

DAILY MOBILITY BY GENDER: AN ANALYSIS OF DIFFERENCES IN MOBILITY PRACTICES IN THE MUNICIPALITY OF BABA HASSEN, SOUTHWEST ALGIERS

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Abstract: This paper examines the transformations of residents' daily mobility practices induced by urban sprawl in peripheral municipalities, a phenomenon that has modified housing types, lifestyles and travel behaviours. The study analyses mobility practices according to gender, and focuses on several dimensions, namely: modal choices, reasons for travel, distances travelled, journey times and destinations. Advanced statistical analyses were performed (Chi square, and Kruskal-Wallis, tests). Exploring a quantitative field survey of 517 households collected from the municipality of Baba Hassen, chosen as a case study in Algeria's capital (Algiers). The findings reveal that men, women, and children adopt distinct mobility behaviours that are influenced by gender roles and specific constraints of urban space. The results also show that urban sprawl has a major impact on mobility behaviours, with considerable differences depending on gender. Men, women, boys, and girls make diverse trips in terms of reasons (work, studies, care, shopping, visits, sports and leisure) located outside the municipality, with a predominance of the car as the primary mode of transportation and varying lengths and duration. These variations underscore the importance of designing mobility policies that may address the individual demands of each group while limiting the negative consequences of urban sprawl and offering sustainable solutions to improve transportation means and travel conditions. The paper concludes with policy recommendations and avenues for comparative and longitudinal research.

Keywords: daily mobility, gender, urban sprawl, household travel survey, distance travelled, journey time, destination, Chi square test, Kruskal-Wallis test, Baba Hassen, Algiers

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INTRODUCTION

The spatial organization of cities has undergone a profound transformation, moving from a compact and pedestrian model to cities that continue to expand, centered on the automobile (Van de Walle & Rivoire, 2005). This phenomenon is manifested by an accelerated urban expansion, often associated with an uncontrolled and anarchic urbanization of built-up areas in rural areas (Ngapgue, 2014). Urban sprawl refers to an excessive spatial growth of agglomerations, disrupting territorial balances (Simard, 2014). It results in the progressive transformation of agricultural land into urbanized areas (Lecoq, 2004). Furthermore, leading to a depopulation of city centres towards peri-urban areas (Aguéjdad, 2009; Ritchot et al., 1994), this phenomenon is observed in particular in the municipalities forming the second peri-urban area (Fabriès-Verfaillie & Stragiotti, 2000). Initially, the development of suburbs was encouraged by public policies in order to facilitate access to private property (Bachiri & Després, 2008). However, the situation has become complicated, some peripheral areas are now facing infrastructure deficiencies, service difficulties and increasing precariousness of their inhabitants (Rebouha & Pochet, 2009). Moreover, a growing proportion of inhabitants would therefore find themselves far from the main employment areas and forced to make increasingly long journeys (Paquette, 2010). The dispersed and sparsely populated morphology of contemporary cities reinforces the need for motorized travel (García-Palomares, 2010), the desire for a detached house, identified as a key factor in the lengthening of commutes (Berger, 1999), is coupled with a paradox: living in poorly equipped and sparsely populated areas doubles, or even triples, the duration of journeys (Wiel, 2010).

Like other countries, Algerian cities, particularly the capital Algiers, have not been immune to the phenomenon of uncontrolled urban sprawl, which has resulted in a slew of issues such as territorial and spatial dispersion, socioeconomic inequality, agricultural land consumption, and long commutes. Algiers is experiencing rapid urbanization as a result of the rural exodus (Abbas et al., 2023). Following independence and the centre's demographic boom, given the concentration in the central agglomeration of 53% of employment and 28% of the city's population (Baouni et al., 2013). This exacerbates

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the conditions of saturation and asphyxiation in the centre, and has resulted in another major upheaval of these core municipalities in the shape of urban sprawl (de-densification) towards the peripheral municipalities, in order to supply and respond to the housing needs of the already saturated central districts. The spread of the agglomeration to the east is linked to improved road infrastructure, whereas to the south-west is owing to land availability, as in the case of our study, the municipalities of Baba Hassen. According to the 2008 national survey, 72.61% of the population of Algiers lives in the city's outskirts (ONS, RGPH 2008). In addition, the capital employs one-third of the country's workers.

These peripheral municipalities responded to the demand for expansion, but this resulted in uncontrolled peri-urbanization (Belhai-Benazzouz & Djelal, 2010), as well as places that were underserved by required support facilities (with the exception of educational facilities), resulting in "dormitory towns." This centrifugal urban dynamic has consequences in terms of daily mobility (Paquette, 2010), they have led to increasingly important needs in terms of travel, a considerable increase in distances, commuter migrations between the place of residence and the employment area, inequalities in infrastructure, increased traffic congestion and an insufficient road network (Chelabi, 2025).

In this context, B.E.T.U.R / E.M.A–C.E.N.E.A.P. (2004) showed that every day 4,757,838 people travel in the Algiers metropolitan area (i.e. 1.69 trips per day for all modes combined), including 2,653,391 on foot, i.e. 56% (with a mobility of 0.94) and 2,104,448 in motorized mode, i.e. 44%, (with a mobility of 0.75). (Motorized travel is represented by public transport: 64%, passenger vehicles: 30%, taxis: 4.5%, and others: 1.5%) and the modal share of cars is 83 vehicles/1000 inhabitants. Due to the intense mobility of the population accompanied by a very rapid growth of the vehicle fleet, the city of Algiers recorded a significant increase of 2.54 times over 20 years, it went from 628,093 vehicles in 2000 to 1,150,077 vehicles in December 2010, (ONS, 2011), an increase of 58%, to then reach 1,596,834 vehicles in December 2019, (Transport Directorate of the city of Algiers, 2019) i.e. an increase of 67%. This paper presents the results of the household survey on mobility practices carried out by individuals in the municipality of Baba Hassen (Algiers).

To achieve this aim, the appropriate statistical tests linking the different analysis variables were explored to determine which are the most significant. The results of this analysis will be used to understand mobility behaviours according to gender in order to find suitable solutions for better mobility. In this regard, some major questions are raised in this article:

1. Are there significant gender differences in mobility practices?
2. Does gender influence transportation mode choice?
3. Is there a nexus between gender and mobility distance and duration?
4. What are the main mobility motivations and destinations for each gender?

Despite extensive international research on gender and mobility (Hanson, 2010; Uteng, 2019), little empirical evidence exists from North Africa, where rapid urban sprawl and limited transport services create specific challenges. In Algeria, most studies address traffic congestion, motorization, or infrastructure, with limited attention to gendered inequalities in daily mobility. Baba Hassen, a peripheral municipality of Algiers, offers a representative case: it has experienced explosive demographic growth, inadequate local facilities, and high commuting flows, making it an ideal setting to analyze how gender shapes mobility practices. Research gap: Existing literature rarely considers gender in Algerian urban mobility, nor does it link gender to spatial inequalities caused by peri-urban expansion.

Objectives: The study's objective is to explore the mobility behaviours of households or individuals living in a peripheral municipality of the capital Algiers. In particular, we want to know how much these households anticipated the impact of their residences on their daily mobility. Therefore, we have proposed the concept that the desire to acquire a property in the peripheral can reduce mobility limitations. Thus, we hypothesize that urban spread causes lengthier commutes and increasing reliance on cars because the installation of families in these peripheral municipalities was not accompanied by the construction of necessary services and equipment (living conveniences) at the same time, resulting in a transformation and alteration of household lives. In addition to that, we assume that the population is young and active, which presents a potential influence the demand for mobility and generates movements by different modes and for varied distances and durations of journeys to meet their needs (work, studies, shopping, Health care, leisure, etc.).

In short, the objective addressed in this study is to analyse how this expansion influences the travel habits of peripheral populations, and how the mobility practices of populations by gender are influenced in terms of modes, reasons, distances, and duration. Firstly, we begin by presenting cutting-edge research on the study objective (combining sprawl and mobility), followed by the chosen study area. Then the data collected will be analysed, the variables, and the analysis approach employed. Finally, the findings of our research will be showed before drawing conclusions.

Hypotheses

This study explores whether gender impacts on mobility variables. Therefore, research hypotheses are presented below:

- H1.** Men are more likely to use private cars, while women rely more on public transport and walking.
- H2.** Women's trips are more often related to domestic activities (shopping, care), while men's are dominated by work.
- H3.** Men travel longer distances than women, while young people (boys, girls) display intermediate patterns.
- H4.** Women experience longer travel durations when using public transport compared to men using cars.

LITERATURE REVIEW

Numerous studies have found that the evolution of modes of transport plays a central role in the spatial transformation of cities. Urban sprawl, characterized by the extension of residential areas towards the peripheries, leads to a deconcentrating of housing and intensive urbanization of peri-urban areas (Le Néchet, 2011), generates a growing dissociation between place of residence and place of work, while limiting access to services, facilities and shops

(Haëntjens, 2009; González, 2017) which is reflected in a significant increase in average distances travelled daily, (Aguilera & Mignot, 2002), also favoring an increased dependence on the automobile and the emergence of daily over mobility (Hatcheu, 2013; Van de Walle & Rivoire, 2005; Wiel, 2010), with the corollary of increased congestion of commuter travel, particularly to work (Bussi re & Dallaire, 1994).

Other research highlighted the decisive influence of urban morphology on modal practices (Kaufmann, 2002; Tran et al., 2014; Garc a-Palomares, 2010), leading to an increase in the number of commuters, longer distances travelled and increasing car dependence. Faced with these constraints, individuals adapt their mobility practices according to their needs, (Masse et al., 2020). Particularly for discretionary activities based on their own preferences (Elld r, 2014), which confirms that the spatial distribution of urban functions and activities influences mobility behaviours (Pouyanne, 2007).

This transformation of spatial balances has led to an exponential increase in distances travelled, with individuals traveling a distance ten times greater than 50 years ago (Z lem, 2009). Business trips are the main organizers of daily mobility in terms of location and duration (Drevon et al., 2015; Nicolas et al., 2012). Hence, this phenomenon is reflected in increased motorization of households (Baudelle et al., 2004), with almost systematic use of cars in the most remote municipalities (Pouyanne, 2007), which (Gallez et al., 1997) even describe as irreversible at the individual level.

Ultimately, this high daily mobility is strongly encapsulated in routines (Masse et al., 2020), as a result, over time, generates significant negative externalities and poses the double problem of increasing congestion. In Europe, commuters spend an average of two (2) hours daily on their travel (Fremont, 2018), while in Algiers journeys of 1 to 2 km can require an hour by car during traffic jams (Remouche, 2016). Besides (Bondue, 2000) reported that these daily mobility practices are part of a complex system influenced by social, cultural and political factors. Mobility is increasingly recognized not only as a technical matter of infrastructure but as a socially structured practice, deeply influenced by power dynamics, access to resources, and gender norms (Sheller & Urry, 2006). Gender, in particular, shapes mobility patterns through differential access to transport modes, safety perceptions, affordability, and socio-cultural expectations. Gendered mobility patterns are especially visible in low- and middle-income countries. In a recent study in Lahore, Pakistan (Rashid et al., 2025) found that young women (15–29 years) reported that affordability, safety, and access to well-maintained public transport stops were key barriers to using public transportation. Similar evidence from Ethiopia by (Arbuzova et al., 2023) showed that even modest interventions, such as providing women with subsidized taxi access increased their travel frequency and spatial reach, indicating that access barriers are a primary constraint. In C te d’Ivoire, (Bande & Kaplan, 2023) demonstrated that women in Abidjan face mobility limitations due to unaffordable and unreliable public transport systems. Their exclusion from transportation directly translates to reduced access to social and economic participation. (Likewise, Anderson et al., 2024), in their study of Ghana’s two largest cities (Accra and Kumasi), found that transit systems often fail to accommodate women’s trip patterns, such as short, frequent, multi-stop journeys related to caregiving and domestic responsibilities.

These caregiving-related travel patterns, sometimes referred to as the “mobility of care,” are increasingly studied. (Goel, 2022), analyzing time-use data in urban India, observed that women made fewer trips outside the home than men, and their trips were more likely to serve household maintenance purposes.

Urban form and spatial inequality compound these barriers. (Khunou, 2022) explored the Gauteng City-Region in South Africa and concluded that peripheral housing locations, coupled with low household income and childcare obligations, leave women with limited transport options and extended travel times. (Mu oz et al., 2023), in Barcelona, Spain, applied sequence analysis to show that women’s mobility decreases significantly during caregiving stages of the life course, especially during early motherhood. These findings are likely relevant in peri-urban municipalities like Baba Hassen, where family responsibilities and service distance may intersect to limit women’s mobility.

Active mobility choices also differ by gender. In Johannesburg (Aderibigbe & Gumbo, 2025) showed that women walk more than men but are discouraged from cycling due to safety concerns, harassment, and lack of infrastructure. These differences in mode choice, safety experience, and confidence illustrate the gender gap in “transport autonomy.”

At the policy level, the gap in gendered transport data and the lack of women’s participation in planning remain major barriers to change. Lawanson et al. (2023), in their multi-country study across Africa, emphasized the institutional limitations namely, gender-blind governance structures and inflexible transit service models. Their findings highlight the need for gender mainstreaming in transport policy, along with the collection of gender-disaggregated mobility data.

Finally, while the literature on gender and mobility is growing globally, there remains a significant gap in North Africa. (Fezzai et al., 2025) examined gendered space usage in the historic city center of Tebessa, Algeria, but this remains one of the few Algerian empirical studies on the topic. This study of Baba Hassen contributes to closing this gap by providing original data on gendered mobility practices in an Algerian peri-urban context.

Study area

Our investigations were carried out in the municipality of Baba Hassen, located 25 km southwest of the city center of the Algerian capital Algiers (second crown: see Figure 1). It covers an area of 916 hectares. The choice of the city of Baba Hassen is justified because it represents an example of a city that has undergone a spectacular increase in population following the saturation of Algiers, and thanks to its land potential. It has become one of the sites that have accommodated the surplus of the main city (de-densification of the central municipality), with an urbanization rate of 81.16% in 1998 and 93.45% in 2008. This expansion transforms the commune into a place of anarchic housing, devoid of equipment and infrastructure to meet the needs of the necessary population. Baba Hassen is faced with problems of high demand for mobility to meet their needs (commuting) and congestion of road networks.

The peri-urban nature of Baba Hassen means that spatial mismatch (distance to services/employment) is likely important; family obligations may further constrain women’s mobility (trip chaining, caring responsibilities, etc.).

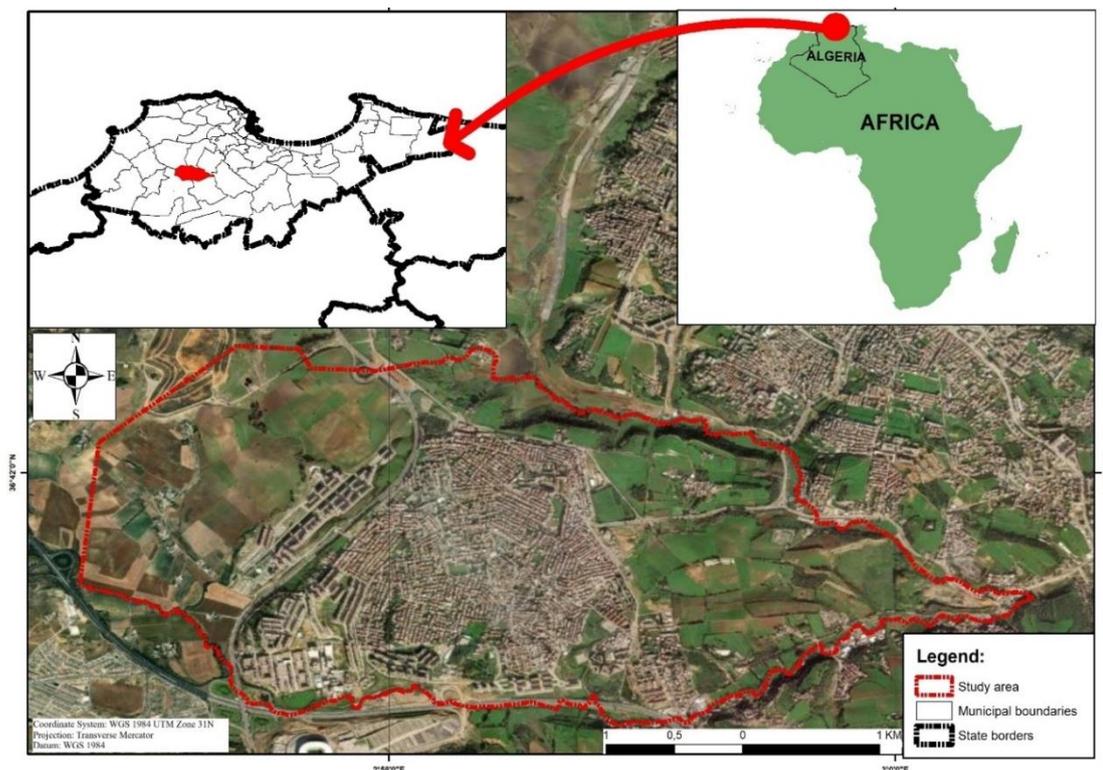


Figure 1. Geographical location of Baba Hassen municipality (Source: established by the authors)

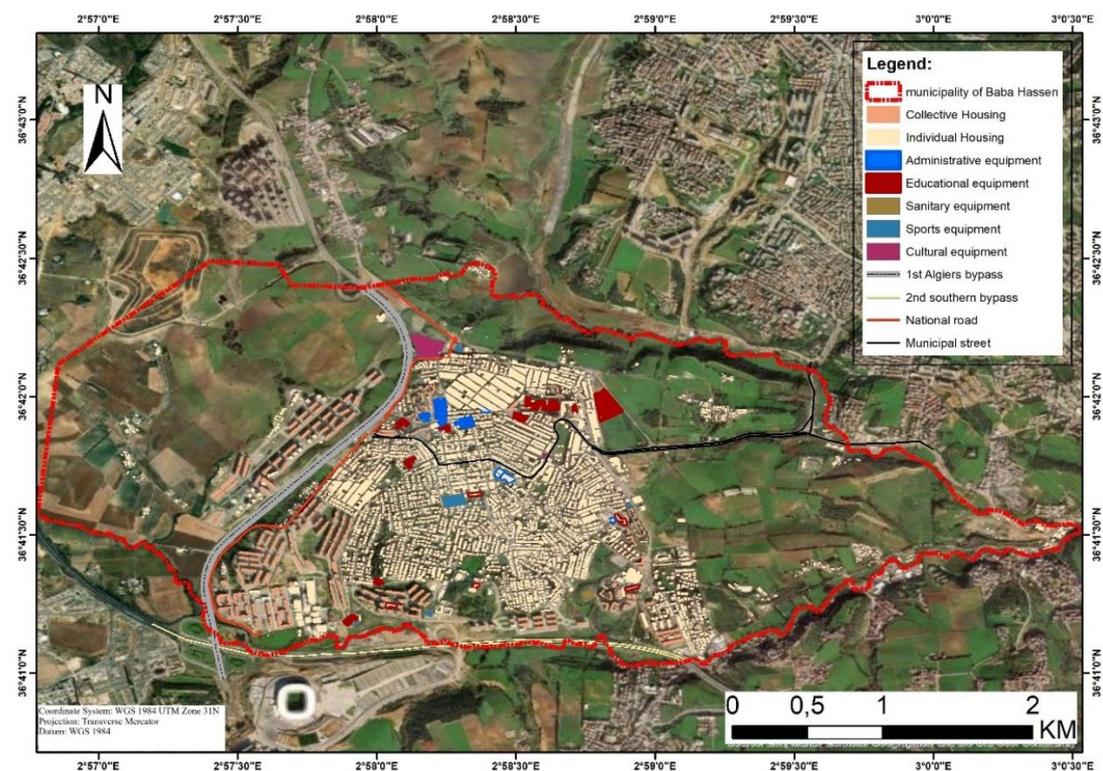


Figure 2. Municipal roads of Baba Hassen (Source: Google Earth + POS 127 /established by the authors)

The population of Baba Hassen is experiencing quite remarkable dynamism. It went from 3,798 inhabitants in 1977 to 23,756 inhabitants in 2008, an increase of 19,958 individuals, including 11951 men and 11805 women, (RGPH, 2008), with a spectacular positive growth rate, 4.9% between 1977 and 1987, the same trends were recorded in the following decades, 8.08%, between 1987 and 1998, and 5.7%, between 1998 and 2008 (ONS-RGPH, 2008), (positive migratory balances). Housing stock: it has been increasing since 1987, from where it went from 933 to 2375 housing units in 1998, an increase of 2.54 times, and to 6217 housing units in 2008, with an increase of 2.61 times. These installations at the municipal level are part of the various construction and rehousing operations (self-construction, real estate developments, resettlement of populations from precarious housing) (Belhai-Benazzouz & Djelal, 2010). Concerning the facilities: the

municipality has a park of facilities which is composed of 35 educational facilities (28 of them being primary schools), administrative facilities (APC headquarters; annex, tax inspection), sanitary facilities (treatment room, private offices), religious facilities (5 mosques, Koranic school and 03 cemeteries), cultural facilities (municipal library and a youth center), training facilities (a state center and another private), service facilities (3 banks, 01 post office, red crescent center), relaxation and leisure facilities: (02 public squares and 01 very small garden), sports facilities: (05 local playgrounds for children, a gym and a local Matico stadium), commercial facilities (some local shops) and building facilities, there is urban security.

Activities: There are several business units, mainly located in an economic entity, which includes: EURL packaging, glass processing, MBS electric, and SARL mono electric. Road network: The municipality is served by a road network, which consists of an expressway, the 2nd South Ring Road, the Algiers 1st Ring Road, national roads (RN) 36 and (RN) 63, city (Wilaya) Roads No. 133, and municipal roads (Figure 2). Regarding public transport, the municipality has a single transport line, which originates in the municipality of Ben Aknoun and goes to the municipality of Baba Hassen with eight (08) private buses. Otherwise, the municipality is served by other transport lines operated by private operators crossing the municipality: the Douéra line towards Ben Aknoun or vice versa with thirty-two buses (32), the El Achour line towards Douéra with five (05) buses, and the Douéra line towards Chéraga with seven (07) buses (Transport Directorate of the city of Algiers, 2025).

MATERIALS AND METHODS

Data collection

A descriptive-analytical (quantitative) approach was adopted in the study, based on a household travel survey (HTS) questionnaire. This research method is frequently used by researchers who wish to collect data from respondents and process it to study a specific issue (Gontean & Trincă, 2025). The survey, conducted between January and June 2018, and the collected data focused on the mobility habits of the population of the Baba Hassen municipality aged 6 years and older.

This survey was administered to primary schools in order to reach a wide number of households across various socio-professional groups. Students carried the questionnaire home so that family leaders may calmly answer questions such as:

- Household demographics, including age, gender, and socio-professional status, as well as employment status (location and type of job);
- Vehicle availability;
- Mobility details for family members on the previous weekday, including method of transportation, reason for mobility, travel time, distance travelled, and destination.

As an exploratory study, the initial sample included 1000 questionnaires and 517 household respondents, totalling 2749 participants, including 2391 of them aged 6 and up. Additionally, individuals under the age of six, (n=358), and those who were not traveling the day before the poll (n=236) had to be excluded, leaving 2155 participants. Moreover, of these 2155 people, 1212 were school-age children under the age of 18. They were also excluded from our analysis since they travelled within the municipality (98% of the total) and within a radius of 0.1 to 0.5 km at most. Therefore, it left 943 individuals who travelled the day before the survey, and on whom the analysis is based. This group concerns (active heads of households and retirees, active and housewives, working and unemployed boys and girls, children in training and students)

Presentation of variables used in the study

To analyse the mobility practices of these individuals, it is essential to clearly define the dependent and independent variables in this case. Dependent variables (to be explained): five types of variables must be explained in relation to travel, which are defined as (a) the mode of transportation used (walking, public transportation, private car, students transportation, etc.), (b) the purpose of mobility (work, studies, shopping, leisure, healthcare, etc.), (c) the distance travelled (in km), (d) the duration of the journey (in minutes), and (e) the workplace or destination of the mobility.

The independent (explanatory) variables are defined by gender (men, women), and these variables generally play a role in the mobility practices observed (Tran et al., 2014).

It should be emphasized that, in economic research, it is relevant to use the term "men/women" to replace the term "Male/Female" in the gender variable, as the last one is more appropriate for biological and physical aspects. In addition, this study also covers boys and girls (working household members, apprentices in training, students and the unemployed).

Analysis techniques

The data were manually entered into an Excel spreadsheet. Descriptive statistical analyses were performed, including various statistical tests applied to bivariate associations, as well as cross-tabulation and grouping of variables. These analyses aimed to identify relationships between variables and study the link between urban sprawl and the mobility practices of residents of the municipality of Baba Hassen. The overall significance of the model will be determined conventionally by hypothesis tests based on the critical probability (p-value).

Using statistical software (SPSS V26), which represents one of the most powerful software packages for this analysis, two types of analyses were explored to perform the statistical data analysis.

Firstly, a Chi-square test was employed to investigate and examine the associations between selected mobility-related variables and individuals' gender. It is vital to highlight that this test is utilized when two qualitative (categorical) variables are supplied, which in this case are gender, mode, and purpose of travel. This significant relationship test helps us to determine whether gender influences the mode of transportation or the purpose for travel. The aim is to monitor is the relationship between the variables and determine whether there is any reliance between the modalities of each two variables.

Secondly, given that distance and duration are metric variables, and gender is a qualitative variable, a one-way analysis of variance (ANOVA) test was used. Therefore, the hypotheses must be verified, starting with the normality test to examine

whether the dependent variable follows a normal distribution. Moreover, the variances of three or more samples should be homogeneous (Liu, 2015; Sun & Dudeja, 2018; Elsherif, 2021; Boukhedimi, 2025).

Gender analysis by distance and duration

Normality tests: According to the results of the *Kolmogorov-Smirnov* test ($n > 50$), the p-values are significant ($p < 0.05$). In other words, the normality of the dependent variable (distance) is not confirmed. However, this assumption can be ignored if the sample size is equal to or greater than 30, as stipulated by the central limit theorem (CLT), as highlighted by (Allende-Alonso et al., 2019; Bajpai, 2013; Berenson et al., 2012; Boukhedimi, 2025; Boukhedimi et al., 2023; Chang et al., 2006; Elsherif, 2021; Fukuda, 2024; Jenkins & Quintana-Ascencio, 2020; Johnson, 2004; Kwak & Kim, 2017; Nair et al., 2022; Polya, 1920; Sriram, 2023; Urdan, 2005; Zhang et al., 2023).

For this purpose, a test of homogeneity of variances is applied: the results of the Levene test show that the variances of the four samples (i.e., girls, men, boys, and women) are not homogeneous ($p < 0.05$). Therefore, it is necessary to use a non-parametric test called the "Kruskal-Wallis Test for Independent Samples," (Denis, 2018; Ofungwu, 2014; Liu, 2015; Hahs-Vaughn & Lomax, 2020; Sun & Dudeja, 2018; Hanna & Dempster, 2012; Xia & Sun, 2024). Using the non-parametric Kruskal-Wallis test for independent samples: this is an alternative solution, given that the ANOVA conditions are not met (the data do not meet the conditions of normality (*Kolmogorov-Smirnov*, $p < 0.05$) or homogeneity of variance (Levene, $p < 0.05$)) (Table 1). The objective is to examine the differences between the population medians (rather than the population means) of the data groups, thus comparing the distances travelled (in km) between different groups defined by gender. In addition to these surveys on mobility and travel, this work draws on the exploitation of several other data sources, namely:

- Statistical data from the results of various population and housing censuses and other data collected by relevant organizations.
- In addition to the results of the field survey, mapping enabled specialisation of the data (GIS environment).

Table 1. Normality test of the study (Source: Household Mobility Field Survey 2018)/ using SPSS)

Gender	<i>Kolmogorov-Smirnov</i>	Mean distance	Mean duration
Women	0.000	10,71	45,35
Boys	0.000	2,29	17,39
Men	0.000	16,67	52,13
Girls	0.000	2,71	19,49

RESULTS AND DISCUSSION

This section presents the results of our study. The starting point was to determine whether the population's gender influences mobility practices in terms of transport modes used, travel purpose, distances travelled, and travel times. The results highlight the following:

Descriptive Statistics

The analysis of descriptive statistics revealed the demographic characteristics of the sampled population. Overall, the survey included 943 individuals aged 19 to 60, with an average age of 40.72. Furthermore, an average of 51.90 minutes and 14.54 km were consumed per day in their daily travel, as shown in Table 2.

Additionally, the sample included 512 men, 291 women, 80 girls, and 60 boys. Furthermore, most respondents were aged 40 ($n=70$; 7.4%), followed by those aged 43 ($n=50$; 5.3%) and 48 ($n=50$; 5.3%).

The results revealed that individuals travelled distances ranging from 1 km to 64 km, of which 75.70% were for compulsory travel (work and studies), while 24.27% were for non-compulsory travel (shopping, medical care, business, sightseeing, sports, and leisure). 45.4% used their own car, 35.9% used public transportation (staff transportation, and student transportation), and 18.7% walked. Compulsory travel to and from work and school is distributed across socio-professional categories, namely: Liberal Professions, Senior Managers, Middle Managers, Self-Employed Employees, Traders, Employees, Academics, and Apprentices. Non-compulsory travel is made by retirees, housewives, and the unemployed.

The total number of trips made by these 943 individuals is 2 216 trips, with a mobility rate of 2.35 trips/person/day, including 1650 compulsory trips, or 2.31 trips /person/day, and 566 non-compulsory trips, or 2.47 trips/person/day.

Table 2. Descriptive statistics of the sample studied (Source: Household Mobility Field Survey 2018/using SPSS)

	Gender	Age	Distance /Km	Duration/Min
N	943	943	943	943
Mean	3.1	40.72	14.54	33.41
SD	0.8	9.43	12.07	51.9

Mode of mobility used by gender (Chi-square test) Hypothesizes using Chi-square test: Null hypothesis:

There is no significant differences between categories of gender regarding the mode of mobility used if p-value is greater than 0.05; Alternative hypothesis: There is a significant difference across categories of gender in terms of the mode of mobility used, if p-value is less than 0.05. According to the Chi-square result, a significant difference appears between men, women, boys and girls ($p < 0.05$). Figure 3, below presents a graph of the different modes of transport used by gender, providing an overview of the transportation behaviors of various demographic groups within the surveyed population of 943 individuals. The modes of transport considered in the study include walking by foot, public transit, use of a personal car, and a category labeled "Other," category which comprises staff transportation and student transportation. The data reveals distinct patterns in mode choice that appear to be influenced by both gender and age. Among the adult male respondents, the

predominant mode of transport is the personal car, with 363 men (out of 512) indicating its use. This figure is significantly higher than any other group, suggesting that men have greater access to or preference for private vehicles. Public transit use among men is the next most common mode (81 individuals), followed by walking (55), while only 13 men reported using the "Other" category. Conversely, women display a different distribution, with a substantial reliance on public transportation (135 individuals) and walking (100). Only 47 women reported using personal cars, which is markedly lower than the corresponding male figure. This suggests that women are more dependent on shared or non-motorized forms of transportation, which could be attributed to socioeconomic factors, access to vehicle ownership, or travel patterns linked to caregiving roles.

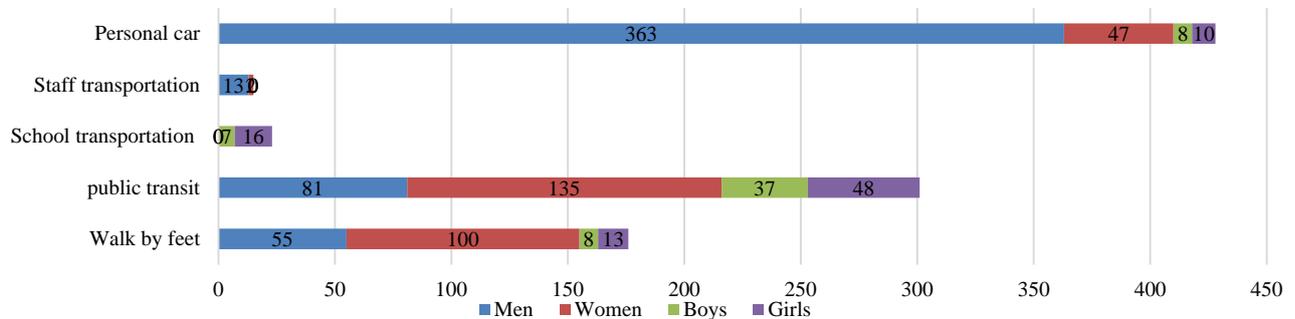


Figure 3. Mode of transportation used by gender (Source: Household Mobility Field Survey, 2018)

The transportation patterns among children also shows notable differences. Boys and girls rely heavily on public transit and the "Other" mode of transport, the latter of which, as noted, includes school and staff transport services. For instance, 48 girls and 37 boys use public transit, while 16 girls and 7 boys utilize "Other" forms. Walking and personal car use are significantly less common among children, which is expected given their dependence on adult-supervised or institutional travel modes. These findings highlight that student transport services play a crucial role in the mobility of younger populations, particularly girls, who use such services at nearly double the rate of boys.

In aggregate terms, the most utilized mode of transport is the personal car (428 individuals), followed by public transit (301) and walking (176). The least used mode overall is the "Other" category (38 individuals), although its relevance is more pronounced among the younger cohorts. The data suggests a clear gender and age divide in transport access and preferences, pointing to broader societal and infrastructural factors that shape mobility behavior. Policies aimed at improving equitable access to transport must consider these disparities, particularly the over-reliance of women and children on public and institutional transport systems. It should be noted that the term "Other" refers to staff transportation for adults and older respondents (Men and women). While student transportation is for younger participants (Boys and girls). In general, we find that private cars are used much more by men, especially men (high motorization).

Mobility reasons by gender (Chi-square test) Hypothesizes using Chi-square test

Null hypothesis: There is no significant differences between categories of gender regarding the mobility reasons, if p-value is greater than 0.05; Alternative hypothesis: There is a significant difference across categories of gender in terms of the reasons of mobility, if p-value is less than 0.05. Referring to the Chi-square results, a significant difference between men, women, boys and girls was confirmed regarding the reason for travel (p < 0.05). Table 3 above presents the cross-tabulation of gender and the primary reason for travel among the same population of 943 respondents.

Table 3. Cross-tabulation of gender and reason for trip (Source: Household Mobility Field Survey 2018/ using SPSS)

	Shopping	Study	Work	Other	Total
Men	14	0	485	13	512
Women	118	0	112	61	284
Boys	8	24	14	14	60
Girls	3	42	27	15	87
Total	142	67	631	103	943

The reasons for mobility are categorized into Work, Study and training, Shopping, and Other, with the latter encompassing trips made for care, visits, personal business and sport and leisure. The data illustrates how mobility needs are not only shaped by gender and age but also by the socio-economic roles and daily responsibilities of individuals. The most striking finding in this table is the dominant role of work-related travel among men, with 485 out of 517 household heads responding that their main reason for travelling was work. This indicates a high labor force participation rate among men and a likely correlation with the earlier finding of high private car usage. Travel for shopping or other purposes among men is minimal, with only 13 and 14 individuals respectively reporting these as their main reasons for travel. Notably, no adult men reported traveling for study, reinforcing the assumption that this demographic group is largely past school or university age.

In contrast, women show a very different travel profile, with a significant proportion of their mobility driven by shopping (118) and other purposes (61). A smaller proportion (112) travel for work, indicating either lower workforce participation or part-time/irregular employment. Like men, no women reported travel for study. The strong presence of women in the shopping category may be linked to gendered household responsibilities and caregiving roles, where women often manage food purchasing, child-related errands, or household provisioning tasks. Among younger respondents,

namely boys and girls, the majority of travel is associated with study, reflecting their status as students. Girls (43) and boys (24) reported study as the primary reason for mobility, followed by work, other purposes, and to a lesser extent, shopping.

Interestingly, girls also reported a higher number of work-related trips (20) compared to boys (14), which may suggest early engagement in informal or part-time work roles. Travel for "Other" reasons is relatively dominant among boys for shopping purposes; personal affair compared to girls. In short, work is the main reason for travel, mentioned by 631 respondents out of a total of 943, mostly male heads of household. Purchases (142 individuals) and the category "others" (139 individuals) follow, the latter being more common among women, retired heads of household and unemployed children. Travel related to studies (67 individuals) and training (24 individuals) appear to be the least common, although they logically predominate among people of school age. These results highlight mobility needs that are differentiated according to gender and life cycle, thus highlighting the importance of inclusive urban planning, capable of meeting a diversity of travel objectives, especially for populations whose mobility does not depend exclusively on formal employment. It should be outlined that the term "Other" comprised the less frequent purposes (ie: Business, Training, Healthcare, Sport and Visit).

Distances travelled by gender (Kruskal-Wallis test) Hypothesizes using Kruskal-Wallis test: Null hypothesis

There is no significant differences between categories of gender regarding the distance used, if p-value is greater than 0.05; Alternative hypothesis: There is a significant difference across categories of gender in terms of the distance explored, if p-value is less than 0.05. The results show that there is a significant difference in distance travelled by gender, and the Kruskal-Wallis test showed that distance travelled is significant by gender ($H_1: p < 0.05$).

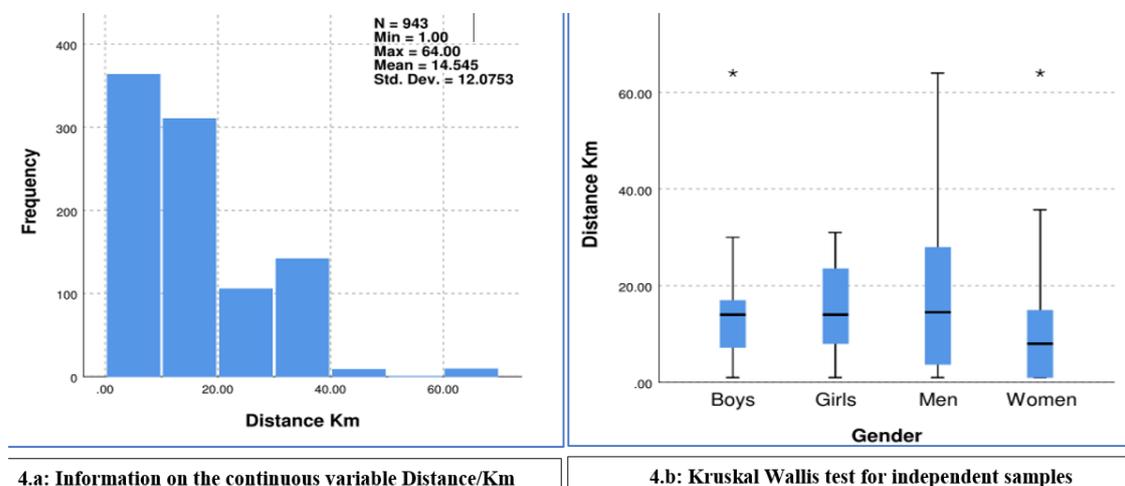


Figure 4.a / 4.b Distance travelled: gender based-study (Source: Household Mobility Field Survey 2018/ using SPSS)

As reflected in the figures above, distances travelled differ considerably by gender, with a median of 14.54 km and a standard deviation of 12.07 km (Figure 4.a). The results show that men travel distances ranging from 2 km to 64 km depending on their place of work, which for some household heads is outside the Algiers city. However, women travel distances between 2 km and 35 km depending on their destination. Young people (boys and girls) travelled distances between 2 and 64 km depending on their place of work or study, with an average of 12 km (Figure 4.b). The results of the pairwise comparison indicate differences in average travel distances across gender groups. Men reported the longest average travel distance (526.15 km), followed closely by girls (501.93 km) and boys (472.58 km), while women recorded the shortest distances (365.09 km). The diagram in Figure 5, highlights a statistically significant difference between boys and men, as shown by the red connecting line, whereas the other comparisons did not reach statistical significance.

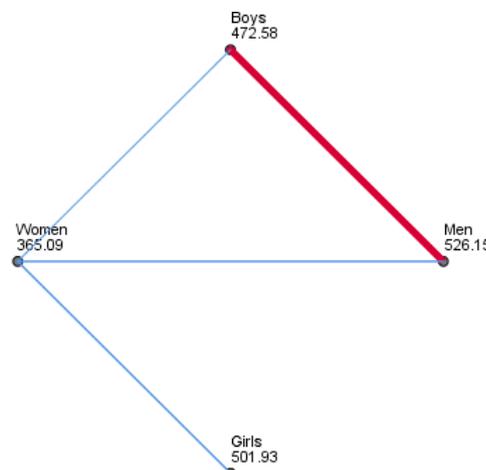


Figure 5. Pairwise comparison (Source: Household Mobility Field Survey 2018/ using SPSS)

These findings suggest that both gender and age are associated with variations in travel behavior. Specifically, men travel farther than women among adults, while girls tend to cover greater distances than boys among younger participants. Overall, the results underscore the combined influence of gender and generational differences in shaping travel distances.

Mobility duration by gender (Kruskal-Wallis test) Hypothesizes using Kruskal-Wallis test

Null hypothesis: There is no significant differences between categories of gender regarding the duration of trips, if p-value is greater than 0.05; Alternative hypothesis: There is a significant difference across categories of gender in terms of trips duration, if p-value is less than 0.05. According to the Kruskal-Wallis test result ($p < 0.05$), the distribution of mobility duration differs across gender categories. Therefore, the null hypothesis is rejected. Compared travel times for different modes of transport across gender categories vary. Travel time is a factor determined by destination, mode of travel, and distance travelled, with a mean of 51.9 minutes and a standard deviation of 33.41 (Figures 6.a / 6.b).

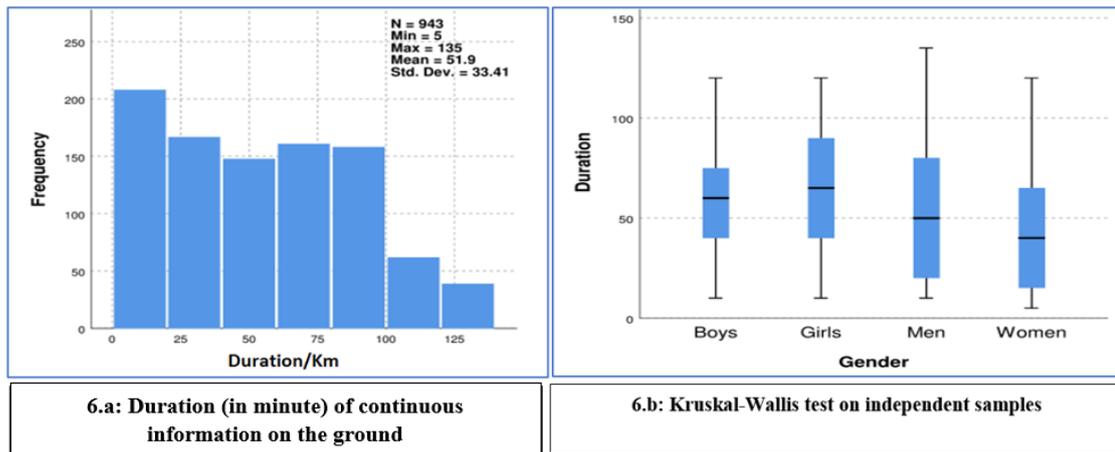


Figure. 6.a / 6.b Duration of trips: gender based-study (Source: Household Mobility Field Survey 2018/ using SPSS)

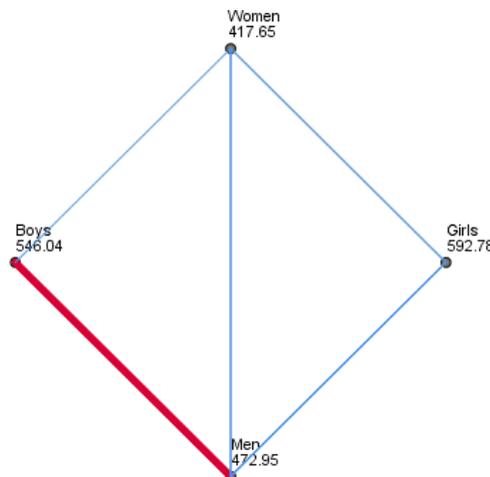


Figure 7. Pairwise comparison (Source: Household Mobility Field Survey 2018/ using SPSS)

In this sense, Men spend a varied travel time, ranging from 10 minutes to 135 minutes, depending on the mode of travel and the distance travelled. Women also spend a significant amount of time, averaging 43 minutes, and generally ranging from 5 minutes to 120 minutes during their travels. On the other hand, girls and boys spent an average of 19.49 minutes and 17.39 minutes, respectively, to reach their desired destination. The duration of the journey to the destination also appears to be an influencing factor on the type of mobility adopted; the majority of individuals who travel to work by car spent more than 60 minutes per day to complete the journey. The analysis of trip duration by gender reveals notable variations across groups. The results indicate that girls recorded the longest average trip duration ($M = 592.78$), followed by boys ($M = 546.04$), men ($M = 472.95$), and women ($M = 417.65$).

This ranking suggests that younger participants, particularly girls, tend to engage in longer trips compared to their men counterparts. Moreover, as shown in Figure 7 the pairwise comparison highlights a statistically significant difference between boys and men, as indicated by the marked red line, whereas the other comparisons did not reach statistical significance. Overall, the findings suggest that trip duration is influenced by both gender and age, with generational differences appearing more pronounced than those observed strictly between men and women.

The results shown in Table 4 confirm the alternative hypothesis for the mode, reason, distance and duration of travel, indicating a dependence on the gender of individuals ($p < 0.05$). The results show that the mode of mobility, reason for travel, distance travelled and duration of travel are influenced by gender.

Table 4. Results of chi-square tests and hypotheses (Source: Survey data/ using SPSS)

Variables	P-value	Result	Statistic hypotheses		Study hypotheses
			H ₀	H ₁	
Mode	p < 0.05	Dependence	Rejected	Accepted	Confirmed
Raison	p < 0.05	Dependence	Rejected	Accepted	Confirmed
Distance	p < 0.05	Dependence	Rejected	Accepted	Confirmed
Duration	p < 0.05	Dependence	Rejected	Accepted	Confirmed

Places frequented by different gender categories according to mode and motive

Towards work: More than 70% of job opportunities are located in city centres. Individuals are therefore not constrained from making these commutes to meet their needs. 73% of these individuals work outside the municipality (heads of household, spouses and children), and are distributed as follows:

Household heads (Men): out of the 485 household heads, 361 or 74.43% made daily trips outside the municipality to reach their workplaces, mainly to the hyper-central agglomeration with 24.12%, (Algiers-center, Med Belouazdad, El Biar, Sidi M’Hamed, El Mouradia, Bad El Oued, Bir Mourad Rais, Kouba and Bach Djerrah), to the first ring with 14.84% (Hydra, Bouzaréah, Bir Khadem, Ben Aknoun, Bab Ezzouar, Djisr Ksentina, El Harrache, ...), to the second ring with 28.65% (Draria, Chéraga, Douéra, Dely Brahim, Beni Messous, Ain Benian, Staouali, Zéralda, Ouled Fayet, El Achour, Bir Touta, Dar El Beida, Rouiba, Réghaia, ...) and towards the neighboring cities with 6.80% (Blida, Tipaza, Boumerdes) as shown in (Figure 8 a).

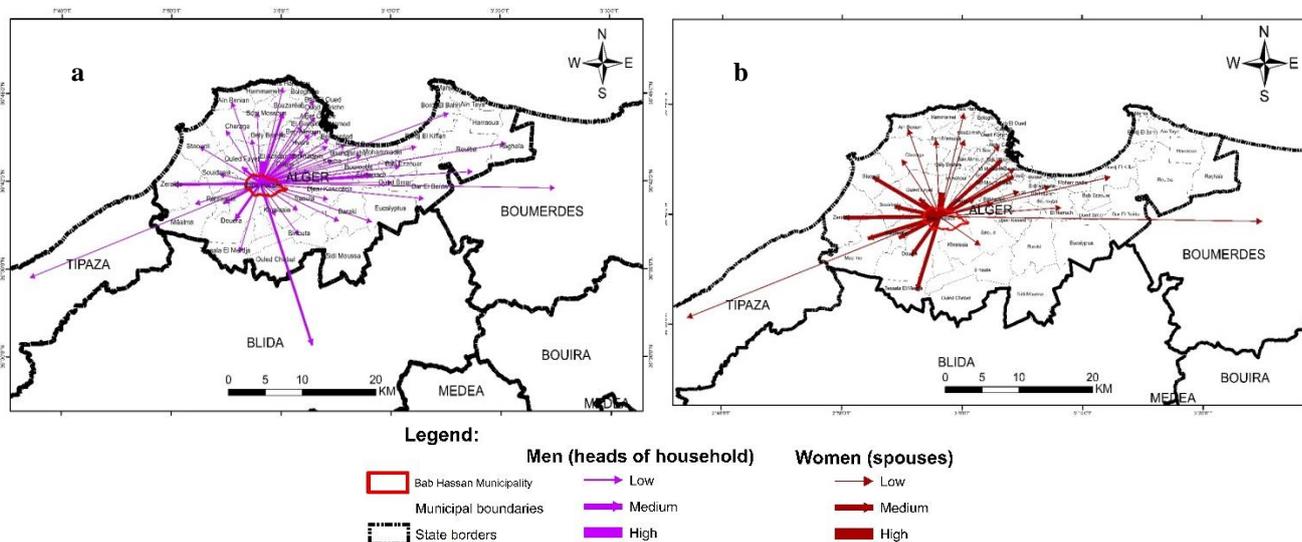


Figure 8 a, b. Places frequented by different gender categories

Spouses (Women): 69.64% of the 112 women had to leave their municipality every day to reach their workplace, particularly towards the hyper-center area with 24.10%, (Algiers-center, Med Belouazdad, El Biar, El Mouradia, Bad El Oued, Bir Mourad Rais, Kouba and Bach Djerrah), towards the first ring with 16.96% (Hydra, Bouzaréah, Ben Aknoun, Djisr Ksentina and Oued Smar), towards the second ring with 25.89% (Mehalma, Draria, Chéraga, Douéra, Beni Messous, Staouali, Ouled Fayet, El Achour, Bir Touta, and Dar El Beida) and towards the neighboring wilaya with 2.67% (Blida, Tipaza) as shown in (Figure 8 b). Children (Boys and girls): out of 34 children, 22 children, or 64.70%, their workplaces are located outside the municipality, that is to say in the municipalities, as shown in the (Figure 8 c) , of (Med Belouazdad, Bir Mourad Rais, Bir Khadem, Hydra, Draria, Douéra, El Achour, Chérag and Bir Touta). Towards studies (Boys and girls): Regarding the trainees, three (03) of them carried out their training directly in the municipality, while thirteen (13) others were enrolled in external training centers (Draria, Douéra, El Achour, Chérag and Hussein Dey). On the other hand, the university students traveled outside the municipality to pursue their higher education; (Bouzaréah 13%, Ben Aknoun 15%, Bab Ezzouar 22%, Algiers-center 8%, Kouba, Dely Brahim 17%, Beni Messous, Bir Mourad Rais, Blida 3% and Tipaza) as shown in the (Figure 8 c). Regarding non-obligatory trips, namely (shopping, care, visits, business and sports and leisure), are made by 229 individuals between retirees, unemployed and housewives. 62.44% of the total trips are made outside the municipality: Retirees: 42.30% made their trips within the municipality of Baba Hassen primarily for shopping.

57.70% outside the municipality, including 19.23% to the hyper-central area (Algiers-Centre) for care and shopping, and to the first ring road with 11.53% (Ben Aknoun and Bir Khadem) for care, shopping and visits. The second ring road (Draria, El Achour, Saoula and Chérega) accounted for 26.92% of retirees' trips for shopping. Housewives: 39.10% of the total made trips within the municipality for the purpose of purchasing first and then visiting family. 60.90% of their trips were outside the municipality, including 9.50% to the hyper-center area (Algiers-Center) and the first ring road (Ben Aknoun, Dely Brahim, Bouzaréah and Bir Khadem) for the purpose of purchasing first and care, business and visit second, for care, purchasing and visit. The second ring road (Zéralda, Beni Messous, Draria, El Achour, Saoula, Douéra, Ouled Fayet and Chérega) represented 41.34% of the trips made by housewives whose purpose was purchasing then care and family visit.

Non-employees: 20.83% travelled to the municipality of Baba Hassen for shopping purposes, while 79.16% travelled outside the municipality, including 58.33% to the second ring road (Draria, El Achour, Douéra, Chéréga and Ouled Fayet) for shopping purposes, personal business, sports and leisure. Figure 8c illustrates the spatial distribution of commuting flows from the municipality of Baba Hassen according to socio-professional categories and trip duration. The map shows that the longest trips are predominantly oriented toward the central municipalities of Algiers, indicating a strong dependence of residents on the metropolitan core for employment and education. Short- and medium-duration trips remain largely confined to nearby peripheral municipalities, reflecting more localized daily activities. Notably, academics and apprentices tend to undertake longer-distance trips compared to working children, whose mobility is more spatially restricted.

This spatial pattern highlights the combined influence of residential peripheralization, socio-professional status, and distance to central employment and educational hubs on daily mobility behaviour.

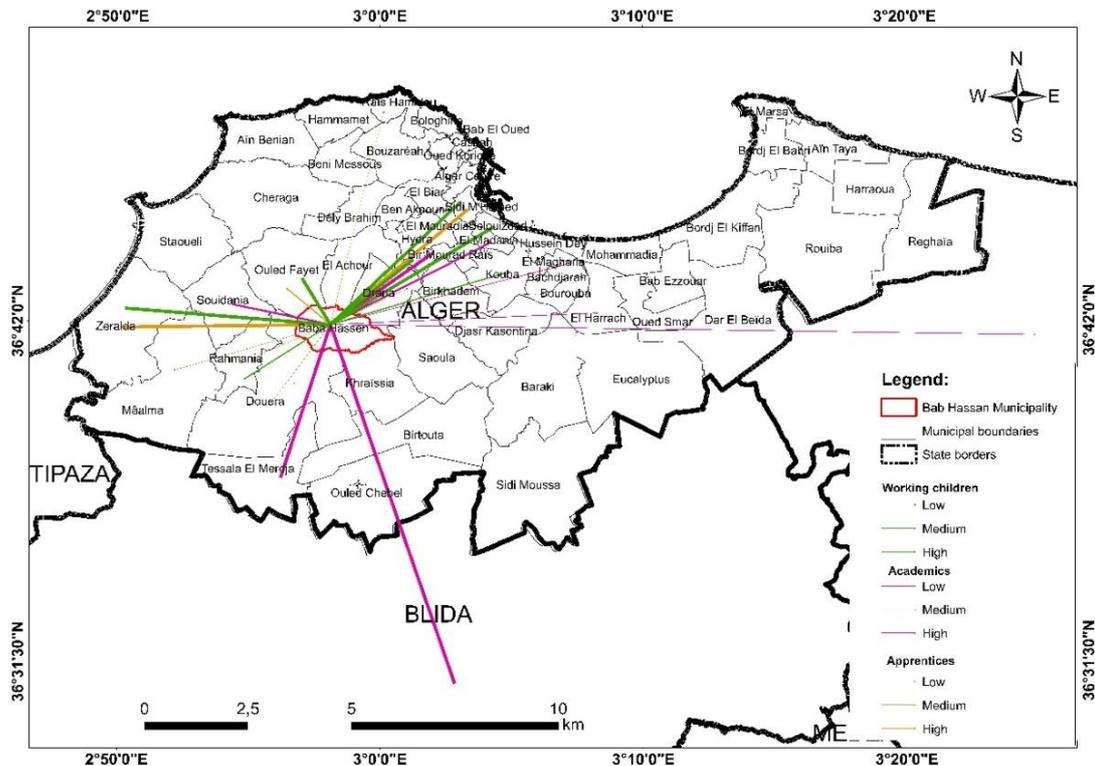


Figure 8 c. Spatial distribution of daily commuting flows from Baba Hassen municipality according to socio-professional categories and trip duration intensity

DISCUSSION

This research examines the influence of gender on mobility practices, particularly in terms of the chosen mode of travel, reasons for travel, distances travelled, journey time and places visited. Statistical analyses (Chi-square and Kruskal-Wallis tests) reveal significant differences between men, women, boys and girls. These results also confirm that gender plays a determining role in mobility behaviours.

Gender differences in modes of transport

The results show a strong mobility diversified according to gender in the choice of modes of transport: men (heads of household), massively favour the personal car (70.9%) as a mode of daily travel, professional motorized mobility of the home-work type provided by men (García-Palomares, 2010). This strong male motorization is explained by socio-economic determinants. Women (spouses), 47.54% mainly used public transport and 35.2% walked the use of the personal car represents only 16.55% of modes of transport.

Young people (boys and girls), all categories combined (workers, apprentices, unemployed, students) used all modes of transport. Boys used public transport (61.66%), private cars and walking (13.33%) and university transport (11.66%). Girls used public transport (55.17%), university transport (18.40%), walking (14.74%) and private cars (11.49%).

This gendered segmentation of mobility practices highlighted by these differences is influenced by social roles, economic constraints and available infrastructure. Women's heavy reliance on public transport highlights the inequality of access to cars.

Gender-differentiated reasons for mobility

The analysis confirms that travel reasons vary significantly by gender. Work is the main reason for travel for 94.72% of men, while women make shopping trips for 41.55%, reflecting their involvement in domestic and family tasks, a trend accentuated by the fact that 78% of them are housewives. Work remains an important reason for 39.43% of women. Among young people, higher education dominates (40% of boys and 48.28% of girls), followed by work (23.33% and 31.03% respectively). These results confirm the persistence of gender roles in the distribution of daily activities. Women assume the bulk of domestic responsibilities, while men and young workers focus their travel on work and studies.

Distance and duration of journeys: marked inequalities

Daily distances travelled varied across groups; men made the longest journeys, ranging from 2 km to 64 km each day, with journey times reaching 135 minutes. Women, on the other hand, travelled longer distances (up to 35 km) with journey times reaching 120 minutes. University students also made long journeys, up to 64 km in 120 minutes; working children travelled distances of around 28 km with journey times ranging from 15 minutes to 90 minutes.

This difference is mainly explained by the location of jobs, often outside the municipality of residence, and the predominance of cars, allowing for longer distances. Men, who have more vehicles, are willing to accept longer journeys to access jobs (Baudelle et al. 2004). On the other hand, women, whose journeys are more diversified, generally cover shorter distances but experience long journey times, particularly on public transport.

Commuting Mobility

The study reveals a strong reliance on commuting outside the municipality of residence by heads of household, women, and young people (boys and girls) for work and study, thus determining the movements of individuals and constituting structural movements (Drevon et al., 2015). Also, for non-obligatory trips (shopping, medical care, visits, business, sports, and leisure), significant movement and flow toward better-equipped municipalities was recorded, highlighting a lack of local infrastructure. These results reveal gender inequalities marked by unequal access to motorized mobility. Urban sprawl, which is not supported by the necessary facilities and services, has led to a change in the population's mobility practices. Relocation operations to distant peripheries, dictated by available land, have complicated mobility and created problems for residents. (Safar-Zitoun, 2020), our survey shows that 71.95% of households originally from the central municipalities then moved to the municipality of Baba Hassen while keeping their work in the main town, which causes the change in travel patterns.

This dependence on external hubs reflects a centralization of economic and educational opportunities, as well as a deficit in local facilities; these are consequences of unstructured urban sprawl, which has generated poorly equipped urban fabrics, aggravating transport and traffic problems (Chadli et al., 2012) and, creates greater and more varied travel needs (Baouni et al., 2013), which has generated an increase in distances between the periphery and the places where jobs are concentrated in the center and led to travel flows and increased motorization of households to compensate for failures and shortages (Zitoun & Tabti-Talamali, 2009). Despite the establishment of a regulatory framework for the institutional organization of urban passenger transport and legal and technical instruments, such as the master plan for development and urban planning (PDAU) and the land use plan (POS), the problem still persists and mobility conditions are difficult due to a lack of coordination between planning and transport (Louafi, 2019). Faced with this situation, urban policies should aim at establishing effective and integrated urban planning and transport mechanisms for a better distribution of services, improving travel and mobility conditions and meeting the needs of the population (young and active) in the municipality is very important to reduce spatial inequalities. Knowledge of travel practices plays an important role in determining, analysing and evaluating the needs of individuals and taking into account different types of gender through the adaptation of facilities to existing demographic realities, strengthening the supply of public transport and developing a soft and sustainable alternative transport network if these measures are accompanied by better control of urban sprawl in order to improve the quality of urban life of residents. In this context, a revision of the PDAU was carried out, with the main objective of transforming Algiers into a "city of mobility and proximity", pleasant to live in (PDAU, Report 2016). This revision also defines the orientations of the POS of all the municipalities of the city of Algiers, also the POS 127 of Baba Hassen provided for improvement actions aimed at meeting the needs of the inhabitants, in particular through the proposal of:

- Develop missing local infrastructure and facilities (shops, healthcare, education, culture, religion, sports and leisure, services, and tourism) to limit forced travel;
- Promote new bus lines to facilitate and improve travel conditions;
- Improve public transportation options to reduce car dependency;
- Widen some roads in the municipality for better mobility.

In summary, these results call for a gendered approach to mobility policies, in order to respond to the specific needs of different groups and reduce socio-spatial inequalities.

The results of this study confirm that gender is a significant structuring factor in mobility practices in Baba Hassen. Men dominate car-based commuting, while women rely predominantly on public transport and walking. Boys and girls, meanwhile, show mixed profiles shaped by education-related travel and limited access to private vehicles.

These findings are consistent with international literature, which highlights that women across contexts experience constrained mobility due to unequal access to resources, safety concerns, and cultural expectations (Goel et al., 2023; Lindkvist, 2024; Rashid et al., 2025). The case of Baba Hassen highlights the intersection of urban sprawl, limited public infrastructure, and gender norms. The municipality's rapid demographic expansion without corresponding investment in local services or transport facilities forces residents into long-distance commuting. Women in particular face "triple constraints": limited car ownership and access, secondly, reliance on slow, overcrowded public transport, and domestic responsibilities that increase trip chaining and reduce flexibility. Such constraints mirror findings in Sub-Saharan Africa (Porter, 2011) and South Asia (Rashid et al., 2025), suggesting that peri-urban contexts reproduce similar gendered inequalities despite cultural differences. A critical methodological contribution of this study is the combined use of Chi-square and non-parametric tests (Kruskal–Wallis), which confirm that, observed gender differences are robust. However, the Chi-square analysis of trip purposes revealed limitations due to small cell counts, indicating that future surveys should design broader categories or larger samples to ensure statistical validity. From a policy perspective, the results underline the need to integrate gender-sensitive planning into Algerian urban and transport policies.

Measures such as improving the frequency, safety, and comfort of public transport, developing local services to reduce forced commuting, and creating safer pedestrian and cycling infrastructures could significantly reduce gendered inequalities in mobility. The Baba Hassen case thus illustrates a broader challenge for Algiers and other rapidly expanding North African cities: without gender-aware policies, urban growth risks reinforcing structural inequalities.

CONCLUSION

This research analysed the influence of gender on mobility practices. The findings indicate that gender influences mobility behaviours and reveals significant differences between men, women, boys, and girls. It also indicates that urban sprawl towards peripheral areas such as Baba Hassen leads to a high level of motorization and a particular dependence on cars among men (heads of households) for long work-related journeys. This leads to gender differences in mobility practices. Public transport struggles to effectively serve these large and distant territories. A crucial and essential tool to reorient urban planning and improve the distribution of territorial opportunities. Besides, a coherent and integrated policy is needed to manage urban sprawl and promote sustainable and equitable mobility. The challenge is to overcome peripheral car dependence to build a more equitable and efficient transport system accessible to all.

Overall, this study demonstrated that gender strongly structures daily mobility in Baba Hassen. Men dominate car-based long-distance commuting, while women rely on slower modes for domestic-oriented trips. Young people show mixed patterns, reflecting limited access to cars but significant commuting for education. These findings highlight the consequences of urban sprawl without adequate facilities, reinforcing gendered inequalities in mobility.

Policy implications: The findings have several policy implications. First, urban transport planning must explicitly address gender differences, not assume a “neutral” traveller. Investment in safe, affordable, and reliable public transport is essential to reduce women’s travel burdens. Second, providing local services (schools, markets, healthcare) in peripheral municipalities like Baba Hassen could reduce the need for long-distance trips, especially for women. Third, participatory planning processes that include women’s voices could help design mobility systems that better match their needs, as demonstrated in other contexts (Çelik & Erbaş, 2023; Anderson et al., 2024).

Limitations: This research has limitations. The data, collected in 2018, may not capture recent changes in transport systems or behaviours. The analysis focused on gender, but did not systematically include other socio-demographic variables such as age groups beyond youth, socio-professional categories, or income, which also strongly influence mobility. Statistical issues with small cell sizes limited the reliability of some cross-tabulations. Finally, the study is limited to one municipality, reducing the generalizability of results across Algiers or Algeria.

Future research: Further studies should expand to multiple municipalities, allowing comparative analyses between central, peri-urban, and rural settings. Longitudinal surveys could capture how mobility evolves with urban expansion and infrastructure investment. Future work should also integrate intersectional approaches, examining how gender interacts with age, socio-economic status, and occupation in shaping mobility.

By addressing these limitations and building on this case, future research can contribute to a more comprehensive understanding of gendered mobility in North Africa and support the development of inclusive, sustainable transport systems.

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