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MOBILITY-ON-DEMAND VERSUS FIXED-ROUTE TRANSIT SYSTEMS: AN EVALUATION OF TRAVELER PREFERENCES IN LOW-INCOME COMMUNITIES

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OVERVIEW

Transportation innovations such as ride-hailing and autonomous vehicles are transforming public transit and disrupting the transportation sector. This presents opportunities to integrate these new ridesharing services with fixed-route public transit services that run along major corridors. This integration brings the promise of affordable and convenient public transit services to areas that were previously unreachable, which could lead to significant benefits for people in disadvantaged communities. These benefits include enhanced "last-mile" access to transit services (less walking to transit stops), a known deterrent to public transit use, and reduced wait time and total travel times. Additional benefits include access to employment opportunities, reduced greenhouse emissions, and increased access to healthcare, and healthy food. However, it is unclear how local travelers, particularly those who are disadvantaged in some way, would respond to a shift from a conventional fixed-route service model to an integrated mobility-on-demand transit system; this policy brief reports initial insights to answer this question.

The brief presents the results of a web-based survey conducted among 900 individuals living in Detroit (N=443) and Ypsilanti (N=457), Michigan. Data for this brief are for those policymakers and stakeholders who are responsible for guiding the implementation of future mobility-on-demand transit services.

KEY FINDINGS

- The results of an ordered logit model outputs suggest a **stronger preference** for mobility-on-demand transit **among men, college graduates, individuals who have used ride-hailing before, and individuals who currently receive inferior transit services**.
- Preferences varied little by age, income, race, or disability status.
- Survey results also suggest that major priorities for transit agencies considering mobility-on-demand initiatives should **address female rider safety concerns and accommodate the needs of less technology-proficient individuals**.
- Survey results imply that for many individuals, **low technology self-efficacy and unwillingness to adopt new technologies** could be a more serious barrier than the lack of access to infrastructure such as bank accounts, smartphones, or Internet for the adoption of mobility-on-demand transit among many individuals.
- The **most important benefit** of a mobility-on-demand transit system perceived by the survey respondents is **enhanced transit accessibility to different destinations**.
- The **most critical concerns** expressed regarding a mobility-on-demand transit system included **(1) the need to actively request rides, (2) possible transit-fare increases, and (3) potential technological failures**.

The research team conducted a web-based Qualtrics survey in the City of Detroit, the City of Ypsilanti, and Ypsilanti Township from July to November 2018. Advertisements for the survey were conducted both offline and online using postal mail, flyers, postings on Nextdoor, and local neighborhood newsletters. On-site recruitment at several public libraries and Detroit-based non-profit organizations was conducted to include individuals who did not have access to digital devices and those who were uncomfortable with them.

The survey requested information such as the perception of and use of local public transit and ride-hailing services (Uber/Lyft), demographic and socioeconomic characteristics, and home address. The survey also requested respondents' preferences for a proposed mobility-on-demand (MOD) transit system (which was named RITMO) versus the current fixed-route system and the potential constraints to adopting MOD services such as not having specific access to technology devices, bank accounts, or Internet access, and disability. Finally, the survey asked respondents to list the potential benefits and drawbacks associated with the RITMO system and which ones mattered to them.

FIGURE 1
ILLUSTRATION OF RIDING WITH RITMO SHUTTLES

Disadvantaged travelers were defined as individuals with a household income of less than $25,000, who are 60 years or older, who do not own a car, or who have a disability. Overall, there were 443 Detroit respondents and 457 Ypsilanti respondents resulting in a total of 900 survey responses. When comparing the resulting samples with the American Community Survey 2013-2017 5-year estimates, college graduates, men, non-black populations, and transit riders were overly represented in both Detroit and Ypsilanti samples. Ypsilanti samples contained too few low-income household responses (<$25,000) and responses from individuals who were older than 60 years, black/African American, or had a disability. Future Ypsilanti research surveys should devote more effort into recruiting from these missing population segments.

Upon applying ordered logit models to identify the determinants of individuals' preference for mobility-on-demand transit versus fixed-route transit (refer to the paper for details), results suggest that men and college graduates are more likely to select a response category that indicates a stronger preference for mobility-on-demand transit over fixed-route than women and individuals without a bachelor's degree. Female respondents' comments suggest that safety is a primary concern, e.g., feeling uncomfortable sharing rides with strangers in small-size on-demand vehicles, and perhaps that is why they did not select mobility-on-demandas their preference. This is consistent with past research that has found that distrust of strangers and safety concerns are barriers to systems of the sharing economy such as real-time ridesharing.[5] College graduates have also shown to be higher consumers of sharing economy applications.[1, 2, 4]

Respondents who had not heard of or used ride-hailing services before and those who were better served by the current fixed-route system (i.e., live within walking distance of a transit stop) were less likely to select a response category indicating a stronger preference for mobility-on-demand transit over fixed-route transit. One could speculate that those who have not heard of or used ride-hailing services might be less proficient with technology. Similarly, those who have not tried ride-hailing services might be reluctant to try new things or hold a negative perception of such services. This is consistent with past research that found that technical proficiency and perceived ease of use are key factors impacting an individual's willingness to participate in the sharing economy.[3] Therefore, this result might be unsurprising.

To our surprise, however, lacking access to a bank account, a smartphone, or Internet at home, or having a disability was not associated with individual preference for mobility-on-demand versus fixed-route transit, but lacking access to a mobile data plan was negatively associated with it. Together with the findings described in the previous paragraph, these results suggest that perhaps barriers to adopting mobility-on-demand such as the lack of access to a bank account, smartphone, or the Internet—which are often raised in public discussions—are not as acute as people perceive; what matters more is the difficulty for certain individuals to engage with new technologies or their unwillingness to adapt to technological changes in the first place.

Table 1 presents responses from all respondents and those identified as disadvantaged travelers. Overall, responses were

TABLE 1: IMPORTANT BENEFITS AND DRAWBACKS OF THE PROPOSED RITMO SYSTEM PERCEIVED BY RESPONDENTS

	DETROIT DATA				YPSILANTI DATA			
POTENTIAL BENEFITS OF RITMO THAT MATTER TO RESPONDENTS	TOTAL RESPONSES (N=441)		DISADVANTAGED TRAVELERS (N=233)		TOTAL RESPONSES* (N=251)		DISADVANTAGED TRAVELERS (N=48)	
	FREQ.	%	FREQ.	%	FREQ.	%	FREQ.	%
It increases the number of places that passengers can get to using transit	267	60.5%	148	63.5%	161	62.9%	25	52.1%
It reduces the amount of walking (e.g. walking to bus stop) of a transit trip	210	47.6%	113	48.5%	147	57.4%	22	45.8%
It allows passengers to request a ride whenever they want and wherever they are	220	49.9%	96	41.2%	129	50.4%	21	43.8%
It allows passengers to wait at home instead of at a bus stop	214	48.5%	97	41.6%	128	50.0%	17	35.4%
It can extend transit service hours for early morning/late evening/weekends	163	37.0%	74	31.8%	137	53.5%	9	18.8%
It can be more economically efficient than a fixed-route bus system	153	34.7%	63	27.0%	100	39.1%	11	22.9%
POTENTIAL DRAWBACKS OF RITMO THAT MATTER TO RESPONDENTS	FREQ.	%	FREQ.	%	FREQ.	%	FREQ.	%
The cost for a RITMO trip is not likely to be lower than a bus trip	156	35.4%	91	39.1%	89	35.5%	12	25.0%
The need to request for a ride instead of just simply waiting for a bus to come	200	45.4%	104	44.6%	119	47.4%	16	33.3%
Passengers are unable to use it when their phone battery runs out or they have no Internet access	170	38.5%	87	37.3%	78	31.1%	19	39.6%
Potential Internet or RITMO application malfunctions	146	33.1%	68	29.2%	51	20.3%	17	35.4%
Difficulty finding the "street corner" to be picked up	87	19.7%	44	18.9%	61	24.3%	14	29.2%

*Note: These questions were added to the Ypsilanti survey after the survey was started, and so the number of total responses (251) collected for these responses was much smaller than the sample size (457).

relatively similar. Both groups perceived the most important benefit of mobility-on-demand transit as enhanced accessibility, economic efficiency, reduced walking time, higher flexibility, more comfort (can wait for rides at home), and service-hour extensions. Potential drawbacks seen among both groups regarding the mobility-on-demand system included the requirements to use the system. This was perhaps due to the need to actively request a ride, wait for the ride, and search for the assigned vehicle, which might be undesirable for those transit riders who are more accustomed to or satisfied with the existing fixed-route system. Another potential drawback, as suggested earlier, is the need to be familiar with technology.

Other concerns, although secondary, included potential increases in the cost to use the service and issues such as limited Internet access, drained phone battery, or system malfunctions. Open-ended issues were also raised and included uncertainty about service reliability and safety and environmental concerns (e.g., more congestion and greenhouse gas emissions).

LIMITATIONS

Because this study was conducted as a web-based survey, individuals who are uncomfortable completing the online surveys or lack access to the internet and/or digital devices might have been isolated or not fully represented in the sample. Another limitation is the research method used. The hypothetical nature of the proposed mobility-on-demand transit system might not translate into actual behavior.

CONCLUSION

Overall, a weaker preference for mobility-on-demand transit was found among individuals with no mobile data plan and among individuals who had not heard of or used ride-hailing services. If a lack of affordability is an underlying barrier, providing Wi-Fi access hotspots at key locations or providing subsidies could be a possible solution. On the other hand, if the lack of technology proficiency is a major barrier, addressing issues as they related to the digital-divide is crucial. Providing direct support to individuals and demonstrating the use of the system might be beneficial. There were also safety-related concerns expressed by female respondents. Transit agencies should pay attention to this issue and explore ways to ease these concerns. Some considerations, though not assessed in this work, include putting larger space gaps between seats, installing security cameras, and ensuring adequate driver training.

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