Chapter 04

Ride-Hailing Platforms Are Shaping the Future of Mobility, But for Whom?

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Highlights:

- This chapter establishes who is likely to benefit from ride-hailing and more importantly, who is most at risk from being excluded from it.
- We consider seven potentially neglected population segments and postulate on the potential benefits and barriers of ride-hailing services for them.
- These equity concerns shape our discussion and inform our recommendations for an agenda to research equity concerns vis-a-vis ride-hailing.

Introduction

Claiming that ride-hailing (RH) companies have disrupted the transportation sector is an understatement. The ability and vision of companies, such as Uber and Lyft, to harness smartphones' built-in GPS technologies, provide real-time information about wait times, and facilitate cashless transactions has enabled them to effectively compete with the taxi industry, and potentially capture a sizeable share of the ridership of other modes as well. RH companies have also enabled drivers to use their own vehicles, and encouraged them to make their own schedules based on their availabilities. Through their alluring low costs and high level of convenience, many people living in major metropolitan regions in the United States are now reconsidering the value of private vehicle ownership, and instead prioritize accessibility to a

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diverse set of mobility tools in order to achieve their daily needs (Clewlow & Mishra, 2017). There is no group for which this trend is more apparent than for Millennials – those aged 20-35 years old – among whom a striking decline in car ownership has been observed in the United States and abroad (McDonald, 2015; Delbosc, 2016; Blumenberg et al., 2012). For an increasing number of urban dwellers, RH services provide the same level of mobility as automobile ownership but without many of the associated costs (e.g. maintenance fees, insurances costs, license renewal, search for parking, etc.). RH services are now increasingly recognized as an accepted transportation service within cities and have rapidly positioned themselves among the most valuable companies within the transportation sector. Albeit a relatively new field of research, studies on this novel mode of travel have mostly focused on its impacts on the transportation sector, and on the regulatory and policy frameworks that should be implemented to either encourage or deter its usage. To date, not much work has been done to determine who actually benefits from RH and the equity concerns that it may engender, notwithstanding research by Brown (2018) and Ge et al. (2016). In this chapter, we explore these largely unaddressed concerns by situating RH within the well-established transport equity literature that has long focused on disparities in access and mobility between different social, economic, and demographic groups. This allows us to elaborate on the potentially restrictive nature of RH for many segments of the population. Once unveiled, these equity concerns will shape our discussion and inform our recommendations for an agenda to research equity concerns vis-a-vis RH.

Equity in Transportation

Transportation is intrinsically linked to almost every aspect of our lives. It shapes human interactions, contributes to economic prosperity, and influences the quality of life of both

individuals and communities at large. Inversely, the lack of, or inability to use, transportation services is shown to be a catalyst to poverty, unemployment, and other socioeconomic disparities as it impedes access to these very same vital opportunities (Lucas et al., 2008; Currie et al., 2007; Paez et al., 2009). Recognizing the synergies between transportation access and socioeconomic outcomes, transportation planners have long sought to maximize the fair and just distribution of transportation services. The problem, however, is that by their spatial nature, cities and transportation infrastructures produce inequalities. Meyer and Miller (2001) show that transportation investments typically reflect the concerns and issues of their time and often shape investment choices made in the future. Planning in the 1950s, for instance, was mainly focused on highway network expansion, the results of which, namely automobile dependency, can still be felt today. By orienting our cities around cars, we provided those capable of affording vehicles with more flexibility and the ability to access a broader range of opportunities. Unfortunately, even in the most motorized societies, many cannot afford to own an automobile and must instead rely on alternative modes of travel, such as walking and transit, which have increasingly been rendered inefficient by the unbundling of work, home, and leisure activities to accommodate car travels. Government policies and planning efforts aimed at improving car travels have made owning an automobile indispensable, even if this comes at a disproportionate cost for those in poverty (Badoe & Miller, 2000; Sheller & Urry, 2000; Urry, 2004). Those without cars are consequently at a transport disadvantage and at a much higher risk of socioeconomic disadvantage. This chain of events descends into a negative feedback loop, as the socioeconomic disadvantages resulting from a lack of opportunities, such as a higher propensity for unemployment, compound the already existing transport

disadvantages, such as not being able to afford a vehicle, and intensify the overall level of exclusion (Lucas, 2012).

Faced with this discrepancy, many have argued in favour of subsidizing automobile ownership as a way to overcome the barriers preventing people from reaching employment, health, and other socioeconomic opportunities in the near-term (Mercado et al., 2012; Blumenberg, 2017). Despite the mounting evidence to support how the absence of automobile access will only exacerbate existing socioeconomic disparities, policymakers have to date, been reluctant to implement automobile subsidy programs, as they correctly assume that this will increase automobile use, and will inevitably worsen congestion, pollution, and sprawl. Furthermore, it would continue to exacerbate the inequalities between those with vehicles and those who will remain carless or unable to drive, even under a hypothetical ownership subsidy.

RH services are seen as a potential solution to this problem, as they enable carless individuals to access a wider range of socioeconomic opportunities, at a cheaper cost than traditional taxi and car-share services. While still up for debate, some argue that RH may actually serve to reduce automobile usage, as it discourages vehicle ownership and eliminates much of the wasteful driving associated with the search for parking (Anderson, 2014). Moreover, by stressing its gap-filling potential, others believe that RH complements more than it substitutes transit use, and may increase accessibility for carless individuals in areas with poor transit supply (Feigon and Murphy, 2016; Komanduri et al. 2018).

RH critics, however, have painted a much more cynical picture of what is to come, pointing out the ways in which RH may further exacerbate existing socioeconomic inequalities. Despite being cheaper than taxis, RH services remains considerably more expensive than transit and can therefore only provide mobility to those who can afford to use them. Additionally, these

services rely on smartphone technologies and necessitate electronic forms of payment, which impose financial constraints and limit its uptake in certain socioeconomic strata.

While RH services exhibit undeniable potential for increasing individual mobility, they also come with their fair share of concerns, and no consensus has been reached on whether those suffering from transport poverty actually benefit from the mobility gains that RH proposes. In order to pick this apart, we will now consider different potentially neglected groups – both socioeconomically and spatially – and postulate on the potential benefits and barriers of RH services for them.

Considering the Socioeconomic Composition of Ride-Hailing

The opening sentence of Uber's mission statement reads: "Good things happen when people can move, whether across town or towards their dreams. Opportunities appear, open up, become reality." (Uber, 2018a). Clearly, this company understands the synergy between transportation accessibility and socioeconomic outcomes, and is deliberately portraying itself as the solution to increase access to a broader range of opportunities. Lacking from this statement however is a caveat explaining how such accessibility benefits, as with those provided by any transportation service, may be inequitably distributed among the population. Unfortunately, RH services, in large part due to their novelty, have not yet been subjected to the same level of scrutiny as other, more traditional modes of travel, and the factors preventing people from using RH services have still not fully been established. Factors preventing access to RH may take various forms, some more visible than others, and obviously to different degrees. Socioeconomic factors such as income, age, gender, race, and disabilities are often responsible for transport inequalities, and based on available research we will now explore how different socioeconomic groups may be excluded from benefiting from RH services.

Income. In its current form, RH cannot be considered a broadly affordable mode of transportation. Income is consistently shown to correlate positively with RH use (Young & Farber, 2019; Rayle et al., 2016), which leads us to categorize this travel mode as a luxury service. The cost of RH in comparison to public transit, and its use of smartphones and electronic payment methods further attribute to this categorization.

While it's use smartphone technologies is perceived as convenient for most, it also restricts the use of RH services among low-income populations, as many are unable to afford the devices and phone plans required to fully take advantage of these services. Take the United States for example, where in 2018 only 67% of low-income individuals, those making less than $30,000 per year, owned a smartphone capable of ordering RH trips (PEW, 2018). While smartphone ownership is on the rise, many segments of the population continue to struggle to afford mobile devices, and are inherently excluded from taking advantage of the benefits that RH services are said to provide.

For convenience and safety reasons, RH companies only allow cashless transactions in most markets. While applauded as an attractive feature for many users, this technological advancement also forces users to have a credit or debit card in order to request trips. Those without bank accounts, which are commonly referred to as the unbanked and are typically comprised of lower-income households, represent 5% of the adult population in the United States as of 2017 (Federal Reserve Board, 2018), and remain unable to use RH services even if they have access to a mobile device (Shaheen & Cohen, 2018).

Surge pricing is another potential barrier to RH use among low-income populations. Used as a way of meeting consumer demand and incentivising drivers, surge pricing involves raising

the cost of rides during rush hour or other periods of the day where demand exceeds supply. While this is an effective business strategy, these real-time price adjustments render RH services even less affordable to low-income individuals. The inability to predict the occurrence and level of surges makes matters worse, as some, fearing the risk of a surge, will decide to use other, more predictable modes of transportation. In order to combat this problem, companies such as Uber and Lyft enable customers to schedule trips in advance, but acknowledge that knowing when one might need a ride is not always possible ahead of time. Combined, the expensive requirements and unpredictable pricing strategy of RH services impose substantial barriers to usage, and narrow the probability that low-income individuals will actually benefit from the added mobility that RH services aim to provide.

Fortunately, whether RH companies are grasping the magnitude of this problem or merely trying to attract an untapped source of new riders, they are now beginning to offer split fare features and carpooling options (e.g. UberPool and LyftLine) to facilitate cost sharing and enable passengers traveling in the same general direction to share rides. These features reposition RH well within the per-rider cost range of public transit, at least for shorter distance trips, and may enable previously excluded low-income travelers to benefit from the mobility advantages that RH services provides, assuming they can afford the other requirements. In Toronto, for instance, public transit costs $3.25 per person, which means that any RH trip below $12, would be cheaper if split four ways.

To summarize, due to the cost, technological barriers, and banking and payment requirements of RH, many low-income individuals may be excluded from its use. Additional research is required to determine the extent of each of these barriers, and to evaluate whether,

and under which circumstances, low-income individuals are willing to pay for the increased convenience and comfort of a RH trip.

Age. RH is often characterized as a younger generation phenomenon. This is predominantly a consequence of the existing digital divide between younger and older generations, and to older people not owning or being unaccustomed to the smartphone technologies required to request trips. Recent estimates in the United States reveal that roughly four in ten adults, ages 65 and over, do not own a smartphone capable of ordering RH trips (Anderson & Perrin, 2017), and Canada appears to display a similar divide as only 2 percent of RH users in Toronto are 60 and above (Young & Farber, 2019).

Despite this digital divide, RH services do propose substantial advantages to seniors. This is especially true for those who are no longer able to drive, as it provides them with a car-based option to regain their independence at a significantly lower cost than traditional taxi services. An increasing, yet concerning trend in North America is seniors' tendency to live in suburbs; areas incidentally in which public transit services are often infrequent and unreliable, and where distance for walking are too great (Golant, 2015). Consequently, many depend heavily on friends and family for their travel needs (Rosenbloom, 2009). By 2030, it is estimated that 72 million people in the US will be aged 65 and over, and 11.5 million of them will be aged 85 and over (US Census Bureau, 2008). Very few will be interested or able to move from their suburban homes, and will witness their mobility dissipate as driving and alternative modes of travel become gradually more difficult to use. In this scenario, RH appears to be a viable solution as it presents an alternative to meet the growing challenge that carless seniors will face.

Mistrust and confusion surrounding RH also pose a problem for getting senior citizens to adopt these services. Recent research (Shirgaokar, 2017) reveals that seniors are often uncertain of the differences between taxis and RH services, and that many are opposed to the notion of surge pricing. Moreover, the study finds lack of trust to be a key issue amongst old people, and reports that many fear using credit cards for online transactions. An additional issue, perhaps culminating from a combination of both these reactions, is the perception that RH remains too controversial to be used. Senior citizens raise several concerns regarding safety, the qualifications of RH drivers, and question the ethics of RH companies operating while being unlicensed or unregulated. While legitimate concerns, it is likely that in time many of these mistrust and confusion issues will be resolved, and future cohorts of seniors – those in their fifties and sixties at the moment – will have had more time to familiarize themselves with the technologies required to request RH trips. In the meantime, companies such as Uber have recognized the opportunity that seniors present, and have introduced new features to enable users to request trips for other people. This, they hope, will help remove the technology barrier preventing older people from using RH services, and gradually build more trust into their online platform.

At the other end of the age spectrum are children, who represent another demographic group with travel demands that are unlikely to be serviced by RH technologies. Despite some companies providing a child car seat upon request for accompanied children, most RH companies do not permit drivers to pick up unaccompanied minors. Seizing this opportunity, specialized RH companies such as Zūm and Sheprd have oriented their services towards catering children and their parents. These services closely replicate the existing RH model, but provide additional features to facilitate scheduling and ensure safety. Notably, children are given a code

word to help find the right driver, and parents are provided the vehicle's location and speed in real-time. These services also conduct more scrupulous background checks, provide more training for drivers than typical RH companies, and allow parents to schedule trips ahead of time for their children to reduce wait times. While still in their early phases, such companies have faced multiple setbacks. Most notably, there is a lack of demand during school hours and a subsequent lack of supply during after-school periods, not to mention the ingrained fear of entering into a stranger's car that public safety norms have long advocated for.

So where does this leave us with regards to children? For now, RH services are still unable to pick up unaccompanied minors and child-friendly alternatives continue to struggle to turn a profit, leaving children widely excluded from RH services. Situating this exclusion within a *commuting to school* context is further important, as parents report safety to be the primary reason for choosing to drive their kids to school in the morning (McDonald & Aalborg, 2009), but if safe RH trips become available parents' perceptions may change. The availability of verified and trusted RH drivers may eventually help appease parents' safety concerns and lighten the burden of having to drive their kids to school every morning, but this will not increase active school commutes. Walking and cycling to school have been shown to be an important source of children's physical activity (Faulkner et al., 2009), and have consequently become a priority for school boards across both Canada and the US. There is safety in numbers when it comes to active school commutes, and if children continue to be driven to school, regardless of whether this is by their parents or by a RH driver, active school commutes will not increase, and safety will remain an issue.

Gender. By underlining how 'half of the human' in human geography has been neglected in the

past, feminist geographers have laid the groundwork for a field of research concerned with the differences between men and women's travel behaviours. Research on gender and transportation has revealed the extent to which women's experiences with gender-based violence and sexual harassment incidences have limited their access to mobility, and consequently impacted their ability to participate in activities (Law, 1999; Dunckel Graglia, 2016). It is in this context that we now explore whether RH offsets this gender exclusion by offering a safer travel alternative, or rather perpetuates this sentiment of fear and in doing so limits their mobility even further.

Thus far, studies have found men to use RH services more frequently than women (Rayle et al., 2016; De Souza et al., 2018). This may be due to women not wanting to embark on a trip with a stranger, or to RH companies facing mounting harassment and discrimination charges; multiple women plaintiffs are now involved in a class-action lawsuit against Uber over sexual harassment allegations and discriminatory pay practices (Wakabayashi, 2018). These concerns are by no means abated by the fact that RH companies remain entirely revenue driven, and that eventually, when presented with an opportunity to sacrifice passenger safety for profits, the latter may likely prevail. Take, for instance, the case in Delhi in 2014, where the medical files belonging to a woman claiming to have been assaulted by an Uber driver were mishandled by Uber's senior executives to cast doubt on her accounts and protect the face of the company (Isaac, 2017). While such harassment and assault incidents are rare in comparison to the total number of RH trips, they clearly deter some people – especially women – from using them. These safety concerns may also dissuade women from becoming RH drivers, and perhaps explain why women make up less that 15% of all Uber drivers (Hall & Krueger, 2017).

That being said, the literature on gender and transportation offers another perspective, and reveals how in some contexts, women may perceive RH as the safest travel alternative.

Having access to a car enables women to travel safely during off-peak hours when transit services are often scarce or unreliable (Blumenberg, 2004). Moreover, it provides safety when traveling at night, when women are most concerned for their personal safety (Schulz & Gilbert, 1996; law, 1999). Viewed from this crime-risk viewpoint, RH may provide women with a safer travel option when compared to walking or using public transit at night or in unsafe neighbourhoods.

While flawed, the five-star rating system adopted by most RH companies offers additional safety, as it enables users to select drivers with whom they feel comfortable, based on previous passenger recommendations. In turn, they are encouraged to rate their own RH experience in order to help others make safer travel decisions. Unfortunately, this rating system does not manage to prevent all incidents of harassment and assault, and has led some new companies to develop single-sex RH services. By-women/for-women services such as Safr and DriveHER, aim to provide a safer RH experience to both customers and drivers, but are currently in the midst of a legal battle, as refusing to employ men as drivers contravenes the American Civil Rights Act prohibiting gender discrimination (Brown, 2017). While women-only transportation may not have much precedence in the US, it has occurred elsewhere. Responding to mounting violence and harassment allegations against women travelers, Mexico City established a women-only public transportation service in the early 2000s. By designating specific subways cars to women during peak periods, Mexico City removed the immediate problem, and managed to significantly reduce the gender-based violence threatening women's mobility (Dunckel Graglia, 2016). Regardless of whether such single-sex services eventually become legal in the US, the issue of safety has unquestionably become a priority amongst major RH companies, and has caused them to develop incident prevention tools such as phone number

anonymization, emergency assistance buttons, and more thorough criminal background screenings to ensure the safety of their passengers. Both Uber and Lyft now claim safety to be among their top priorities (Uber, 2018b; Lyft, 2018).

Race. Racial discrimination has been imbedded within transportation decisions in America for decades. This goes at least as far back as the Jim Crow era; where black patrons were forced to ride at the back of the bus and to give up their seat when asked to do so by white patrons. This can also be seen more recently during the development of the national highway system in America, when vulnerable low-income black neighbourhoods were systematically targeted for demolition in order to accommodate inner-city highway expansions. Even now, African Americans are found to be three times more likely to live in a zero-vehicle household than Caucasians, limiting their mobility and significantly impeding their access to employment opportunities (Blumenberg, 2017). In addition, public transit investments have disproportionately favoured wealthy Caucasian users; despite buses accounting for the bulk of all transit trips in America, suburban commuter rail expansion receives the majority of government subsidies. This is justified by rail's ability to attract discretionary riders and more effectively convert commuters away from driving, yet given the racial and economic composition of bus and rail users, these subsidies also clearly favour wealthy Caucasian users (Blumenberg, 2017; Grengs, 2002). Given this long history of discrimination in transportation, it is reasonable to question whether the arrival and widespread usage of RH has help mitigate this disparity, or whether instead it has widened the divide.

Put simply, RH services are not immune to racial discrimination. For instance, a recent report found that drivers on average take longer to pick up African-American passengers than

Caucasians (Ge et al., 2016). While concerning, this discrepancy in wait time is actually an improvement over the taxi industry, which despite its regulatory framework, has systematically been shown to discriminate against visible minorities. In a recent comparative study in Los Angeles, African-American taxi riders were found to wait, on average, 52% longer for their taxi than their Caucasian counterpart, equivalent to a 6-15 minute longer wait time. African-American RH users, on the other hand, were only found to wait 1-2 minutes longer for their driver to arrive, and were also less likely to experience cancelations than Caucasians RH users (Brown, 2018). Similar patterns of discrimination were noted in Seattle and Boston (Ge et al., 2016). While speculative, the prejudice towards African-Americans may be attributed to the fact that nearly half of all Uber drivers in America identify as being Caucasian (48.6%) and only 8.1% identify as African-American (Statistica, 2018). The above studies illustrate how RH may be an improvement over taxis in terms of waiting times, but do not address whether RH helps mitigate racial discrimination as a whole. To answer this broader question more data is needed to explore the intersectionality of race and other socioeconomic characteristics, as these will expose whether minorities are excluded from RH due to other, more profound, societal problems.

Disabilities. Disabilities have long been recognized as a barrier to the access and use of transportation services (Evans & White, 1998; Lucas, 2004; Currie & Senbergs, 2007). Every mode, even walking, requires a specific set of abilities and skills, and when lacking, may hinder a person's mobility. As with any other barrier to mobility, once present, it will affect the number of opportunities one can attain and result in much broader socioeconomic impacts. Considering this, we will now explore whether RH provides a solution to improve the mobility of those with

disabilities, or whether it further excludes those with disabilities by overlooking and omitting them completely.

Much like taxis, RH drivers will often help passengers that require assistance, and by offering this help at a lower fare cost than taxis, there is potential for RH to improve the mobility of those with disabilities. That being said, RH services remain particularly exclusive. For example, their application interfaces are not usually adapted to visual impairments, and vehicles are often inadequately suited to accommodate disabled passengers. This may be a result of drivers using their own vehicles, very few of which are equipped to handle wheelchairs or motorized scooters. Even the RH companies that do provide wheelchair-accessible vehicles do not provide a sufficient number of them to meet current demand, and the ensuing wait time for such vehicles is estimated to be four times longer than for regular RH service, if available at all (NYLPI, 2018). Another growing concern is that RH drivers may not receive the necessary training to assist disabled passengers. Taxi drivers are often compelled to take a disability awareness certification to properly assist such passengers but this training is not required by RH companies and has led to instances of mistreatment and abuse (Weatherby, 2018).

Fortunately, RH companies appear to be listening to these concerns, and are committed to finding new ways to provide better services to individuals with disabilities. Uber and Lyft are now involved in a pilot program in New York City to provide pooled wheelchair-accessible vehicles to their users, route them through a centralized dispatcher to facilitate, and ultimately accelerate the matching process. Despite these efforts, critics insist that in their current form, RH companies will never provide enough wheelchair-accessible vehicles to accommodate demand, and argue that economic incentives must first be set to encourage drivers to make their cars wheelchair-accessible (NYLPI, 2018).

Spatial Equity

Recent research shows a suburbanization of poverty both in the United States and in Canada, and is increasingly concerned by the transport implication this may have (Allen and Farber, 2018; Deboosere and El-Geneidy, 2018). Low-income households are found to be even more disadvantaged in the suburbs, as their mobility heavily depends upon transit, which is rendered inefficient by the dispersion of home, work, and leisure activities that has become quintessential to suburban landscapes (El-Geneidy et al., 2015; Currie et al., 2007; Lucas, 2012). Others have extended transportation disadvantage to encompass broader socioeconomic outcomes, arguing that the absence of mobility may act as a catalyst to exacerbate existing socioeconomic inequalities (Lucas et al., 2008). RH offers a potential solution to this problem as it has the ability to provide access to carless individuals, especially those living in areas with poor transit access. The question remains however; will enough RH drivers choose to operate in low-density suburbs to ever render wait times acceptable? And will the cost of RH remain low enough to enable low-income suburbanites to use and benefit from the mobility advantages that RH services allegedly provide?

RH is primarily an inner-city phenomenon. In Toronto, over a quarter of all RH trips occur entirely within the City's central Planning District, which encompasses the central business district and the densest parts of the City. Three quarters of all trips in Toronto either begin or end within this Planning District (TTS, 2016). The prominence of trips downtown is largely due to demand and to drivers' ability to converge to this area in order to satisfy demand. Unfortunately, this preference and ability for drivers to operate in central areas creates an imbalance of supply in other areas, and renders this service inefficient in lower-density suburban neighbourhoods without sufficient RH demand. Drivers rightfully recognize that they can

increase their revenues by commuting downtown and by picking up passengers in areas where demand is high and wait times between trips are low. Uber further encourages this behaviour by advertising areas where most requests occur, and by incentivising drivers to converge to these hotspots. In Toronto, for instance, Uber recommends drivers begin in the Financial District and other downtown shopping areas in order to maximize revenues (Uber, 2018c). It therefore appears, that a minimum demand threshold is required to persuade drivers to stay in a given location, especially when demand in adjacent areas is much higher. Looking at the issue from an equity perspective, some may notice that downtown neighbourhoods, where the bulk of RH trips occur, are also where individuals' need for mobility are already best met by public transportation. Adding RH services to these areas only marginally increases individuals' participation rates and likely replaces trips that elsewise would have been conducted by transit. Thus continuing in that logic, RH will only serve to increase the mobility of those living in well-served transit areas, and perpetuates the overall level of transport inequality between the inner and outer parts of the regions.

Modal Equity

The fear that RH may be cannibalising a substantial portion of transit demand is widely expressed in literature (Hall et al., 2017; Clewlow & Mishra, 2017; Zwick & Spicer, 2018; Young et al., 2020). If accurate, the increase in RH demand at the expense of transit ridership may have damaging effects in the long run, as transit agencies, witnessing a decrease in demand, may have no choice but to reduce the level of transit supply. The result of which will negatively impact travelers who depend upon transit and who are unable to shift towards RH, as their mobility will have decreased in the process. Others, however, have drawn much more optimistic conclusions with regards to the modal impacts of RH, suggesting that it will act as a

complement, rather than a substitute to transit. Proponents of this view emphasize the potential of RH to serve as the first/last mile of transit trips, and its ability to provide access to carless individuals in areas with low transit supply (Feigon and Murphy, 2016; Komanduri et al., 2018). As evidenced by this debate, much uncertainty remains about the effect of RH on transit ridership and on whether these services will be able to coexist.

Automobile drivers may also be impacted by the arrival and widespread usage of RH. If RH results in an increase of vehicles on the road, this will inevitably materialize into higher levels of congestion. In San Francisco, recent reports found RH vehicles to account for approximately 50% of the increase in traffic congestion between 2010 and 2016 (Erhardt et al., 2019) and similar trends appeared in New York City a well (Mangrum & Molnar, 2017). Others are less convinced of its detrimental impact upon congestion and believe that the arrival and widespread usage of RH may result in lower levels of congestion as it removes the need to own a private vehicle in the first place (Rayle et al. 2016; Clewlow & Mishra, 2017; Young, 2018). To support this, researchers point towards the small, yet consequential, portion of RH users that have given up their personal vehicle, or that plan to do so in the near future in response to the arrival of RH (Clewlow & Mishra, 2017). Moreover, the reported late-night popularity of RH may also suggest that RH services are reducing the amount of dangerous vehicle kilometers traveled. A study by Greenwood and Wattal (2015) found the entry of UberX, Uber's most popular service, to be associated with a decrease in the rate of motor vehicle homicides in the State of California by up to 5.6%. This finding was later corroborated by survey participants reporting, even when unprompted, that alcohol consumption was a major determinant in their decision to use RH services (Clewlow & Mishra, 2017; Feigon and Murphy, 2016). Thus while

potentially increasing the level of congestion within cities, RH may also reduce the rate of motor vehicle fatalities ensuing from drunk driving.

Conclusion and the Future of Ride-Hailing Research

What appears most evident when examining groups that may be excluded from RH is the level of complexity and uncertainty that remains. Due to its novelty and to a related paucity of available data, many of the effects of RH cannot yet be established with certainty, and many of its intersectionalities with transport inequalities remain largely unexplored. Take gender-related transportation exclusion for instance, where some women may perceive RH as a safer alternative than walking alone at night, whereas others may not want to embark on a RH trip with complete strangers under any circumstances - be it other passengers or the driver - and may see their mobility decrease as congestion levels worsen and other modes of travel become slower or less feasible.

In light of this prevalent uncertainty, our recommendations are divided into two parts. The first will consider what can, and arguably should, be done to minimize current equity concerns and persuade RH companies to behave in ways that minimizes exclusion. In this section we offer policy advice to ensure that the objectives of RH companies align themselves closely with those established by governments, and propose regulatory measures to penalize those that do not obey. It is worth acknowledging at this point that our policy recommendations will be centered on minimizing exclusion from a rider's perspective, but that is not to say that drivers cannot also experience safety or equity concerns, and that governments should also be responsive to their needs when framing policy initiatives. Recognizing that many unknowns remain with regards to RH, the second part of this section will consider the issue from a research perspective, and examine the updates and improvements that must occur on the data collection

front. It is clear that we do not have sufficient data to fully grasp the magnitude of the effects of RH and this latter section will serve to elucidate which additional sources of data and research approaches should be explored in order to properly inform policy decisions.

Policies to minimize exclusion. In an effort to make RH more affordable, governments should consider subsidizing pooled RH trips, especially in areas with low transit supply. This of course would not address the technology barriers or banking/payment requirements, which would be better resolved through a wealth distribution mechanism such as income taxes (Rietveld, 2007), but would help reposition RH as an affordable means of travel, while promoting sustainable behaviours. In addition to making RH more affordable, this would also alleviate congestion. Congestion remains a primary concern with RH, and despite having a much higher average occupancy rate than taxis, the majority of RH trips are still conducted alone (Rayle et al., 2016). Another form of trip that governments should consider subsidizing are those that either begin or end at transit stations. Many believe that RH companies will play a crucial role in servicing the first-last mile of transit trips, and that in doing so they will render transit more appealing. RH companies know exactly where each passenger is picked-up and dropped-off, and by integrating this information with Smart transit passes, governments could accurately determine whether RH were used for the first-last mile of a transit trips. A variance of this subsidy was launched in Philadelphia during the summer of 2016 when the Southeastern Pennsylvania Transportation Authority (SEPTA) partnered with Uber and agreed to offer a 40% discount to all RH trips used as access or egress to suburban rail stations. Early results find this partnership to have been a success, and show it to have increased the ridership of these rail stations while also alleviating their parking problems (Campbell, 2016). Together these subsidies would reduce the cost of RH,

while ensuring that it behaves as a complement rather than substitute to transit. To finance these subsidies and further encourage such behaviours, governments could establish a feebate system and tax undesired RH trips. Using the trip data collected by RH companies, governments could impose additional fees to users traveling alone, and to trips which could easily have been replaced by transit. These efforts could be supplemented by surge price restrictions, which would only enable RH companies to apply surge pricing to users traveling alone, and would further encourage pooled trips. No longer fearing the risk of a surge, low-income users would be more inclined to use RH as well.

To address racial and gender exclusion, governments should require RH companies to provide their drivers with thorough discrimination, harassment, and sensitivity training. This training should be monitored and upheld by government agencies, and non-complying firms should be prevented from operating within their jurisdictions. Instead of slicing the training requirements for both taxis and RH drivers, in hopes of levelling the playing field, cities such as Toronto should seize this opportunity to revisit and update their current training requirements. Using data from both RH and the taxi industry, governments could pinpoint the ways in which passenger are being discriminated against, and could tailor their training programs accordingly. For instance, if observed through the data, racial prejudices and misogynistic behaviours could be emphasized during training sessions and the effects of such training could then be monitored using subsequent data on harassment incidents and on wait time discrepancies between minorities and Caucasians.

Gender exclusion is also often associated with safety concerns, which governments could address by imposing stricter background checks and by requiring that these be conducted by government agencies rather than private firms. To date, RH companies such as Uber have been

reluctant to accept government-run background checks for their drivers, often claiming that these are overly burdensome for their business model (Zwick & Spicer, 2018). This may all have to change, however, if ever governments want to address the causes of gender exclusion. In contrast to Uber's current self-run background checks, which are well documented to be error prone (Hill, 2015), governments should prevent drivers from applying under a false name, and should require fingerprinting to screen and potentially remove those with criminal records.

To ensure RH serves to improve the mobility of those with disabilities, cities should compel all RH drivers to complete a disability awareness certification. This requirement would ensure that all drivers receive the necessary training to properly assist disabled passengers and would likely incentivise more drivers to convert their cars into wheelchairs-accessible vehicles. If despite these efforts, the supply of wheelchair-accessible vehicles remains insufficient, governments could also impose minimal accessible vehicle requirements by which RH companies are forced to abide in order to operate within their jurisdictions. These could range anywhere between 5-10% of total RH vehicle fleets, depending on demand.

A final recommendation would be to limit the supply of RH permits. The impact of RH on congestion and on the ridership of other modes remains complex and largely unexplored, and to simply assume that the revenue-driven objectives of RH companies will produce an optimal level of supply is overly optimistic. Governments should instead take pre-emptive measures to ensure that the supply of RH vehicles aligns itself with societal objectives, and err on the side of caution in recognizing that many uncertainties still remain with regards to RH; the supply of permits can always be increased down the line. In 2018 New York City became the first city in the US to pass a legislation capping the number of RH vehicles on the road, but this law has since been challenged by Uber and other RH proponents, who deem it an anticompetitive

practice (Fitzsimmons, 2018). If left unchecked, as is currently the case in Toronto and in most cities, the supply of RH vehicles will likely continue to rise, and once entrenched as such, regulating the industry any further in hopes of scaling it back could prove to be politically prohibitive.

Data needs and improvements to the data collection process. To ensure that RH companies behave in ways that limit rather that propagate transport inequalities, governments must also make an effort to fully understand the impacts of RH. This will include collecting new data from both public and private sources, and will ultimately call for an update and improvement of their entire data collection process.

Clearly there is a need to conduct more frequent and exhaustive travel surveys, and to include RH as a travel mode within them. Associating users' characteristics to their travel behaviours will enable government officials to determine groups that are underrepresented and at risk of being excluded from this mode. This in turn, will inform them of areas that deserve to be emphasized during the discrimination, harassment, and sensitivity training sessions. Because of their low sampling rates, however, these travel surveys cannot accurately expose how RH will impact congestion nor reveal how it will affect the ridership of other modes of travel. For this, governments must rely on other sources of data, and updating their data collection process will therefore also involve partnering with RH companies to obtain data from them directly. While somewhat reluctant to share their data in the past, RH companies have progressively warmed up to the idea, and are now beginning to grant governments with access to many of their datasets. This shift with regards to data sharing has been most noticeable with Uber, which reversed its notoriously long-held confrontational stance with local governments to now offer a stand-alone

data sharing tool entitled *Uber Movement* in order to "provide anonymized data from over two billion trips to help urban planning around the world" (Uber Movement, 2018). Despite these encouraging efforts, collaborations such as these remain in their early stages, and governments must continue to enact policies that compel RH companies to share their data in order to operate within their jurisdictions. RH companies possess disaggregated trip data, which includes the location, duration, cost, and type of vehicle for each trip. This information is crucial in order to properly assess the volume of traffic for which RH is responsible, and to determine whether this mode acts more as a complement or substitute to transit. Using data on the location and duration of trips, cities could technically calculate how easily these trips would have been replaced by transit, and introduce policy measures accordingly. The cost of trips could also be used to evaluate whether, and under what circumstances, low-income individuals are willing to pay for RH. Obtaining data on the frequency and duration of surge pricing would further serve to enrich this understanding and would offer insight as to the behavioural response of users to such pricing mechanisms. RH companies also possess data on wait times that could be used to discern racial discriminations in the form of wait time discrepancies and establish how much congestion is actually caused by deadheading, which refers to the kilometers required to get to the passenger's pick up location in the first place. From this trip dataset, city officials could also determine the proportion of trips that are pooled and detect all those that either begin or end at transit stations. This would inform policymakers of the proportion of trips that should be subsidized and of the monetary value these subsidies should take in order to be effective.

Even if successful in obtaining all this data from RH companies directly, governments will still face several uncertainties with regards to RH, and will depend on researchers to further advance their understanding. Qualitative approaches are especially well suited to answer the

issues raised in this chapter; interviewing elders, minorities, women, and members from other potentially neglected groups will elucidate the reasons for which they either choose to use or avoid RH, and will shed light onto the policy that must be enacted to ensure these individuals are not excluded.

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