah is pursuing her MSc in Human Factors/ Ergonomics program at the San Jose State University at San Jose while conducting this research.

To Learn More

For more details about the study, download the full report at transweb.sjsu.edu/research/2110

MTI is a University Transportation Center sponsored by the U.S. Department of Transportation's Office of the Assistant Secretary for Research and Technology and by Caltrans. The Institute is located within San José State University's Lucas Graduate School of Business.