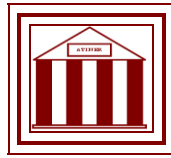


**Athens Institute for Education and Research
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TRA2017-2279**

**Analysis of the Metro Night Service Usage in
Vienna, Austria**

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Analysis of the Metro Night Service Usage in Vienna, Austria

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Abstract

Since September 2010 the public transport company “Wiener Linien” operates its metro network 24 hours at weekends and holidays. All the 5 existing metro lines are running every 15 minutes between 0:30 hours and 5:00 hours in the morning. Passenger counts in the year 2015 show, on the average 6.5 Mio. passenger trips were carried out with the night metro with an increasing demand over the last years. The aim of the research work is to get a clearer picture of the users of this service. Can there be detected behavioural changes in terms of mode choice, destination choice or changes in the time period of the trips because of this supply? Another aspect is security, do feel passengers safe, is there a difference between male and female users? In spring 2016 in total 154 interviews were carried out at the stops and in the vehicles. Main results to be presented are: The frequency of usage is strongly related to age class with highest share of persons aged 20 to 30, but there is no relation to the occupation status or availability of a car. 50% of the users are combining their trip through the night with other transport modes, mainly the feeder night-bus, regional trains or taxi. The majority of users have shifted their trips because of the metro night services, e. g. resulting in later returns from visits of restaurants and bars in the city. More than 50% of the users would carry out the observed trip without night metro service as well, but would shift in time or mode choice. Only 13% would omit the trip. Male users feel safer than female. Whereas main aspect for males is violence, females fear mainly of harassments and thefts. But the rating of security of travel, both of males and females is positive.

Keywords: Night service, Public transport, Transport demand.

Introduction

In the night 3rd to 4th September 2010 Wiener Linien, the operator of the Viennese metro lines, started its night service, which closes the gap between 0:30 hours and 5:00 hours in the morning in the nights before Saturdays, Sundays and red number dates. This decision was based on the results of a city-wide plebiscite, which took place a half year in advance. This paper is based on the results of a master thesis, which was carried out in the year 2016 (Rieder, 2016). A passenger survey and a passenger counting were carried out in the course of this work accompanied with analysis of statistical data provided by the operator who supported this work. The results of the survey will focus on the users of the service and its influencing parameters such as perception of security, frequency of use, trip purpose, intermodality of the trips, alternatives for the trip, individual accessibility to the station, age of users or influences on the time period, the trips are carried out.

International Examples of Night Services and Documentation

24 hours night services of metros exist in other cities as well such as in New York City, Stockholm, Copenhagen, Hamburg or Berlin. However, there is no long history of such operations in any of these cities. In many other cities buses take over the night service and the metro lines are closed, e.g. Munich, Paris, Vancouver or Chicago, (Seattle Transit Masterplan, 2011). In Europe, the most important services are operating as night tube in London (Transport for London, 2016) and as Nacht-U-Bahn in Berlin (Hell et al., 2000). Literature mainly documents economic aspects of the service (Volterra, 2014) or safety aspects (BVG, 2015), but no research was found on detailed travel behaviour of the users themselves.

The Viennese Metro System and its Night Service

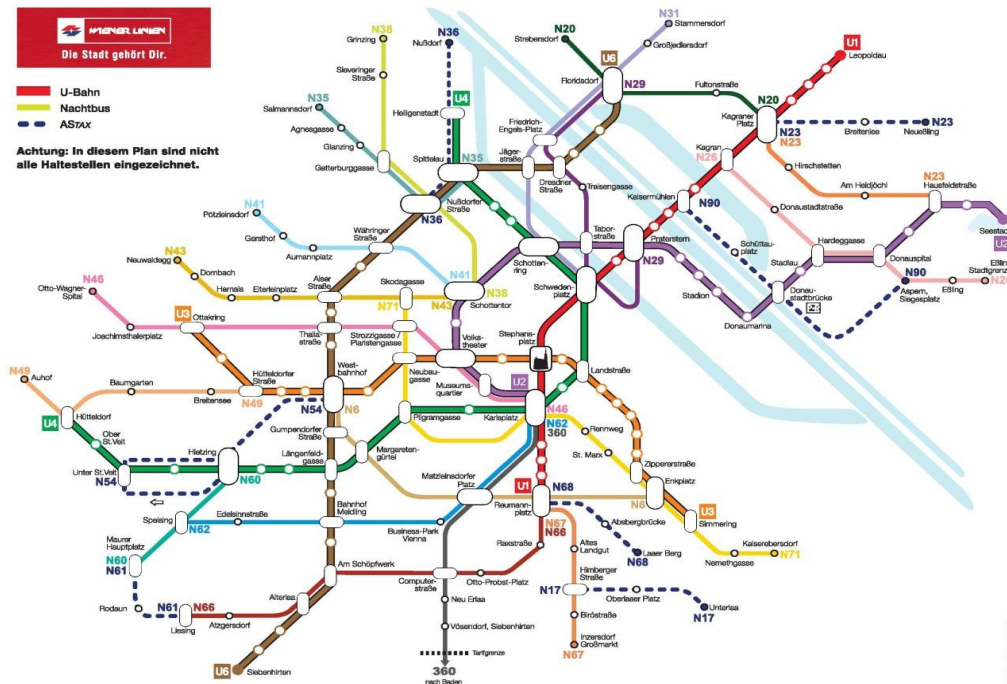
The construction work of the Viennese metro started in the year 1969. Seven years after a first section was opened to the public. Till today, the metro network was extended and will be in the future. In the year 2015 the network consisted of 104 stops, 5 lines (U1, U2, U3, U4 and U6). Construction work for line U5 has started recently and is planned to start its service by the year 2023. The network length is 78.5 kilometres, all districts within the city are accessed and the average distance between the stops is 755 metres. The average travel speed is 32.5 km/h. During the night service 15 minutes headway is available for the users, all lines and sections are included. Complementary to this service a night bus network (30 minutes headway) and a demand responsive night service are operating as feeder and to fill the spatial gaps (see Figure 1). During nights with no night metro service the night bus systems cover the metro line areas as well. This means, 96% of the Viennese population are accessed by the night service within walking distance to the next stop. The additional costs for the metro night service are

calculated with 5.1 Mio. Euros per year and is covered by the city of Vienna based on a grant agreement (Wiener Linien, 2010). Passenger counting takes place at the vehicle doors via infrared technology, which allows a complete counting, but includes double counting of passengers, if they change vehicles or lines during their trips. Results are shown in table 1. It can be seen the share of users of the night services is little above 1% of the number of passenger during the day. The number of passenger is relatively even distributed over the different lines, with line U1 as the one with the highest and line U2 as the one with the lowest number of passengers. Comparing the data of 2014 and 2015, an increase of the number of users of the passenger service can be observed.

Table 1. Demand Data of Viennese Metro (Wiener Linien, 2016b)

	Day service 2015	Night service 2014	Night service 2015	Shares of night service 2015 between lines
U1	126.7 Mio	1.50 Mio	1.60 Mio	24.4%
U2	74.7 Mio	0.98 Mio	1.04 Mio	15.9%
U3	128.8 Mio	1.49 Mio	1.53 Mio	23.3%
U4	108.9 Mio	1.23 Mio	1.21 Mio	18.5%
U6	88.0 Mio	1.25 Mio	1.72 Mio	17.9%
Sum	527.1 Mio	6.45 Mio	7.10 Mio	100%
Night bus service		3.21 Mio	3.24 Mio	
Sum incl. bus		9.7 Mio	10.3 Mio	

Figure 1. The Metro Night Service U## and the Complementary Night Bus System N## (Demand Responsive Services as Dotted Lines) in the City of Vienna (Wiener Linien, 2016a)



As the metro night service is operating approximately 120 nights per year, an average of 50 000 passengers are counted per night, with a peak in the first hour of operation (i.e. 0:30-1:30 hours in the morning). When its operation started in 2010, in order to ensure a high security standard, in every unit two policemen were attending the 22 vehicle units in operation. After its first year of operation without any major security problems this presence was modified, policemen are now more focusing on the stations and its vicinity. Additionally 22 persons from the Wiener Linien staff are present during the service, among others to check the tickets and intervene in any case of incidents. Station managers are present at ten major metro stations. CCTV is active in all stations and vehicles, recordings are stored for 48 hours.

Method of Passenger Survey and Passenger Counting

The passenger survey was carried out in a random selection method with personal interviews. The survey was carried out during 22 nights, 154 interviews were completed. And the statements were weighted based on the passenger counting (age, gender). Persons, who refused the participation, were recorded by age and gender as minimum information. The interview venues were the metro stations within the network. To increase representatively, different stations, nights, night times, weather conditions and metro lines were selected. The operator Wiener Linien signed a letter of agreement allowing carrying out the interviews at the platforms of the stations. Additionally to the demand data of the metro operator a passenger counting took place to observe age class and gender of the passengers for weighting and grossing up of the survey data. For a period of 30 minutes all passengers were counted leaving or entering the metro service. The selection procedure for the stations, time and metro lines followed the same rules as for the passenger survey.

Weighting of Data and Data Structure of Respondents

Comparing the distribution of gender, survey data were weighted according to the passenger counts. The biggest bias was the distribution on gender, as more males refused to participate in the survey than females. Age distribution was more representative but was included in the weighting as well (see Table 2).

Table 2. *Distribution of Age and Gender according to the Passenger Counting and the Survey (Rieder, 2016)*

	Passenger counting (n=430)			Survey (n=154)		
Persons	male	female	total	male	female	total
<20 years	6.74%	5.58%	12.33%	3.25%	5.19%	8.44%
20-30 years	37.21%	24.88%	62.09%	40.26%	45.45%	85.71%
>30 years	17.44%	8.14%	25.58%	3.90%	1.95%	5.84%
total	61.40%	38.60%	100%	47.40%	52.60%	100%

Results of Survey

As expected, the majority of the users of the metro night service are residing in the city itself (see Figure 2). The share of tourists or other visitors from outside the city is ca. 10% in total, mainly origin from the other provinces of Austria. The smallest group are people living in the surrounding. As in most of this area, no or only poor public transport night services exist, obviously the majority of this group use other modes (e. g. private car) for the whole trip and do not use existing park and ride options at the edge of the city. Comparing the professional status of the metro night service users with the total population the bias towards persons in education (which includes students) is obvious (Figure 3). This can be noticed as well, if one takes a look at the age distribution (Table 2). Roughly one third of the metro night service users are employed (those students with an average engagement of more than 15 hours per week are categorized as employed here). Other categories, such as working in the household or retired were indicated not at all. 70% of the metro night service users do not have a car available to be used in alternative to the metro ride, whereas 20.8% stated to have a car available at any time. Nevertheless 73% of the metro night service users possess a driving licence for a car. 27% of those possessing a driving licence are member of a car sharing club. More than 75% of the members of a car sharing club stated, not having used a shared car in the last month.

Figure 2. *Places of Residents of the Metro Night Service Users*

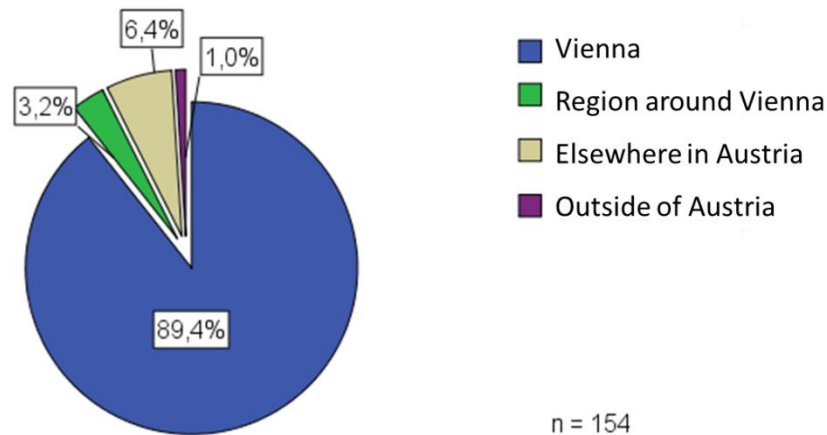
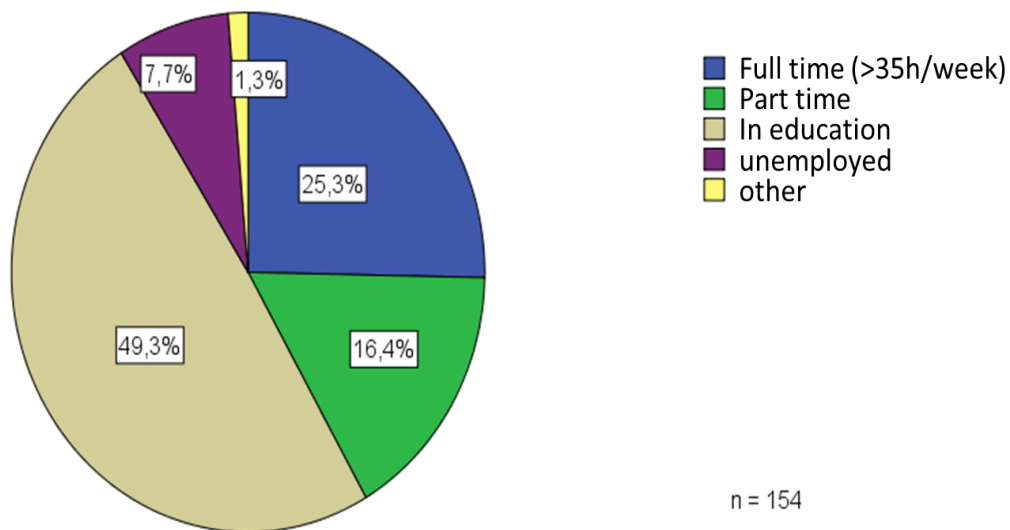
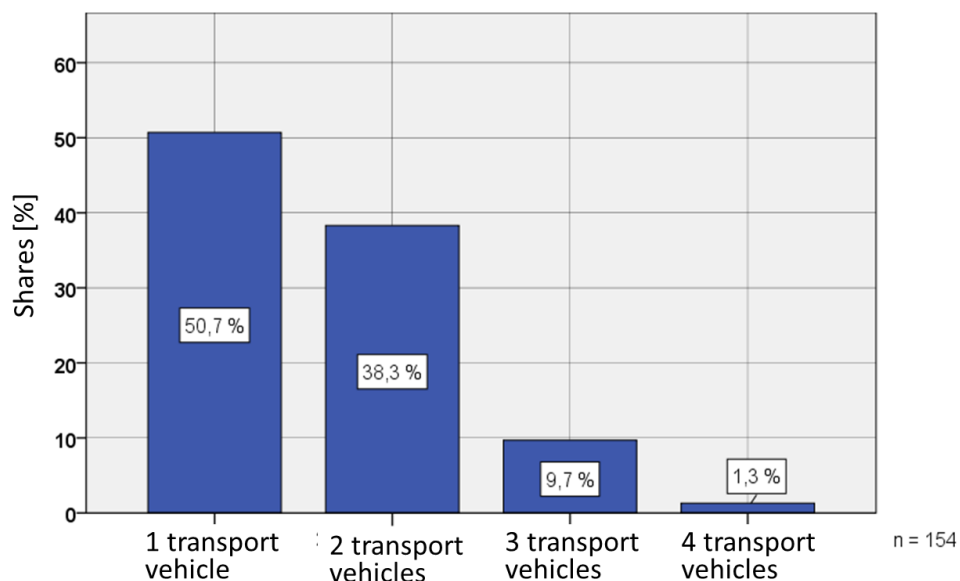


Figure 3. *Professional Status of Metro Night Service Users*



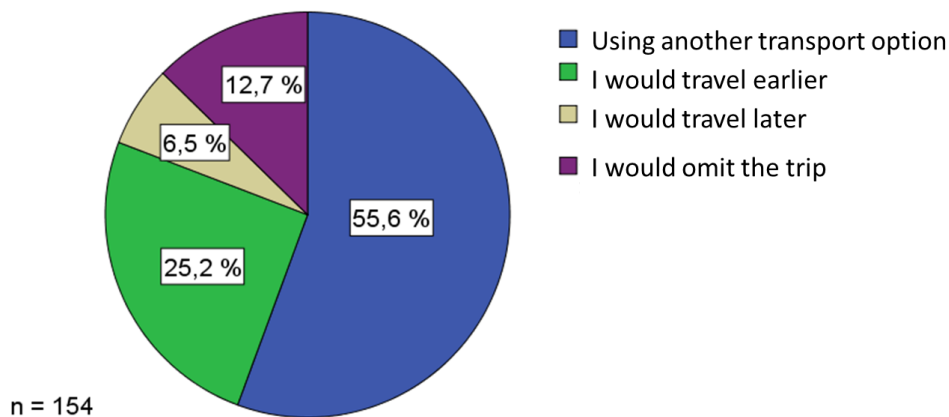
The average walking time of the metro night service users to the first mode other than walking (in most cases the metro) is 5.6 minutes (first mile) and the average walking time towards the destination of the trip is 7.2 minutes (last mile). Approximately the half of the respondents used one transport vehicle on the trip only (i.e. the night metro), another 38.3% have used two different transport vehicles, including another metro line, the night bus service or private modes such as car, motorcycle or bicycle (see Figure 4). With a share of 93.4% trips from and to leisure activities, these is the main trip purpose of the metro night service users, only 6.4% of the trips are work related, no other trip purposes were stated (homebound trips were allocated to the origin purpose of the trip in this distribution).

Figure 4. *Distribution or the Number of Transport Vehicles Used for the Current Trip of the Metro Night Service Users*



Respondents were asked how they would behave, if no metro night service would exist for the current trip. More than half of the respondents stated, they would carry out the current trip using alternative transport options, a quarter stated, they would arrange the activity earlier to be able to use the last metro service of the day time operation, another 6.5% would shift the trip in order to catch the first supply of day time operation in the early morning. 12.7% omit the trip, if no night time metro service would exist (Figure 5). Of those, who have stated to use another transport option 46.3% would use a taxi, 17.6% would walk, 8.9% would use the bicycle, 7.7% would use the car as driver, 6.2% would use the car as passenger, and 4.5% would use a shared car. Beside this, 60% of the respondents stated to have used other transport modes in the night as alternative to a ride with the metro night service in the last month.

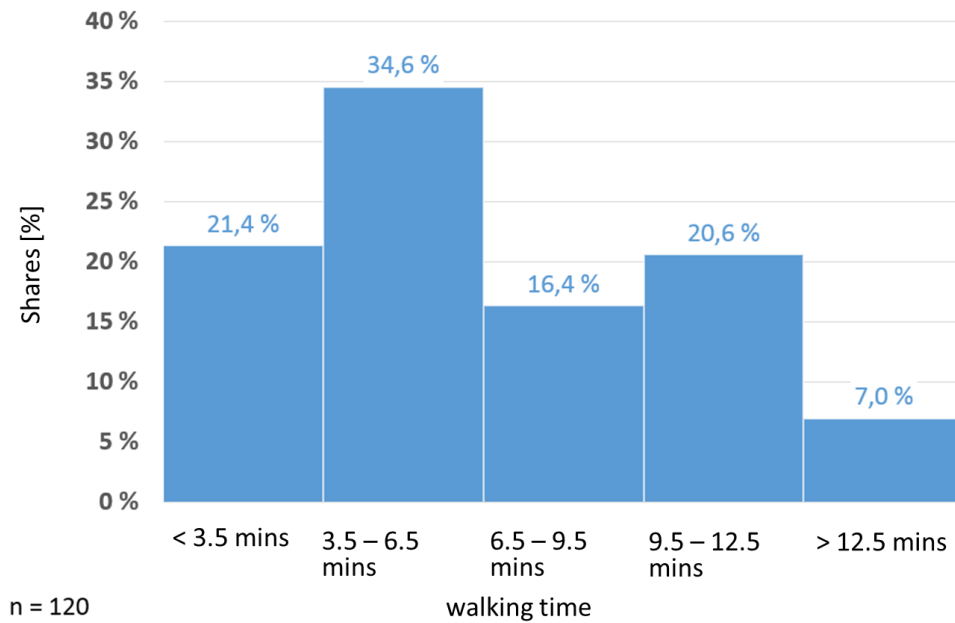
Figure 5. *Distribution of Answers of the Metro Night Service Users with regard to the Question “What Would you Have Done, if Today No Metro Night Service Would Exist?”*



With regard to the trip frequency, the answers differ according to the gender of the respondents. Male metro night service users are more often using the service (22.4% more than 6 times in the last month, 30.7% between 3 and 6 times in the last month). Contrary to this, only 13.6% of the female metro night service users used the service more than 6 times in the last month, and 18.3% between 3 and 6 times in the last month.

Only those respondents residing in the city of Vienna were asked for the walking time between the place of residence and the next metro station. More than 50% stated to live closer than 6.5 minutes walking time to the next metro station (see Figure 6). Of course this is not the average distribution of the total population as more likely those persons living in a bigger distance to the stations more likely will not use the metro night service (or the public transport in general). Two third of the respondents were using a season ticket (one year pass, semester or monthly pass) for the trip, approx. 10% are using a single ticket. Other types of ticket are special youth tickets or touristic tickets for 48 or 72 hours. 81.4% of the users are using a mobile app assisting the use of the public transport, providing real data of arrivals at the stops, time table and routing information.

Figure 6. *Distribution of Walking Time between the Place of Residence and the Next Metro Station of Those Metro Night Service Users Residing in Vienna*



Main reason of using the metro night service are the consumption of alcoholic drinks (64.9%), the cheapest trip option e. g. as possessing a season ticket (44.2%), travelling more independently (43.5%). Only 31.8% see themselves as captive riders with no alternative to travel. Other reasons (ecological aspects, time savings, social interaction during the trip) are of less importance (see Figure 7). Figure 8 and Figure 9 highlights security aspects, if travelling with the night metro service. Again it need to be mentioned, only users were interviewed, which means no information is available, how many potential users do not use the service as feeling unsafe. In the analyses, answers of female and male respondents were segregated. In general, the majority of the users feel safe, if travelling with the metro, male respondents agreed to a higher degree. Approximately a third of the female respondents do not feel safe (in comparison to 21% of the male, see Figure 8). To decrease any possible incidents, some users avoid travelling alone, again roughly a third of the female users and ca. 10% of the male users (Figure 9).

Figure 7. *Distribution of Reasons to Use the Metro Night Service, Maximum of Three Answers Possible, Metro Night Service Users*

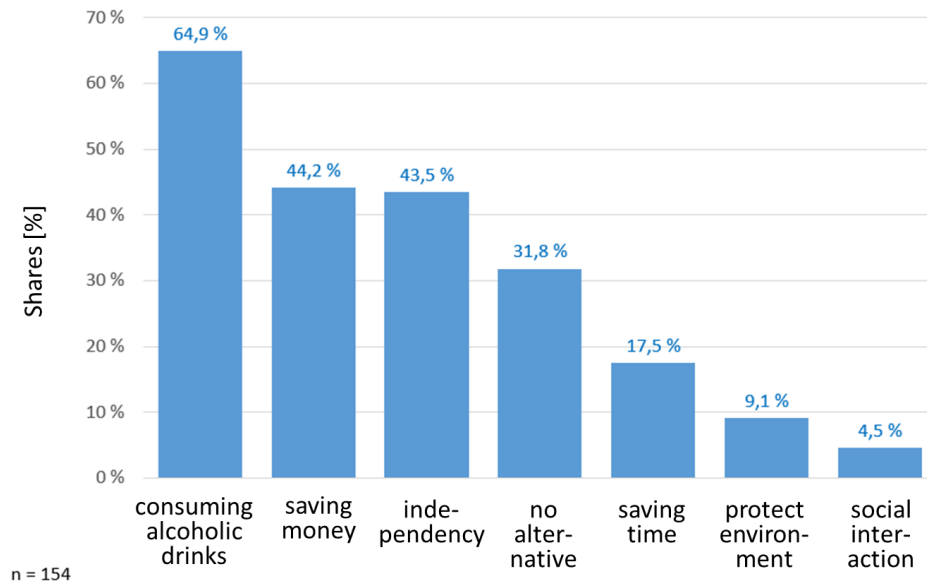


Figure 8. *Distribution of Answers Referring to the Statement “I Feel Secure, if Travelling with the Night Metro Service”, Metro Night Service Users*

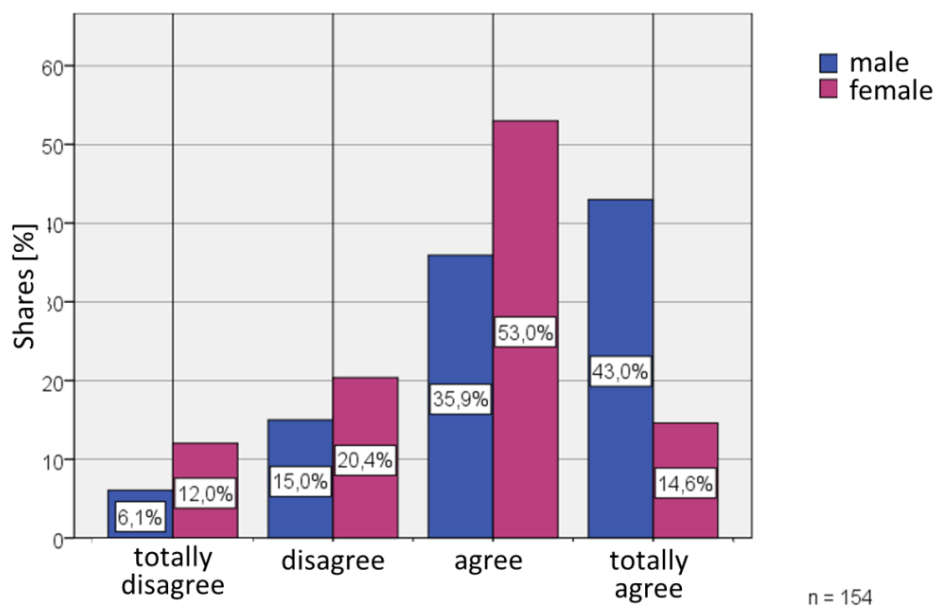


Figure 9. *Distribution of Answers Referring to the Statement “I am Using the Metro Night Service, if Travelling Alone as well”, Metro Night Service Users*

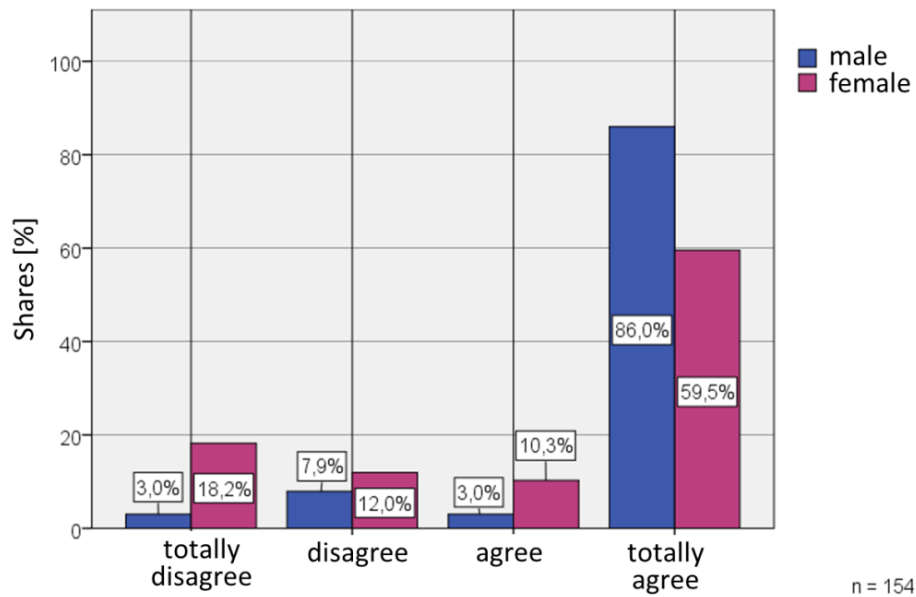
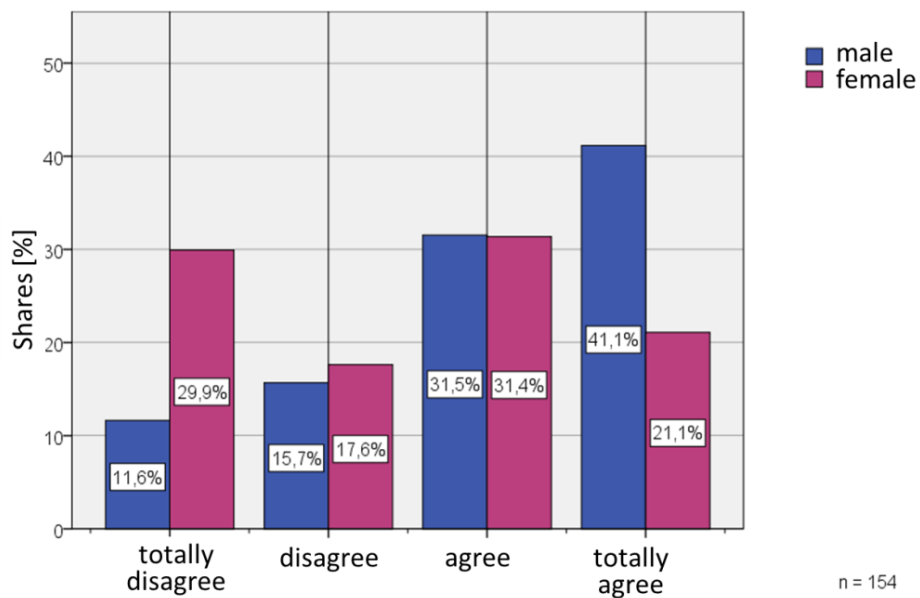


Figure 10 shows some indication with regard to behavioural changes. A clear majority, both male and females agreed to stay longer at activities and to travel later because of the metro night service.

Figure 10. *Distribution of Answers Referring to the Statement “Because of the Night Metro Service, I Stay Longer at my Activities and Travel Later”, Metro Night Service Users*



Cross Correlations

Some possible influences with regard to the frequency of usage were tested with regression analysis, but no significant correlation could be found. There is no correlation between the frequency of usage and the accessibility to the metro stations from the place of residence (in minutes walking time). The usage of mobile apps for (real time) passenger information does not relate with the frequency of usage, but the clear majority of the users are using such an application. Nor the professional status nor the accessibility to a car correlates with the frequency of usage.

Conclusions

This research work was carried out to access better information about the metro night service users and their behaviour. The majority of the users are aged between 20-30 years, there are more male users than females. Most of the users only use the metro night service and do not combine these trips with other means of transport (except walking). Male metro night service users feel safer than female users, although both groups feel safe in the majority. The majority of the users would carry out the trips as well, if no night metro service would be available. Nevertheless many stated to shift their activities in terms of time. Main drivers for the usage of the night metro service are the opportunity of consuming alcoholic drinks and saving money (no additional costs for season ticket holders). Although there is a need for public subsidies for the service, the metro night service is generally perceived as a justified supply in the city. To carry out a total economic cost benefit analyses would be interesting to balance the additional cost of the service with avoided costs especially the reduced accident costs or additional consumer spending at restaurants or bars.

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