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Mobility Inequality of Disadvantaged Groups in Greater Cairo Region

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ABSTRACT

Mobility inequality in the Greater Cairo Region (GCR) affects disadvantaged groups of women, children and adolescents, elderly people, and persons with disabilities. These groups require inclusive mobility arrangements or protection on the streets. The research aims to explore the existing mobility inequality in GCR, through reviewing the trips of an introductory sample of disadvantaged groups and their transport choice. The paper reviews the concepts of mobility inequality, disadvantaged groups, and the United Nations standards of adequate urban mobility, which are utilized as a guide for the empirical study. The primary data collection applied two qualitative research methods, which are semi-structured interviews, and on-site trips/investigations of the urban mobility in GCR. Additionally, general figures on the target groups in GCR and Egypt are deployed as the secondary data. Subsequently, the research demonstrates a sample of the existing experiences of mobility inequality, local context realities, and consequential life compromises in GCR. The paper then aligns the priorities of the interviewed sample with their transport choices, which is the focus of the study. The investigated sample demonstrated high interest in car ownership, only to avoid challenges they encounter via walking and public transport, including issues like harassment and the inadequate, unsafe urban mobility experience. Finally, the paper suggests two sets of recommendations, the first set addresses the mobility inequality and proposed solutions as per the investigated sample. The second set incepts further research on mobility inequality, towards integrating the needs of the disadvantaged groups in GCR within the planning and delivering of urban mobility.

Index-words: *disadvantaged groups, mobility inequality, transport choice, urban mobility*

I. INTRODUCTION

Mobility is "*the ability to move freely or be easily moved*" (Cambridge Dictionary, n.d.). Such a brief and general definition of mobility associates the ability to move with the convenience of the environment/process to be easily moved within. This explains how the limitations within the urban context can restrain the mobility choices of many people in cities. This aligns with the period when cities expanded enormously into metropolitan areas; where millions of people commute every day and trips have become a long, crowded, costly, unpleasant, and unsafe experience for many inhabitants (Rodrigue *et al.*, 2013). Similarly, multiple disadvantages and exclusion acts occur that burden the mobility of many citizens. For instance, being a teenage girl who must walk every day to school in an unsafe area, or a child with visual impairment or a wheelchair for that matter (McConachie *et al.*, 2006).

Labelling individuals as disadvantaged seems subjective; however, the word "disadvantaged" refers to missing an aspect that others have. According to Merriam Webster dictionary, it was first used in 1893 to refer to the "*lacking in the basic resources or conditions (such as standard housing, medical and educational facilities, and civil rights) believed to be necessary for an equal position in society*" (Merriam-Webster, n.d.). The term "disadvantaged groups/populations" was coined by the United Nations in 1948 to refer to groups that are deprived of equal participation in life aspects. These groups usually encounter social, political, or economic barriers within their societies (Estes, 2014). Disadvantaged groups include children, the elderly, persons with disabilities (physical/mental/emotional), and women and indigenous groups (Estes, 2014; Social Protection & Human Rights, 2015). The term then developed to include other groups such as migrants, refugees, and ethnic minorities, as well as persons with chronic

infections such as HIV/AIDS (Estes, 2014).

As a result, the world realized the importance of equity and enabling all populations to connect and obtain various life opportunities and benefits. This led many cities to rethink and transform their masterplans (Tsavachidis and LePetit, 2022; Lopez, 2022); towards generating better sustainable and inclusive communities (Jones, 2014). However, many citizens until this day lack equal access to functional and adequate mobility. This state of mobility inequality prevents their acquisition of different educational, health, and other vital services (LERU, 2015). Many critical reviews are against traditional mobility planning because it realizes one prototype with standard capabilities, whereas variables such as age, gender, and physical abilities are ignored (Litman, 2003; Hidayati *et al.*, 2021). Thus, urban mobility is no longer rotated in the horizons of the vehicles industry, roads, and fuels (El-Sherif, 2020); but the concept of moving people or goods has developed into responsive and inclusive services (Schneider Electric, ARUP and The Climate Group, 2014).

This research focuses on the disadvantaged groups of women, children, adolescents, the elderly , and persons with disabilities; in which the existing mobility inequality across the city directly affects them (LERU, 2015). The study attempts to understand the forms of mobility inequality in GCR. Hence, the paper identifies issues as per the choices of transport modes of a sample of disadvantaged populations to commute in GCR. The paper's sections overview mobility inequality and disadvantaged groups and then review the United Nations standards of adequate mobility. Afterwards, the paper proceeds with illustrating methods adopted in the empirical study, then demonstrates the views of the interviewed sample of the target disadvantaged groups; to provide an introductory overview of mobility inequality in GCR.

II. LITERATURE REVIEW

The core of this section stands by the United Nations' value to "*Leave no one behind*"; which summarizes the SDGs and NUA[1] global agendas and rights such as adequate urban mobility.

A. *Mobility Inequality*

The role that mobility plays in our lives is elemental in obtaining services and transporting people and goods, while on the other side lies the projected disparity onto those persons with no/limited mobility choices, which ends up in their isolation (Litman, 2003). In 2022, only half of the world's urban population (51.6 percent) had convenient access to public transportation, with considerable regional differences (United Nations, 2022). Levels and intensity of the experienced inequality vary as per the different spatial and sociocultural contexts (Hidayati *et al.*, 2021). Hence, mobility inequality is highly context-dependent and is understood in its socio-spatial context. This premise aligns with Ferreira *et al.'s* conceptualization of mobility inequality to be analyzed as per two components of physical inaccessibility and socioeconomic disparity and its impacts (Ferreira *et al.*, 2012; Hidayati *et al.*, 2021).

The result is a state of mobility inequality that generates disadvantages for groups whose needs are not considered. Mobility inequality is described in the literature as a transport disadvantage, transport inequality, transport poverty, mobility justice, and transport justice (Hidayati *et al.*, 2021). The commonly recurrent terms when searching for attributes or causes to identify mobility inequality were transport disadvantage and transport poverty. Transport disadvantage looks at mobility inequality from a broader perspective that considers the geography of the land, the distribution of services and activities, health conditions, and socioeconomic status (Murray & Davis, 2001; Gasparovic, 2016). Alternatively, transport poverty refers to households and individuals who struggle or are unable to make the journeys that they need; subsequently, they fail to obtain their everyday needs. According to (Lucas et al., 2016) transport poverty is due to one or multiple

1 The United Nations has adopted outstanding agreements of:
- In 2015, Sustainable Development Goals (SDGs) were accepted by 193 nations. SDGs are 17 goals towards ending poverty, protecting the planet, and ensuring overall well-being for all (United Nations, 2015).
- The 2016 New Urban Agenda (NUA) was accepted by 167 nations and sets an updated global structure and guidelines for planning, managing, and living in cities (United Nations, 2017).

challenges within the provided urban mobility such as:

- Unavailability,
- Inaccessibility,
- Unaffordability,
- Inadequacy,
- and Timely inefficient.

Hence, mobility inequality is associated with the state of being disadvantaged and the impacts of social stigma and exclusion (Estes, 2014; Social Protection & Human Rights, 2015). However, the research focuses on the disadvantaged groups related to improving urban mobility and not discussing issues such as racism, marginalization, or conflicts. Consequently, the target disadvantaged groups in this research are identified as the four generic groups of women, children and adolescents, elderly people, and persons with disabilities; their suffering from moving around the city is a direct consequence of the urban mobility deficiencies (LERU, 2015; Hidayati *et al*, 2021).

Still, the focus of many references on mobility inequality is usually fragmented according to the institution's interest (Law Insider Inc., n.d.). For instance, if the interest is gender equality, the tackled issues would imply topics such as security against harassment and assaults (Viswanath, 2015; UN-Habitat, 2019; Ding, Loukaitou-Sideris *et al.*, 2020); while if the interest is persons with disabilities or elderly, the focus is more about ramps and accessible designs (WHO, 2017; United Nations, 2018; Azevedo *et al.*, 2021); while if the children's mobility is the scope, the subject would be the walking distance, safety, crossings and quality of sidewalks (Porter & Turner, 2019; ITDP, 2021; United Nations Environment Programme and United Nations Human Settlements Programme, 2022).

B. Equal Right to Adequate Urban Mobility

The United Nations led advocacy events and agendas towards equity and sustainability, included discussions on adequate urban mobility. One of the key direct references in this regard is SDG 11.2 which associates the right to urban mobility with safety, affordability, accessibility, and sustainability of the transport systems for all, and responding to the needs of women, children, persons with disabilities, and older persons (United Nations, 2015). Another example is the Habitat III New Urban Agenda which states the role of urban mobility to enhance the life opportunities and well-being of communities. Article 13 (f) stimulates cities and human settlements to apply age- and gender-responsive planning and investment towards sustainable, safe and accessible urban mobility for all (United Nations, 2017). Additionally, article 114 (a) provides further elaboration and steps towards such a vision by stating that associated urban mobility success with the "*increase in accessible, safe, efficient, affordable and sustainable infrastructure for public transport, as well as non-motorized options such as walking and cycling, prioritizing them over private motorized transportation*" (United Nations, 2017).

Reviewing the Global Mobility Report GMR[2]; it clustered the collective results of SUMP, SDGs, and NUA into four global objectives that are Universal access, Efficiency, Safety, and Green (SuM4All, 2017). Also, Egyptian research efforts to apply SDGs are revised; for instance, the parameters introduced in TADAMUN's[3] article on urban mobility, and the report of Transport for Cairo TFC[4] and Takween Integrated Communities Development TICD[5] on adequate urban mobility. TADAMUN identified six parameters matching the Egyptian context that are affordability, availability, accessibility, acceptability, safety, and sustainability (TADAMUN, 2016; TICD and TfC, 2017). Hence, the scope of the empirical study employs these holistic reviews on adequate urban mobility with a focus on NUA as it provides collective, recent, and global references among the other discussed studies (Table I).

2 The GMR was developed under the umbrella of the World Bank-led Sustainable Mobility for All global platform (SuM4All), in collaboration with other 55 influential public and private international organizations, from the United Kingdom and German Governments (The World Bank, 2020)

3 TADAMUN: The Cairo Urban Solidarity Initiative, develops tools to raise the profile of urban rights (TADAMUN, n.d.)

4 Transport for Cairo (TfC) is a strategic advisory practice in the domain of sustainable urban mobility (Transport for Cairo, n.d.)

5 Takween, an urban development company for architectural and urban design solutions (Takween ICD, 2020).

TABLE I
SAMPLE OF THE STANDARDS OF ADEQUATE URBAN MOBILITY AS AN EQUAL RIGHT FOR ALL

SDGs	NUA	GMR	TADAMUN
Safety	Accessible	Universal access	Affordability
Affordability	Safe	Efficiency	Availability
Accessibility	Efficient	Safety	Accessibility
Sustainability	Affordable	Green	Acceptability
	Sustainable		Safety
			Sustainability

Source: Illustration by the authors as stated by SDGS (United Nations, 2015), NUA (United Nations, 2017), GMR (SuM4All, 2017), TADAMUN (TADAMUN, 2016; TICD and TfC, 2017).

Accordingly, many international events pursued the endorsement of international agendas and discussed transforming the general standards into an associated list of laws, planning and design guidelines, policy and operational frameworks, and stakeholder mapping (United Nations, 2020).

C. *Synthesis and Gap*

This research tackles the literature gap in terms of the insufficient primary data on mobility inequality of the aforementioned four groups in Egypt. The reviewed body of published studies on mobility and transport studies in Egypt mainly focuses on:

- Quantitative perspective of measuring the trip duration and distance, or smart mobility and reducing carbon emissions.
- Investigating a certain transport mode, which does not apply to many citizens that shuffle between multiple modes across GCR.
- Upgrading and redesigning of certain zone or district, which are scattered studies that overlook the fact that travel pattern in GCR is associated with commuting across various districts at arrive to their destinations.

This demonstrated synthesis and gap analysis derived from the empirical study focuses on qualitative investigations and direct interaction tools such as semi-structured interviews (Creswell, 2007; Corbin & Strauss, 2015); which uncovers knowledge in this new study area. On another level, the study attempts to complement the fragmented views of literature and international agendas on mobility inequality that focus on the needs assessment of one group and one issue, for instance, women and sexual assaults in Egypt. Thus, this research recognizes that the union of the mobility inequality issues of the four groups of women, children and adolescents, elderly people, and persons with disabilities, would demonstrate an active call to consider their integral presence. Furthermore, it works to showcase the potential of formulating their needs into a set of applicable participatory recommendations/solutions.

III. METHODOLGY

Data collection for the empirical study followed a qualitative approach, it is subdivided into three main methods. The first method is semi-structured interviews with an introductory sample of the disadvantaged groups (primary data); whereas the researchers choose this particular method because:

- In-depth interviews provided trustful context to explain sensitive or embarrassing situations than written and numerical surveys.
- Direct communication with the interviewees allowed follow-up on many topics that revealed more details on their transport preferences and their travel behavior in addition to brainstorming of solutions that were brought up as discussions developed with other respondents.
- Unwillingness and inaccessibility of many participants to fill out surveys/ questionnaires.

This coincides with existing literature discussing the advantages of qualitative methodologies, and the advantages of conducting detailed semi-structured interviews, especially when focusing on groups with specific needs or unique behavior (Creswell, 2007; McNeeley, 2012). McNeeley explains that surveys on

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sensitive topics are problematic, because of the reluctance of target groups to participate in such surveys and discomfort to answer questions transparently due to embarrassment (2012).

The second method is conducting field visits via a sample of the different transport modes mentioned in the semi-structured interviews (primary data). The third method is reviewing data through desk research to obtain insights and figures on the target groups in Egypt and GCR (secondary data). The research analyzed the collected data in the findings section to identify inequality struggles across a sample of GCR trips and the associated transport modes.

A. Interview Design

The interviews were divided into six consolidative sections. The first section identified the general demographic information of the interviewees such as age, gender, marital status and number/ages of kids if applicable, type of disability if present, income, profession, literacy level, and car ownership. Besides, mapping their home as the origin point and their frequently visited destinations; while, measuring the time and distance of the routes of their frequent trips. The type of questions in this part were open-ended general questions.

The consequent five sections of the interview investigated urban inequality as per the NUA's five standards of adequate urban mobility which are accessibility, affordability, efficiency, safety, and sustainability. The five standards were subdivided in each section into a set of guiding indicators; to preserve the study focus within the mentioned situations by the interviewees. The types of questions in this part started with open-ended questions to encourage them to explain details of their city trips, for example, "How would you describe your everyday trip from your home to the metro station?" or "Why do you prefer using the metro instead of the microbus if both are available?". The open-ended questions tackled the five standards through starting topics inspired by their profile and information received in the first section. Also, the interview utilized yes/no questions for example, "Were you subjected to verbal/physical harassment or discrimination?" Or "Are you willing to shift from private car to public transport if available and accessible?"

The researchers then followed up on their answers through examples-type questions to validate their general responses. Questions in this regard investigated real situations and pursued further understanding of the context and types of barriers whether physical, social, economic, administrative, or technological. Hence, their mentioned needs were further discussed in terms of many analysis layers of urban context, timing, and individuality aspects; to differentiate between repeated situations and the one-time situations in the received responses.

B. Sample Size and Selection

Usually, the sampling size in qualitative studies is different than in quantitative studies, as the sample size is smaller to manage the detailed layers of the received narratives and extracted material. Sample size in qualitative research should be only sufficient to produce a new and richly textured understanding of the investigated experience (Fugard & Potts, 2015), which is subjective and identified as per the research focus and goal (Fugard & Potts, 2015; Creswell & Clark, 2017). Thus, this paper selected a controlled sample size, which allowed the authors to tackle further details regarding their mobility biographies. The research studied trips of an introductory sample of 31 interviewees who belonged to one or more of the four target groups. Some interviewees represented intersectional cases such as a child with a disability, which are counted once (per one group), and additional data are noted in the other group (see Table II). The research adopted the snowball sample selection where many respondents nominated each other. The included sample doesn't necessarily live in the same district, and if they coincidently lived in the same district they do not commute to the same destinations or via the same transport modes.

TABLE II
SAMPLE SIZE AND THEIR GENERAL CHARACTERISTICS

Group	No. respondents	Ages	Notes
Women	10	20-46	Supplementary data from other groups • Women at age above 60 are 3 • Girls aged less than 18 are 4 • Women with Disabilities are 3
Children/ Adolescents	7	5-17	Supplementary data from other groups • 1 Child with Disability
Elderly People	5	64-71	Supplementary data from other groups • 1 Person with Disability
Persons with Disabilities	9	5-66	The interview with the guardian (mother) of the 5-year-old child with a disability revealed the disadvantaged status of representing women with no private car and having two children (one with physical impairment).

Source: the authors

Although this number does not indicate a full representation of all disadvantaged groups in GCR, the characteristics of the selected sample covered a variety of ages, physical abilities, gender, and socio-economic levels (see Table II). It also fulfilled the average number of qualitative interviews as agreed upon through the body of literature to range between 20 and 30 (Creswell & Clark, 2017; Deterding & Waters, 2018). The number of respondents in each group was based on the concept of data saturation[6] that continues to bring new participants until data replication or redundancy occurred. The selection of the included interviewees considered the diversity in the location of the origin point (home) to cover several districts in the three governorates composing the GCR which are Cairo, Giza, and al-Qalyubiyya.

C. *Observatory Trips*

This method is utilized to provide supporting and validation research (Gray, 2022) . It examined the received explanations behind the respondents' preferences, besides whether the interviewees missed grasping or expressing any details. In this respect, the research planned and applied 35 field trips at different times across GCR that involved transect walks and riding many of the mentioned transport modes such as microbuses, buses, minibuses, metro (3 lines), tuk-tuk, taxis, uber and similar applications, SWVL, private car. The full urban context was observed (human behaviors, built environment and street conditions, transport modes, and riding practices), whereas different sorts of inadequacy incidents were noted. This contributed to obtaining a comprehensive picture of the urban context in different neighborhoods.

D. *Desk Research*

The secondary data collection implemented desk research of fact sheets and official data across the Egyptian websites of the Ministry of Transportation and the Central Agency for Public Mobilization and Statistics CAPMAS. Similarly, the research investigated officials' interviews and governmental statements and figures in official Egyptian newspapers such as Al-Ahram. On another side, the desk research examined 30+ published academic references as well as reports of Egyptian-International joint mobility development projects[7].

IV. RESULTS

This section introduces the results of the desk research and empirical study on the transport mode preferences of the interviewed sample. It continues then to demonstrate interpretations in alignment with the notions of mobility inequality and urban mobility standards.

6 It was developed for grounded theory studies but is applicable to all qualitative research that employs interviews as the primary data source. Hence, the estimation of the adequate size in this research was based on saturation (Bowen, 2008; Marshall *et al*, 2013; Creswell & Clark, 2017).

7 For instance, studies that were conducted through cooperations between credible international agencies such as UN or the German Agency for International Cooperation GIZ, the Egyptian government, and local urban and transport offices/labs in Egypt.

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A. GCR Context: Insights

Overviewing the situation in GCR, thousands of people commute every day internally or from other governorates[8], pursuing work or services in governmental agencies and major hospitals (Cairo Metro, n.d.). These massive trips in GCR create a pressuring demand for mobility and infrastructure (TICD, TfC, 2017). The current metro services transport up to 2.5 million passengers per day (Cairo Metro, n.d.), which is expected by the Egyptian government to increase to reach 3.5 million passengers after the completion of the in-progress stations (Soliman, 2022). Also, in 2020, around 3% of passengers traveled in CTA buses, while 74% traveled using microbuses that expanded to connect the city and fill the supply gap (Hegazy and Women For Justice, 2022). At the same time, there are attempts to initiate projects towards smart and environmentally sustainable urban mobility such as the Cairo Bike project (Sami, 2022), the production of Egyptian electric cars (SIS, 2023), Cairo Monorail (Railway Technology, 2019), and more projects that implied the expansions of metro and public transit lines. Yet, most of the projects are recent, or still in progress. As a result, there are no available published evaluations indicating the impacts on improving urban mobility in GCR.

Population counts and demographics of the four target groups indicate their existence not as a minority but more of an integral part of the society structure. For instance, results based on Egyptian official statistics in 2017 and updated reports in the following years, which are released by the Central Agency for Public Mobilization and Statistics CAPMAS show that:

- There are 45.9 million women in Egypt, representing nearly half of the population. Their contribution to the workforce was 15.6% of the total workforce (15+ years), which is a relatively small share compared to 67.3% for men. Still, the percentage of female-headed households reached 18.1% (CAPMAS, 2020).
- Persons with Disabilities that are 5+ years old represent 10.6 % of the population and are given only a quota of 5% in a few services and jobs (CAPMAS, 2020).
- The total number of Egyptian children (under 18 years) is about 38 million children, representing 40% of the total population in the census 2017 (CAPMAS, 2017).
- The number of elderly persons reached about 6.8 million which represents 6.7% of the total population and is expected to increase to 7.9% in 2052 (CAPMAS, 2021).

Mostly, literature targeting mobility inequality is concerned with women, in addition to a few scattered studies to promote active mobility for children. For instance, the research utilized updated results by the Institute for Transport and Development Policy (ITDP) that conducted a survey for 2500 female respondents in Cairo. The study revealed that the majority spend 2+ hours on public transport for daily commutes, in addition to enduring safety and harassment problems (ITDP, 2023). According to the study, more than 80% experienced harassment, and 35% referred to Cairo Transport Authority (CTA) buses as the least secure due to overcrowding (ITDP, 2023). More than 60% reported incidents of physical harassment, besides, the more respondents who reported verbal harassment (ITDP, 2023). Another interesting study that this paper builds on, examined the independent mobility of children in six schools in Heliopolis, one of Cairo districts. The study revealed that 30% commute to school by public transport, and 42% by a small van/private bus (Shafik *et al*, 2021). Also, 69% of the surveyed children expressed anxiety about crossing streets (Shafik *et al*, 2021).

Regarding the other two groups of elderly people and persons with disabilities, there are no significant quantitative or qualitative studies that address their mobility inequality in Egypt. However, there are multiple attempts by civil society organizations (e.g. Helm Foundation); towards improving accessibility for persons with disabilities in Egypt. Projects that target installing ramps and tactile tiles for visual impairment and similar initiatives are still in

8 GCR is the biggest in Arab countries in terms of inhabitants and surface area. it's the seventh globally in terms of population (20+ million, est. 2020), which is 20+ % of the total population of Egypt. (Cairo Metro, n.d.)

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the early stages and are not supported by sufficient national plans or academic research.

B. The Revealed Main Transport Choices

The combination of gender, age, ability, and income level in correspondence to their main transport options is demonstrated in Table III.

TABLE III
DEMONSTRATION OF INTERVIEWEES' DEMOGRAPHICS AND THEIR MAIN TRANSPORT OPTIONS

			Disadvantaged group				Income			Main Transport
Code	Gender	Age	Women	Children/ Adoles-cents	Elderly people	Persons Disabilities	Low	Middle	High	
IW1	Female	33	■					■		Minibus
IW2	Female	41	■				■			Minibus/ Microbus
IW3	Female	31	■						■	Car
IW4	Female	46	■				■			Bus/ Minibus
IW5	Female	20	■					■		Minibus/Uber
IW6	Female	25	■					■		Uber
IW7	Female	37	■						■	Car
IW8	Female	36	■						■	Car/ Uber or in drive
IW9	Female	40	■					■		Minibus/ Microbus
IW10	Female	43	■				■			Microbus/Metro
IA1	Male	12		■					■	Car
IA2	Female	12		■				■		Car
IA3	Male	11		■				■		Car
IA4	Male	14		■				■		Car
IA5	Female	16		■			■			Walking
IA6	Female	17		■			■			Walking/ Microbus
IA7	Female	15		■			■			Walking/ Microbus
IE1	Male	67			■			■		Car/ Metro
IE2	Female	64			■				■	Car
IE3	Female	65			■			■		Walking/ Taxi
IE4	Female	71			■			■		Microbus/ Metro
IE5	Male	68			■			■		Car/ Taxi
IPD1	Female	35				■	■			Metro/ Walking
IPD2	Female	25				■		■		Uber/ Car
IPD3	Male	22				■		■		Car/ Microbus
IPD4	Male	31				■		■		Uber/ Walking
IPD5	Male	42				■		■		Car (Special)
IPD6	Male	5				■		■		Uber
IPD7	Female	27				■		■		Uber
IPD8	Male	35				■	■			Motorcycle
IPD9	Male	66				■	■			Microbus/ Minibus

Source: Prepared by the authors

C. Factors Influencing Transport Choices

These findings correlate the decision of selecting transportation with the demographic profile and physical abilities of the interviewees; in which their choices of transport mode serve their specific needs and responsibilities.

Car: All groups' representatives with high income (IW3, IW7, IW8, IA1, IE2) prefer using cars that represent to them privacy, safety, accessibility, and timesaving. Also, they agreed that the lack of adequate walking infrastructure for the first/last mile underlies this transport choice. For example, walking in New Cairo involves crossing high-speed streets or walking long distances to reach the nearest transportation station. Another point of view that favors cars was mentioned by one of the persons with disabilities (IPD5), in which he used to shuffle between three transport modes for his homework trip every day. He bought a car that is customized for special needs, to avoid encountering the inaccessibility and exhaustion in public transport. He expressed his preference for using his car; despite it not being the most financially viable choice, as it consumes around 40% of his monthly income, not to mention the initial purchase cost.

Walking: It was mentioned as the first choice for interviewees living in areas of downtown, historic Cairo, and Shubra, where these areas represent old and compact districts in Cairo. Thus, walking is highly associated with central areas of old Cairo that were planned essentially as livable and dense areas. Interviewee (IE3) explained that as an elderly person, she appreciates the diverse blend of mixed land uses and the proximity of different services and activities along the streets. Also, all girls under 18 years old (IA5, IA6, IA7) walk to their school for around 20 minutes and agree that walking is the most economical and realistic option. However, on the other side, the three girls mentioned that they encounter verbal harassment and sexual assaults on a daily basis. Moreover, the interviewee (IA7) is subjected to safety hazards as she walks across a railway separating her neighborhood from her school. She explained that she and the majority of her neighbors opt for this to avoid the pedestrian bridges, which have become unsafe spots due to the presence of criminals and drug addicts.

All elderly people and persons with disabilities repeatedly noted that walking becomes an unpleasant choice for them. This is due to the lack of adequate space for pedestrian movement on the streets; for instance, the sidewalks are occupied by shop expansions or parked cars. Similarly, they mentioned that sidewalks are too crowded in commercial and mixed-use streets; in which they get physically knocked by others. They encounter difficulties as well due to the uneven surfaces of the sidewalks, leading to incidents of tripping and falling. Besides the height of the sidewalks (many cases 30-40 cm high) and the absence of ramps or handrails for assistance multiply their challenges. These two groups in particular expressed dissatisfaction with the lack or inaccessible pedestrian bridges and tunnels;, they endure risks of crossing the high-speed street instead of the painful experience of climbing stairs. On another note, a common issue (20/31 respondents) was being afraid of stray dogs, which was raised coincidentally without being in the questions list.

Minibuses and Buses: They are preferred by the sample of women who belong to middle and low-income economic classes (IW1, IW2, IW4, IW5, IW9). They find them available, affordable, and relatively safe methods of navigating the city. Interviewees from middle-income group prefer a newly introduced type of buses, which are more expensive but air-conditioned (cost is 1.5 and 2.5 times the basic bus fare). Also, these new buses have distinctive lines that connect long-distance trips. However, the arrival of these new buses is not frequent; also at rush hours, the trips take longer times because of the many scattered stops on the route.

Altogether, elderly people and persons with disabilities stated that they avoided minibuses and buses because of several reasons: the necessity to climb stairs for boarding, the lack of designated seats for people with special needs, and if available, passengers refuse to offer them to sit. Additionally, they echoed the concerns of children and adolescents regarding the hazardous experience of departing the vehicle,

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which is dangerous, as drivers tend to slow down without stopping, leading passengers to jump out.

Metro: It was mentioned as one of the primary choices by four interviewees, for example, the respondent (IW10) has no faster option during rush hours to reach her work (one hour away from her home) except shuffling between metro lines. Similarly, the interviewee (IE4) depends on the metro occasionally if she is running late. While the interviewee (IE1) uses the metro as a park-and-ride system to go downtown, he only rides the third line as it is air-conditioned. This option allowed him to access one of his favorite destinations regularly and without worrying about where to park his car or enduring traffic jams. The only person with a disability who rides the metro is (IPD1). She depends on the metro to access all GCR. However, she has a mobility impairment in one hand and one leg and she suffers to climb the enormous number of stairs to cross between platforms as not all stations are equipped with escalators and elevators. This painful experience coincides with the avoidance of other persons with disabilities to use the metro as a transport choice; in which some of them memorize the number of stairs that they had to climb in pain in order to exit a station or cross to the other side.

Microbuses: This transport choice was favored by IW2, IW9, IW10, IA6, IA7, IE4, IPD3, IPD9. They favor microbuses for their availability and connectivity to many destinations across GCR. Sometimes they shuffle between two or three microbuses or mix with other transportation modes. However, all the interviewed sample who ride microbuses agreed that they get scared by the drivers' attitudes such as rushing the riders, keeping the remaining change money, heavily smoking or allowing others to smoke, speeding and fear of road accidents, and aggressive behaviors and engaging in fights with other passengers or drivers on the streets. Like buses and minibuses, many persons with disabilities avoid riding microbuses due to the vehicle's height and narrow spaces for maneuvering inside.

Motorcycle: Mentioned by one case only (IPD8) who is a wheelchair user. He explained that it is convenient for short distances, yet he rides a taxi or UBER if commuting for long routes or riding with his family.

Taxis/ Ride hailing such as Uber: All these transport choices marked incidents of harassment by women between the ages of 20 and 40. All passengers of this transport choice including other riders with disabilities expressed concerns about the significant expenses, which account for 30-40% of their monthly income, representing a substantial financial burden for accessibility.

Tuk-tuk: It was mentioned in the scale of micro-mobility to usually access the nearest public transport in low-income neighborhoods. The respondents who use it mentioned it is relatively high-cost that can be substituted by 10-15 minutes of walking. Correspondingly, they all agreed that they prefer to avoid the tuk-tuk drivers, who are commonly underage, reckless, or drug addicts.

Bicycle: None of the interviewees used bicycles except (IA5) who uses it occasionally if with her sister. Mainly all youth and children and adolescents' group at ages between 10 and 20, referred to their wishes to cycle more. Nevertheless, they emphasized that they cannot compromise their safety in the absence of bicycle lanes, not provided right of the way nor adequate space adjacent to sidewalks. Riding a bicycle under such circumstances can become deadly dangerous.

SWVL and Uber bus: They are not mentioned by any of the respondents. When the researchers introduced and explained such choices, the low-income respondents replied with their discomfort to the relatively higher cost as compared to similar transport modes such as microbuses. Also, the elderly persons stated that they are not comfortable to book through mobile applications. While two women respondents who tried SWVL (IW1, IW6) agreed that they do not prefer it anymore. Both stated that that if they missed the arrival time by one minute; they lost the full ticket price.

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A. Interpretations and Discussions

In reference to the semi-structured interviews' findings, field observations, and desk reviews, the mobility inequality characteristics of different transport modes show that:

- Walking/Cycling implies negative probabilities of harassment, road accidents, and inaccessibility (physical/ visual).
- Public Transport (Roads such as buses or rail such as subway) causes diverse struggles such as harassment, unreliable times of arrival, inaccessibility (physical/ visual), and drivers' negative and offending behaviors.
- Cars are inaccessible for many types of disabilities and younger ages, more expensive than other modes, and hold risks of road accidents.
- Taxis/ Ride hailing is reported by many women in Egypt for harassment, also not preferred as a more expensive option than other modes.
- Motorcycle riders are commonly exposed to road accidents, besides barriers such as the inaccessibility (physical/ visual), and cultural barriers for women in some areas.

There is an obvious overlap between many of the urban mobility issues that are endured by the target disadvantaged groups, however, each individual/ group reacts in a different way. One common thing is that the suffering of the four groups has limited their transport modes to certain choices that are not necessarily adequate. Thus, Table IV reviews the best and least transport preferences for the interviewed sample and the key urban mobility standard that contributed to this decision.

TABLE IV
PREFERNCES OF TRANSPORT MODE BY THE INTERVIEWED SAMPLE

NUA Standards	High Preferences	Less Preferences
Accessible	Car, Uber	Minibus, Bus
Affordable	Walking, Minibus, Metro, Microbus	Car, Uber
Efficient (Time)	Walking, Metro, Car	Minibus, Bus
Safe	Metro, Car	Walking, Uber, Bicycle
Sustainable	Walking, Metro, Bicycle	Car, Uber

Source: Prepared by the authors, the indicators column is based on the NUA standards.

B. Limitations and Recommendations

The study encountered limitations in the desk research due to the scarcity of published research and data on the urban mobility of disadvantaged groups in Egypt. Also, some studies are conducted for specific areas or per each group solely in GCR which still does not provide sufficient comprehension of the current situation. Thus, this paper depended on qualitative approaches and in depth semi-structured interviews to address this new area of research, while building on quantitative figures from previous literature even if based on a single-transport mode or examines single neighborhood or district. As a result, the recommendations of this study are divided into two sets,

- the first set is the direct results from the empirical study and as per the travel behavior of the examined sample.
- the second set postulates a thread of integrated academic studies towards future research and actionable projects; to mitigate mobility inequality in GCR.

As a result of the empirical study, the researcher suggests applying:

- Accessibility and universal design standards should be enforced by law in the streets and sidewalk design, stations, and vehicle design.
- Supervision and awareness of drivers to respect and consider the conditions of different disabilities.
- Promotion of walking and cycling should be associated with strict land use plans, feasible travel distances, and infrastructure alignment.

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- Pedestrian bridges and tunnels require strict monitoring to become safer and to have elevators and escalators accessible.
- Provision of various public transport lines to include short routes and long routes that connect downtown with new urban communities. Some of them should have direct lines and fewer stops to become time-efficient.
- Provision of nearby shuffle transportation to main transportation hubs to improve the experience of the first/last miles with affordable prices or an inclusive ticketing system.
- Carpooling applications should be developed and promoted and should consider safety and security measures to encourage their use by the target groups.

Regarding the proposed future research opportunities, the research underscores the lack of coordination between urban land use planning, street network design, and the provision of transportation services. Hence, it emphasizes the necessity to conduct inclusive needs assessment studies on the existing urban mobility which focus on the sustainable urban mobility approaches rather than the rigid transport planning approaches. Hence, urban mobility and equality are not only calculated by time and distance, but also through human interaction, emotions, sense of safety, social engagement, and humanity. Also, GCR is a complex setting where around 20 million people mostly commute every day which requires:

- Studying this metropolitan region holistically within long term official research projects and integrate with independent academic studies.
- conducting auxiliary research towards the evolution of participatory methods, generating geographic interactive maps and crowdsourcing data collection tools.
- Increasing the outreach of academic researchers and accessing a diverse spectrum of these disadvantaged populations through qualitative studies building on quantitative and statistical studies, and vice-versa.

C. Conclusion

The mobility networks and infrastructure in GCR advance the vehicular connectivity of the region; and do not necessarily consider the accessibility specifications of those vehicles, or the diverse needs of the passengers. Furthermore, walking becomes an unsafe or painful experience for many populations in GCR due to inadequate street designs, inappropriate behaviours, and lack of safety and security measures. Hence, the empirical study investigated the factors influencing transport choices for an exploratory sample of the target groups. The majority of the respondents either preferred their cars or wished they could afford cars to avoid the existing mobility inequality. Similarly, the majority of the interviewed sample, regardless of their abilities, economic status, and age, expressed their willingness to walk more (average 10-20 minutes) if the streets were better designed with sidewalks that have sufficient widths, and safely connected across their neighborhoods; besides supervising and mitigating the inappropriate attitudes and verbal assaults against women and young girls. In conclusion, this study pinpoints the importance of including the needs and voices of women, children and adolescents, elderly people, and persons with disabilities within the intricate local context of GCR. The researchers suggest future surveys, in order to quantify the identified issues. This should be composed of database generation, statistical analysis, and geographic mapping of barriers and solutions across the trips of target groups. Also, this paper strongly suggests involving the actors responsible for planning and delivering urban mobility in GCR as an integral partner in the research process. Hence, investigating coordination and implementation opportunities to provide a more inclusive and equitable city experience for all.

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