



Research paper

Personal safety perception of ride-share amongst young adults in Cape Town: The effect of gender, vehicle access and Covid-19

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ABSTRACT

This paper investigates ride-share related personal safety of young adults in Cape Town in relation to the Covid-19 pandemic. As a response to gender-based violence, the focus is on the different perceptions of females and males. Additionally, this paper considers how having access to a private vehicle affects an individual's perception of their safety. Data was collected amongst university students in Cape Town, as they have previously been identified as likely ride-share users.

Uncertainty in using ride-share services is explored in the scenarios of 'before', 'during' and 'after' Covid-19 to see possible impacts of the pandemic. This study shows that access to a private vehicle is a significant factor when considering ride-share trips 'before', 'during' and 'after' the Covid-19 pandemic. Being female, especially with access to a private vehicle, has a negative correlation to making ride-share trips 'at night', 'alone' or 'alone at night'.

By understanding the Covid-19 pandemic influences on individuals' perceptions, strategies and policies can be better informed. This ensures that the negative impacts of similar future disruptive events are mitigated. Supporting the progress of the case city, Cape Town, into having a more inclusive, multi-modal transport culture, this study proposes the implementation of several policies and strategies.

1. Introduction

Ride-share is not a new phenomenon. The US economic recession, induced by World War I, saw the introduction and mushrooming of the 'Jitney' (Dayen, 2014). Although the interest in ride-share dwindled, over time, moments of crisis, or uncertainty, have increased the uptake in ride-share various times. An increasing trend was witnessed during World War II (Cozza, 2012) and during the oil crisis in the 1970's (Amey, 2011; Cozza, 2012). Vanderschuren and Baufeldt (2018) established that, in the South African context, ride-share has the potential to provide mobility opportunities for the so-called 'missing-middle', which includes university students. In this paper, ride-share or ride-share services refer to app-based transport services such as Uber, Bolt, or Lyft.

The answer to the spread of Covid-19, by many governments around the world, was to limit mobility (Engle et al., 2020). As restrictions eased, but infection consciousness remained, walking and cycling became more appealing, even leading to the rethinking of infrastructure provision in sixty global cities (Combs & Pardo, 2021). There are

changes in spatial patterns, partly informed by the move away from cities, as working from home becomes more accepted. As Covid-19 starts to subside, researchers are speculating what the future of mobility will look like (Hensher, 2020).

Another field of research is the differences between the outcomes of the pandemic for different societies. The consequences of Covid-19 in South Africa, for different modes of transport, as well as the potential of working from home for the transport network, are somewhat different than what can be seen in Hensher (2020). Venter et al. (2020) show that work travel has nearly recovered to pre-Covid levels with only an 8% difference from the baseline. This indicates that, unlike more developed economies, it is unlikely that working from home will be a feasible option for many commuters in Cape Town. However, similar to Hensher (2020), formal public transport modes have been severely impacted, both during and post Covid-19 lockdowns (Venter et al., 2020).

It is well documented that males and females have different mobility patterns (see for example: Adeel et al., 2014; Campbell et al., 2016; Allen & Vanderschuren, 2016; Vanderschuren et al., 2019; Vanderschuren et al., 2023). Furthermore, across the world, women face real and

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perceived threats of gender-based violence, assault, and harassment, while negotiating their daily travel in public spaces (UN WOMEN, 2016). In developing countries, limited access to, and the safety of, transport is estimated to “reduce female labour force participation by 16.5%” (SuM4All, 2019). Besides increased concerns related to, for example the affordability of transport and road safety risks, women have the added concerns related to personal safety (Hickey, 2014; Jackson et al., 2006; Vanderschuren et al., 2019) leading to anxiety and uncertainty avoidance. Allen et al. (2018) established that a significant higher portion of women than men are concerned about their personal safety. Feelings of uncertainty were even higher for mothers with children.

Studies conducted during the pandemic found strong associations between gender and Covid-19 related fear and anxiety (Evren et al., 2020; Hossain et al., 2020; Padovan-Neto et al., 2021; Reznik et al., 2020; Sakib et al., 2020; Tsipropoulou et al., 2020). A meta-analysis by Metin et al. (2022) confirmed that Covid-19 related fear and anxiety were higher in females. This study explores if gender-based uncertainty avoidance, anxiety and fear during Covid-19 also effects the perception of transport system, in particular the use of ride-share. More specifically, this paper investigates the personal safety perceptions of ride-share users, and the impact of the Covid-19 pandemic on the personal safety perception of young adults in Cape Town in terms of ‘before’, ‘during’ and ‘after’ the Covid-19 pandemic. Personal safety means the safety and security of a person from physical or mental harm that may have an adverse effect on the individual. In the context of this paper, the safety level of an individual from road crashes is excluded.

Students were used as the population in this study. Besides easy access to the students by the authors, this research population was informed by previous research that established that ride-share had the potential of filling part of the demand gap for this part of the Cape Town population (Vanderschuren & Baufeldt, 2018). This study specifically investigates how Covid-19 has, or has not, affected how individuals perceive and engage with ride-share services in Cape Town before, during and after the global pandemic. Focus is placed on what differences there are between female and male personal safety perceptions and how this influences the willingness to use ride-share services, especially for trips involving possible uncertainties around personal safety.

Additionally, having access, or not, to a private vehicle is included in the investigations, as it is assumed to have the potential to influence some of the perceptions. Normally, having access to a private vehicle is simply a matter of ‘car ownership’. As the surveys were mostly distributed to students who may not own the vehicles, the term ‘access’ is used, following common practice in South Africa. Therefore, the phrases ‘access to private vehicle’ and ‘no access to private vehicle’ are used in this paper, to be consistent with the wording in the surveys.

These three factors of gender, access to a private vehicle and the Covid-19 pandemic are explored in the perceptions and uncertainties of ride-share trips involving personal safety. The transport research field has been criticized as often being unrealistic in the investigation approaches (Rasouli & Timmermans, 2014). A more realistic understanding of how different individuals were affected by the additional uncertainty associated with ‘before’, ‘during’ or ‘after Covid-19’, especially for trips involving uncertainties of personal safety, will help transport planners and stakeholders to ensure the needs of all individuals are considered in the future in such unusual events of higher uncertainty or perceived risk.

Large differences between the perceptions of individuals with or without access to private vehicles would confirm the need for contrasting strategies to encourage desired modal changes in Cape Town. However, if this study shows relatively small differences in perceptions, then specific policies and strategies, defined on whether individuals have access or not to a private vehicle, are not needed.

The insights from these investigations can better inform policies and strategies for the Cape Town context in addressing challenges, working towards a more integrated transport network. A major challenge is to

improve personal safety, especially for females, within ride-share services and public modes of transport (Vanderschuren et al., 2019, 2023). Vanderschuren et al. (2019) found that, despite females and males perceiving personal safety differently, travel changes, due to harassment, or gender-based violence are often not realised, as economic limitations or the lack of alternative available transport hamper change. The focus of Vanderschuren et al. (2019) was on public transportation modes. In this paper, the focus is on ride-share services in Cape Town and those individuals who engage with ride-share services, from the occasional trip to frequent users. Individuals must have some experience with the services, to improve the validity of the responses. This would also correct for any initial barriers of new users or potential guesses by individuals who have not used ride-share services.

The assumption made, prior to the investigations, is that ride-share services can supplement trips that individuals either cannot, or will not, make with public transport, as established previously by Vanderschuren and Baufeldt (2018). By meeting the needs of individuals for trips that they are unwilling or unable to make with public transport, it may be possible that individuals lean towards more multi-modal transport behaviour. Another argument that was made, in the previous paper, is that if ride-share services provide higher access to (semi) private motorised trips, for those who cannot afford the ownership of a private vehicle, the ‘missing-middle’, then individuals who do not yet own a vehicle, may be persuaded to delay, or prevent, private vehicle ownership in the future. Within this paper, having access to a private vehicle is used as a proxy for economic income and, therefore, also identifying those who could be classified as part of the ‘missing-middle’ (Vanderschuren & Baufeldt, 2018).

The focus of this paper is on the role personal safety has within ride-share services decisions, especially involving uncertainties of personal safety (travelling ‘at night’, ‘alone’ and ‘alone at night’). While there are likely to be several other factors of consideration behind transport mode selection (for example cost, availability, or quality of service), in this paper, the scope is on the impacts of Covid-19 and vehicle access on personal safety decisions of ride-share trips involving uncertainties.

A short literature review now follows.

2. Literature review

2.1. Covid-19 pandemic in Cape Town

The Covid-19 pandemic was an event that affected all aspects of daily life, as cities around the world implemented lockdowns. Transport networks were heavily affected, including South Africa’s transport network (Aderibigbe & Gumbo, 2022; Lubbe & Vermooten, 2021; Venter et al., 2020). Table 1 shows an extract of the South African transport related restrictions (Chakwizira, 2022). The dates of the different levels have been added by the authors.

The data used in this paper was collected from the end of April 2021 till the middle of May 2021, just as the Delta variant was increasing and South Africa was in lockdown level 1. The main lockdowns of the first two waves of Covid-19 were already over. However, due to the third wave, restrictions increased back up to level 4 by the June 28, 2021 (Government of South Africa, 2022), after the collection of the data.

2.2. Effects of Covid-19 on perceptions of young adults

The consequences and effects of Covid-19 on individuals were not equal throughout society. The Covid-19 pandemic has negatively affected young adults particularly severely (Álvarez-Iglesias et al., 2021). Álvarez-Iglesias et al. (2021) argue that the effects of Covid-19 on education and employment among the youth of South Africa are likely to induce depression and anxiety symptoms, especially negative perceptions of self and future. The study by Gittings et al. (2021) support these findings. Haag et al. (2022) found higher increases in anxiety and depression amongst young South Africans living in adverse (less

Table 1

Extract of summary of Covid-19 lockdown levels in South Africa and transport implications.^a

Level	Transport Restrictions	Movement Restrictions	Dates of Lockdowns ^b
<i>Covid-19 pandemic declared a pandemic by the WHO on March 11, 2020 (Zibasesesht, 2020)</i>			
Level 5: High virus spread, and/or low health system readiness	Bus services, taxi services, e-hailing and private motor vehicles - operate at restricted times, with limitations on vehicle capacity and stringent hygiene requirements	No inter-provincial movement of people, except for transportation of goods and exceptional circumstances (e.g. funerals)	26.03-30 04.2020.
Level 4: Moderate to high virus spread, with moderate readiness	Bus services, taxi services, e-hailing and private motor vehicles - operate at all times of the day, with limitations on vehicle capacity and stringent hygiene requirements		01.05- May 31, 2020 28.06-25.07.2021
Level 3: Moderate virus spread, with moderate readiness	Bus services, taxi services, e-hailing and private motor vehicles - operate at all times of the day, with limitations on vehicle capacity and stringent hygiene requirements Limited passenger rail restored, with stringent hygiene conditions in place Limited domestic air travel, with a restriction on the number of flights per day and authorisation based on the reason for travel		01.06-17.08.2020
Adjusted Level 3	No person can use, operate or perform any service on any form of public transport without wearing a face mask Public places and transport operators and systems to be serviced with hand sanitizers All land ports of entry of the Republic are closed, until February 15, 2021, including the ports of entry which were opened under Alert level 1, except for ports of entry designated and permitted for cross-border and international	Curfew from 21h00 to 06h00 daily unless exempted through a travel permit up until February 1, 2021 Curfew from 23h00 until 04h00 daily unless exempted through a travel permit from February 2, 2021	29.12-28.02.2021 16.06-27.06.2021 26.07-12.09.2021

Table 1 (continued)

Level	Transport Restrictions	Movement Restrictions	Dates of Lockdowns ^b
	travel and trade, as gazetted by Minister and in compliance with categories of goods, services and passengers allowed to transit		
Level 2: Moderate virus spread, with high readiness	Domestic air travel restored Car rental services restored	Movement between provinces at Level 1 and 2 restrictions	18.08-20.09.2020 31.05-15.06.2021* 13.09-30.09.2021*
Level 1: Low virus spread, high health system readiness	All modes of transport, with stringent hygiene conditions in place	Inter-provincial movement allowed, with restrictions on international travel	21 09-28.12.2020 01.03-30.05.2021* October 1, 2021*

^a Text in *italics* added by the authors of this paper.

^b Source: <https://www.gov.za/covid-19/about/about-alert-system>. Adjusted levels indicated with *, except for Level 3 which has its own row in the table. Source: Chakwizira, 2022.

affluent) environments, during the Covid-19 pandemic, even when controlling for baseline levels.

Duby et al. (2022) found that pre-existing inequalities in South Africa were exacerbated during the Covid-19 pandemic. Adolescent girls and young women were disproportionately impacted, due to a lack of access to appropriate technology and internet access (Duby et al., 2022). Furthermore, Duby et al. (2022) found that the Covid-19 restrictions also resulted in increased levels of stress and anxiety in adolescent girls and young women.

Not all individuals experienced increased levels of anxiety or stress. Higher income professionals, as well as individuals who were able to maintain physical distancing were less affected (Álvarez-Iglesias et al., 2021). Furthermore, older men undergoing cancer treatment did not reveal a significant change in anxiety (Irusen et al., 2021). This is interesting, as the sample group involved individuals with known risk factors for severe Covid-19. This indicates that the (mental) burden of Covid-19 is not only directly related to physical risk factors but can have strong socio-economic aspects as well.

Differences of Covid-19 on particular groups was also confirmed by Behrens and Newlands (2022) who predicted that the longer-term impacts in Sub-Saharan Africa are likely to reduce travel and accessibility for low-income households on the peripheral areas of cities and increase remote activity by white-collar workers.

In the next section, the research design of the data used in this survey is described.

3. Research method and case study introduction

Transport decisions are traditionally investigated through the paradigm of Utility Theory. Utility Theory, and variations, such as Expected Utility Theory, use approaches based on Classical Probability Theory (CPT). The assumptions of these models are that decision-makers are rational, logical, and utility maximisers.

However, humans are often not rational utility maximisers. Transport decisions are influenced by human aspects, such as habits, incomplete information, and uncertainties. Kahneman and Tversky (1979) famously illustrated that decisions do not adhere to the axioms of CPT. This resulted in the development of Prospect Theory as an alternative. However, Prospect Theory, and other similar theories, such as Regret Theory, do not change the fundamental axioms of CPT.

In more recent literature, Quantum Probability Theory (QPT) has been used as an alternative probability theory. QPT-related concepts and

structures allow for the outcomes that have been seen in human decisions (Pothos & Busemeyer, 2022). Such approaches are often referred to as ‘quantum-like’ (Facco & Fracas, 2022; Yearsley & Busemeyer, 2016). Quantum-like approaches offer novel application to generating knowledge that especially focuses on exploring decisions made under uncertainty or perceived risks.

A quantum-like approach is explored in the design of the surveys in this study through the inclusion of uncertainty. Decisions of ride-share services in Cape Town were identified as an appropriate transport decision area for such an investigation. Due to the increased flexibility of these transport service providers, ride-share service decisions were assumed to be more likely to be susceptible to flexible changes, as well as uncertainty and perceived personal safety risks. This makes ride-share service decisions in Cape Town a suitable investigation area for this research.

The uncertainty that is relevant to the scope of this paper includes the uncertainty around Covid-19, how vehicle access may influence uncertainties experienced, and how personal safety influences ride-share services involving uncertainty (‘at night’, ‘alone’, ‘alone at night’). Fig. 1 provides an overview of the relationships between the research factors included.

In the introduction and the literature review of this paper, the differences between how females and males experience transport decisions were discussed in connection to how individuals perceive their personal safety. As Fig. 1 shows this investigation proposes a bi-direction relationship between gender characteristics and perceptions of personal safety. This contributes to a state of ‘uncertainty’ in each individual. This paper investigates if this uncertainty could be influenced by the gender of the individual, Covid-19 (‘before’, ‘during’, ‘after’) or by the individual’s access, or lack thereof, to a private vehicle. This is then tested specifically in the perceptions of ride-share services involving uncertainty with regards to personal safety, namely taking ride-share service trips ‘at night’, ‘alone’ or ‘alone at night’. Statistically significant differences were tested using Pearson’s Chi-Square Test with a confidence level of 95% or $p < 0.05$.

Individuals needed to be able to recall their likely ride-share service decisions for trips ‘at night’, ‘alone’, ‘alone at night’ for ‘before’, ‘during’, ‘after Covid-19’. It was assumed that, due to the severe nature of the initial lockdowns of level 5 that the Covid-19 pandemic in South Africa, it could be argued to be a significant event as described by Beckett et al. (2001), Dex (1995), and Smith and Thomas (2003). Behrens and Del Mistro (2010) argue that significant events allow individuals to reliably recall travel behaviours. The reason given is that the recalled travel behaviour is connected to such significant or memorable events. Behrens and Del Mistro (2010) describe possible events as ‘life shocks’, examples given is of moving house, or a traumatic experience, as confirmed in the work by Müggengurg et al. (2015), Lanzendorf (2010), and Rau and Manton (2016). Considering the impacts of the level 5 lockdowns in South Africa, Covid-19, and the related consequences, it is argued to be such a significant event (life shock). Individuals are likely, and without uncertainty, able to reliably recall

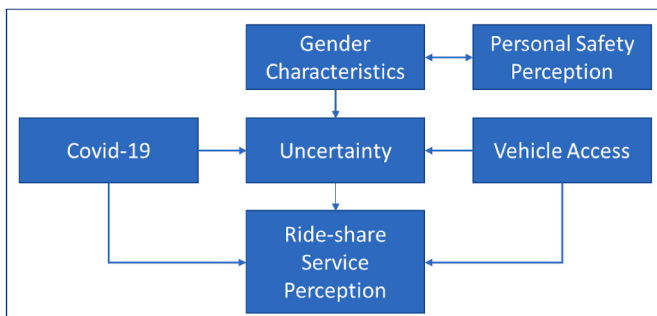


Fig. 1. Overview of the relationship between various research factors.

their most likely decisions in ‘before’, ‘during’ or ‘after’ Covid-19 framing of the questions.

The data for this study was collected amongst young adults in the case city Cape Town. Given the research topic, ride-share, computer literacy is required among respondents, as without computer literacy and access to the internet, using ride-share is not possible. As internet access is provided to all students by the University of Cape Town (UCT), methodological problems, such as under-coverage and self-selection, as discussed by Bethlehem (2010), do not present as issues. It was, therefore, deemed acceptable to action the data collection through two main online surveys, distributed to students at the UCT, in May 2021.

Participants of the main survey were randomly assigned to a survey, which focused on either ‘before Covid-19’ or ‘during Covid-19’. In the second online survey, ‘after Covid-19’ was investigated. The second survey was distributed independent of participation in Survey 1, two weeks after the first survey, to allow sufficient time, in case participants had participated previously, preventing the participants from clicking through the survey based on their memory recall. Two weeks was deemed sufficient time, based on research by Höhne (2021). The data from both surveys is the primary data used for the investigations in this paper. Individuals were asked a series of questions, including several travel related questions. At the end of the surveys, personal data of the participants, such as age, type of student/staff, faculty, and gender/sex, among other aspects were asked.

The survey was piloted on a small group of respondents, with detailed feedback from individuals who were representative of the target sample population. The ethics of the survey were reviewed by an expert, as well as the necessary ethical approval processes of the UCT. An incentive of a ‘lucky-draw’ was included to encourage participation in each survey. The value of the prize was a shopping voucher of R500, which is around US\$32.

4. Results and discussion

This section provides the results of this study. Fig. 2 provides the breakdown of the number of responses, their gender and whether they have access to a private vehicle. Duplicates and non-consent are excluded from the dataset. Individuals who selected ‘prefer not to say’ when asked about gender/sex are also excluded from this analysis, as this paper focuses on the differences and similarities between males and females. Similarly, individuals who identify as other than female or male were excluded, because the sample size was not large enough for any meaningful statistics. Individuals who said that they do not use ride-share services are also excluded from the investigation, as per identified methodology.

Just under half of the respondents (48.2%) have access to vehicles. As mentioned, individuals were always allocated to one either ‘before’, ‘during’ or ‘after’ Covid-19. The cleaned sample size of ‘before’, ‘during’ and ‘after’ Covid-19 are 911, 961, 985, respectively.

A confidence interval of 95% requires a sample size of 382 respondents. The male and female samples for access to a private vehicle and no access to a private vehicle all meet the 95% sample requirement

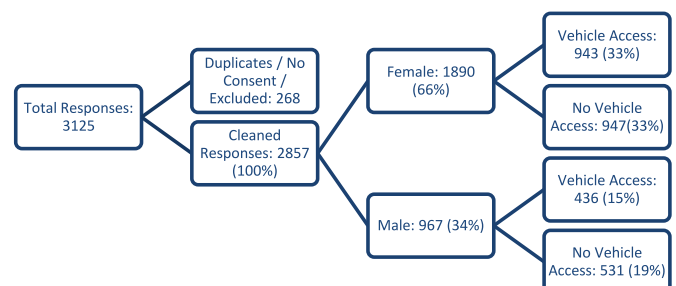


Fig. 2. Breakdown of responses in before, during and after Covid-19 surveys.

and are, therefore, representative of young adult males and females in Cape Town. The percentage split between females and males was 66% females and 34% males. The survey respondents are predominately female, which correlates with a high response from the humanities faculty, which is 69% female. The overall gender split at UCT is 54% female and 46% male (UCT, 2022). The percentage split between undergraduates and postgraduates in the survey was 76% and 24%, respectively, while the split between undergraduates and postgraduates at UCT is approximately 60% and 40%. Therefore, the undergraduates are over-represented in the survey by approximately 16%.

4.1. Perceptions of the impact of Covid-19 on overall travel/movement of individuals

The first item of interest is how respondents perceive the impact that Covid-19 had on their travel or movement around Cape Town. This is shown in Fig. 3.

Unsurprisingly, individuals with no access to private vehicles reported more impact on their movement than individuals with access, with 44.3% females and 39.7% males reporting change and only 26.2% and 32.4% of females and males reporting no change.

Statistically, the differences in the perceived impact of Covid-19 between females and males were significant with Pearson Chi-Square test ($p = 0.017$). When the data was split per gender, significant differences between individuals with and without access to a private vehicle were found in both females ($p < 0.001$) and males ($p = 0.004$).

4.2. Perceptions of crime in Cape Town before, during and after Covid-19

This section explores how different individuals (gender, access to private vehicle and 'before' or 'during' or 'after' Covid-19) perceived crime in an overall general manner at the time they were answering the focus questions explored in the next section. The aim of establishing what these perceptions were, was to better understand how the respondents felt about crime in Cape Town at this exact point in time, and if differences between individuals could be seen.

Respondents were asked if they considered crime in Cape Town to be low, average, or high. These levels of crime were chosen specifically to allow individuals to determine what they perceive as low, average, or high levels of crime, as tolerance levels of crime may be different. This helps frame the results of section 4.3.

When analysing the crime perception data in Cape Town, it is seen that access to a private vehicle and gender generate different crime perceptions. This is illustrated in Fig. 4, which shows, per gender and status of access to private vehicle, the responses to crime levels before, during and after Covid-19.

The overall perception of crime in Cape Town is generally very high, with roughly half (or more) of the groups indicating that they consider crime to be high. Students in Cape Town who consider crime to be low

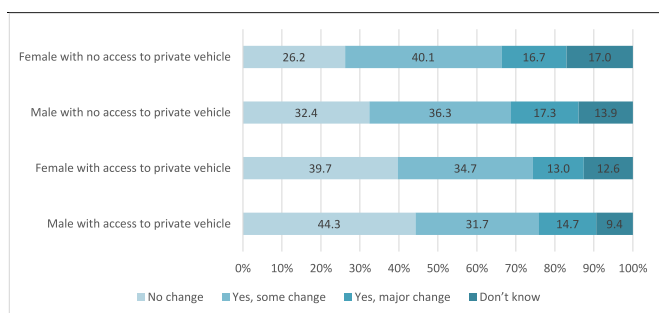


Fig. 3. Perceived impact of Covid-19 on individuals' movement around Cape Town (n (male with private vehicle access) = 436; m (female with private vehicle access) = 943; o (male with no access) = 531; p (female with no access) = 947).

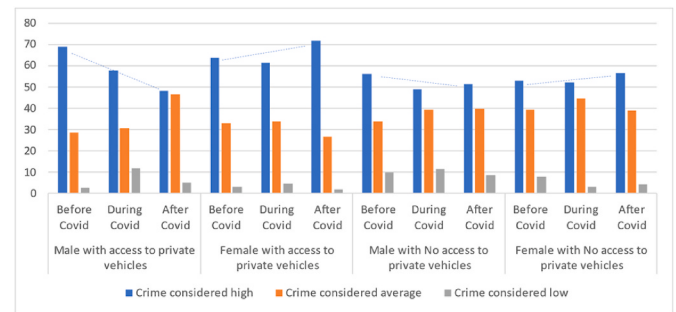


Fig. 4. Crime in Cape Town by gender with (no) access to private vehicle – before, during and after Covid-19 in percentage.

ranges from a mere 1,9% (females with access to private vehicles, after Covid-19) to 11,9% (males with access to private vehicles, during Covid-19). These low percentages of individuals, who considered crime to be low, indicate that crime is a major challenge to be overcome for all.

The difference between males and females with access to a private vehicle is astonishing. Male students with access to a private vehicle in Cape Town report a reduction in the perception that crime is high, as the Covid-19 pandemic unfolds ($p = 0.037$), while the percentage females with access to a private vehicle that perceive crime as high increases during and after Covid-19; however, the changes are not statistically significant ($p = 0.559$). So, while males were influenced by the framing of the question in 'before', 'during' or 'after' Covid-19, females were not significantly influenced in their perceptions of crime in Cape Town. Their higher uncertainty levels before Covid-19 may influence this.

Curiously, the different perspectives of females and males without access to a private vehicle do not differ much for those who think crime is high in Cape Town. Females without access to private vehicles, who consider crime to be high in Cape Town, range between 52,1% and 56,6% ($p = 0.274$) for 'before', 'during', 'after' Covid-19, while responses by their male counterparts for crime is high range between 49,1% and 56,3% ($p = 0.624$). Although the findings do not significantly change, this indicates that individuals without access to a private vehicle were not influenced in their perceptions of crime in Cape Town by the 'before', 'during' and 'after' Covid-19 context.

It is also noteworthy that females with access to private vehicles have a significantly higher perception of crime than females without access to private vehicles ($p = 0.001$), while for males access to a private vehicle was not significant ($p = 0.220$). This may imply two different insights.

1. Females with access to private vehicles use private vehicle trips as a measure to avoid crime.
2. Females with access to private vehicles have a more critical perception of crime in Cape Town than females without access to a private vehicle.

The responses in the voluntary open feedback sections of the survey suggest that, at least for a portion of the individuals, the first insight is true. If the second insight is true, then strategies specific for females with access to private vehicles, to increase multi-modal behaviour, may be necessary.

Perceptions are explored further, when reviewing the willingness to use ride-share services 'at night', 'alone' and 'alone at night', in the next section. At this point, the difference in how females and males, that have (no) access to private vehicles, change their travel options in 'before', 'during' and 'after' Covid-19, is highlighted.

4.3. Perceptions of personal safety when using ride-share in Cape Town

To gain insights into how individuals perceive their personal safety, in the context of using ride-share services, three questions were asked.

1. Would you be willing to use ride-share services **at night**, (before/during/after Covid-19) Covid-19?
2. Would you be willing to use ride-share services **alone**, (before/during/after Covid-19) Covid-19?
3. Would you be willing to use ride-share services **alone at night**, (before/during/after Covid-19) Covid-19?

The results of the first question are shown in Fig. 5. All groups have over 50% majority of the respondents willing to use ride-share services at night. Females have larger changes between 'before', 'during' and 'after' Covid-19, than their male counterparts.

Females with and without access to a private vehicle (Fig. 5) responded differently to this question in 'before', 'during' and 'after' Covid-19 (both females with and without access to a private vehicle with $p < 0.001$). Females with access to a private vehicle were likelier than females without access to a private vehicle to respond with 'no'. However, males with and without access to a private vehicle 'before', 'during' and 'after' Covid-19 did not seem to influence the perceptions of taking a ride-share trip at night between 'before', 'during', and 'after' Covid-19 with $p = 0.511$ and $p = 0.078$, respectively.

In Fig. 6, individuals were asked if they are willing to use ride-share services 'alone'. Females (with and without access to private vehicles) are, overall, less willing to use ride-share services by themselves, compared to males (with and without access to private vehicles) ($p < 0.001$).

Females with no access to private vehicles, however, are more willing to use ride-share services alone 'during' Covid-19 ($p = 0.007$), compared to 'before' or 'after' Covid-19 ($p = 0.512$ and $p = 0.049$, respectively). This may indicate that ride-share services, during Covid-19 for females without access to a private vehicle, are perceived to be less dangerous. This may be due to the reduced risk of Covid-19 transmissions, when using ride-share services, compared to public transport modes. During Covid-19, this benefit outweighs the personal safety concerns that are generally perceived by females when using ride-share services alone.

Most females, shown in Figs. 5 and 6, indicate that they are willing to use ride-share services either 'alone' or 'at night'. However, when both factors are combined, as shown in Fig. 7, the willingness to use ride-share services is substantially reduced. Firstly, for females with access to a private vehicle, the majority percentage is no longer related to being willing to use ride-share services. Rather, the majority of respondents refuse to use ride-share services. Furthermore, for both females with and without access to a private vehicle, the responses were significantly different between 'before', 'during' and 'after' Covid-19 ($p = 0.016$ and $p = 0.003$, respectively). These significant differences in the responses to taking a ride-share trip 'alone at night' was not seen in the responses of

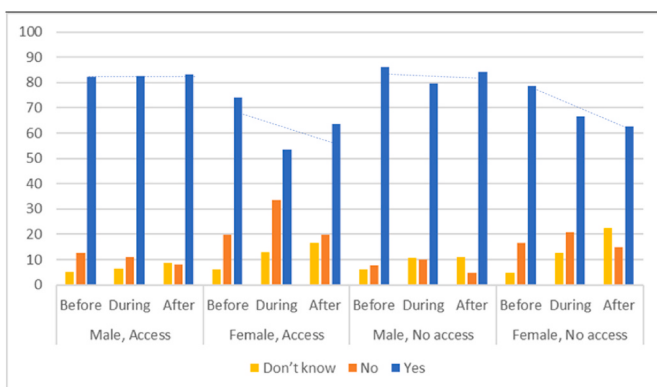


Fig. 5. 'Would you use ride-share services at night' for before, during, and after Covid-19 in percentage (n (male with private vehicle access) = 361); m (female with private vehicle access) = 751; o (male with no access) = 471; p (female with no access) = 881).

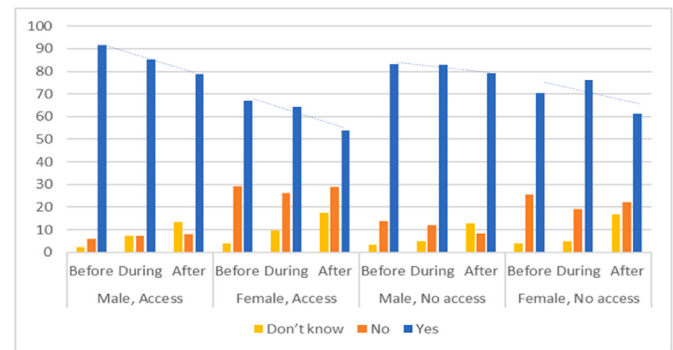


Fig. 6. 'Would you use ride-share services alone?' for before, during, and after Covid-19 in percentage (n (male with private vehicle access) = 361); m (female with private vehicle access) = 751; o (male with no access) = 471; p (female with no access) = 881).

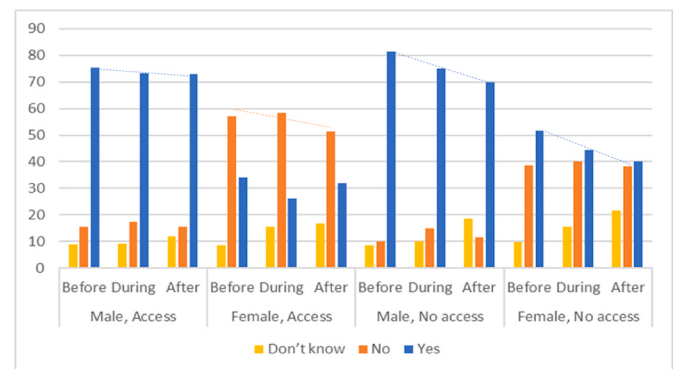


Fig. 7. 'Would you use ride-share services when you are alone at night?' for before, during, and after Covid-19 in percentage (n (male with private vehicle access) = 361); m (female with private vehicle access) = 751; o (male with no access) = 471; p (female with no access) = 881).

males with access to a private vehicle ($p = 0.844$), however, for males without access to a private vehicle, there was a significant difference between the responses to 'before', 'during' and 'after' Covid-19 ($p = 0.023$).

For males without access to a private vehicle, a significant difference for taking a trip 'alone at night' (see Fig. 7) between 'before', 'during' and 'after' Covid-19 was found with $p = 0.023$.

All groups, apart from females with access to private vehicle, show a decrease willingness to use ride-share services 'alone at night' across 'before', 'during' and 'after' Covid-19. Only an average of 30% of the females with access to private vehicle are willing to use ride-share services alone at night. This resistance to use ride-share services 'alone at night' can be seen in the contrasting results of females with no access to a private vehicle. Most females, without access to a private vehicle, are still willing to use ride-share services 'alone at night' in 'before', 'during' and 'after' Covid-19. However, the percentage of females with no access to a private vehicle who are no longer willing to use ride-share services increases to around 40%.

From the open feedback text of the surveys, many female respondents without access to a private vehicle indicate that they see ride-share services as their only possible option for transport, even though, at times, they did not feel safe while doing so. These respondents also indicate that, in such circumstances, they share their trip with friends or family, if possible, to manage their concerns. Male respondents also comment, in the open feedback, that they perceive less personal safety issues with making ride-share trips, because they are male and not female and, therefore, less likely to be attacked.

In Figs. 5, Figs. 6 and 7, it can be consistently seen that males without

access to a private vehicle are more willing to use ride-share services than females. This contrasts with some literature which shows that females were more willing to use ride-share services than males (Dong, 2020). This indicates that ride-share services can be perceived completely differently in varying local contexts. Ride-share services in Cape Town are, therefore, not exempt from concerns of personal safety, as previously seen in public transport modes (Vanderschuren et al., 2019). This is especially true for trips 'alone at night' as shown in Fig. 7.

Furthermore, this research shows that for females, the uncertainty associated with Covid-19 is not necessarily the highest for all ride-share trip decisions. For trips 'alone', females without access to a private vehicle were more willing ($p = 0.007$) than 'before' or 'after' Covid-19 to engage with ride-share services. Indicating that in transport uncertainty is not consistently increased or decreased across ride-share trips involving different personal safety uncertainties.

Interventions to reduce and prevent personal safety concerns, especially of females using ride-share services, can be implemented in several ways. Informed by the literature (Lane-Visser & Vanderschuren, 2022), some examples of different approaches, applicable to the ride-share app space, include:

- Surveillance and policing: digital interventions – surveillance cameras in vehicles or digital safety auditing tools,
- Education: campaigns and educational events – digital or printed campaigns on various forms of media or in transport vehicles; workshops and training for drivers of ride-share services about appropriate behaviour and positive masculinity,
- Physical implementations: ensuring vehicles of ride-share services do not have child-locks installed and window tinting is limited so that the interior is always visible from outside,
- Reporting of incidents and feedback: allow users to easily and quickly report incidents that are then investigated appropriately, and
- Company policies: clear zero-tolerance company policies on sexual harassment and related behaviour within ride-share app companies to bring accountability of drivers to the ride-share platforms.

Due to the unclear role that ride-share services currently have within transport policy in Cape Town and South Africa, the following policy and implementation recommendations are also proposed.

- Update transport frameworks and policies to include ride-share services as a mode of transport within transport policy and strategies.
 - Formulate frameworks, policies, and strategies to address the personal safety concerns of women using public transport and ride-share services.
- Improve personal safety for females, while undertaking public transport and ride-share trips to increase multi-modal use and decrease perceived necessity of private vehicle access, especially among females of the 'missing middle' and higher income groups. Frameworks, such as the one developed by EMPOWER, could be used to guide policymakers and stakeholders within ride-share services in their response strategies (Lane-Visser & Vanderschuren, 2022).
- Identify ride-share services within the transport network as having the potential to overcome safety concerns faster than public transport modes, especially in the short to medium term.
- However, additional measures and incentives are needed from both app platforms, as well as from policymakers, to increase perceived and actual personal safety, especially for females. Besides the examples given above, these may also include:
 - Criminal background checks on drivers to prevent repeat offenders.
 - Clear (official) identification of driver in vehicle. This could be in the form of some official identification that can be clearly seen by the passenger before entering the vehicle to ensure driver is the individual mentioned in app.

- Female ride-share app users' option to select female only drivers for trips, especially when alone and late at night. Checks and emergency features in app should also be included, to ensure safety of both drivers and passengers.

Concerns about personal safety in Cape Town are a societal challenge. It is unlikely to be completely resolved within the transport system, without improvements throughout the supporting institutions, such as legal, policing and prosecution, as well as cultural and societal changes in norms. However, as suggested, much more can be done and implemented to work towards improving the situation within ride-share services.

5. Conclusions

In this paper, the perceptions regarding ride-share services of individuals in Cape Town are investigated, focusing on personal safety and Covid-19 concerns.

From a crime perspective, the main differences identified are between those who have access to a private vehicle and those who do not. Females and males with no access to private vehicles perceive crime in a surprisingly similar way, when compared to the different perspectives of females and males with access to a private vehicle.

Substantial contrasts are found between the genders specific to ride-share trips. Here, differences for all females (with and without access to private vehicle), when compared to all males, suggest that the safety concerns that alter perceptions of taking a ride-share trip are linked to gender-based violence rather than to general crime perceptions. The differences between females and males are clear when one factor ('alone' or 'at night') is considered and exaggerated when travelling 'alone at night'. This insight is supported by the voluntary open feedback of both female and male individuals.

While addressing the high crime levels in Cape Town is outside of the scope of the transportation policies and strategies, there is significant room to increase measures within ride-share services to address the safety concerns related to these trips. A stronger policy focus on addressing the personal safety concerns of females within transport is needed from the City of Cape Town, at national level, and ideally a global level. One such example is to officially include ride-share apps within the transport policies and frameworks to adequately integrate the mode into the transport system. Furthermore, to formulate active and practical strategies using clear frameworks.

Commitment from ride-share service providers, to develop practical and effective implementations to improve the perceived and actual personal safety risks on these trips, is also required. Medium-term strategies of ride-share companies to address concerns may include increasing the number of female drivers available to females at night and providing sensitivity training for drivers to reduce incidents of sexual harassment through clear guidelines of appropriate behaviour. Furthermore, providing improved reporting and whistle-blower avenues is recommended. The latter needs to be underpinned by ride-share companies, enforcement and legal agency support, so that perpetrators are held accountable.

Measures that could be implemented immediately include increased requirements to improve background checks of drivers, before adding them to the ride-share service network. Furthermore, permanently disabling child-locks on the passenger and rear doors will ensure that passengers are not held against their will.

In conclusion, this paper, as well as earlier work, establishes that ride-share has the potential to meet a significant portion of the latent transport demand in Cape Town. To do so, in an equitable manner, gender-based violence issues need to be addressed. This paper provides initial guidance on the way forward. Further work is planned, not only regarding identifying additional gender-based violence measures, but also regarding the way uncertainty exacerbates perceived personal safety risks.

CRediT authorship contribution statement

Jennifer Louisa Baufeldt: Conceptualization, Methodology, Writing – original draft, Data curation. **Marianne Vanderschuren:** Writing – review & editing, Formal analysis, Visualization, Analysis and Visualization of Data, Supervision.

Declaration of competing interest

None.

Data availability

The data that has been used is confidential.

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