Aalto-yliopisto
Aalto-universitetet
Aalto University

Master's Programme in Spatial Planning and Transportation Engineering

Perceived Safety at Metro Stations in the Helsinki Metropolitan Area

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Master's thesis
2025

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Aalto-universitetet
Aalto University

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Title of thesis Perceived Safety at Metro Stations in the Helsinki Metropolitan Area	
Masters' Programme Spatial Planning and Transportation Engineering	
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Collaborative partner Metropolitan Area Transport Ltd	
Date 31.07.2025 **Number of pages** 122 + 25	**Language** English

Abstract

Shifting from private cars to public transit is essential for sustainable, healthy cities. Perceived safety is key to public transport use, as insecurity can lead passengers to choose other transport modes, regardless of actual safety levels. Safety perceptions often differ from objective safety measures, yet they strongly influence travel behaviour and public transport demand. Perceived safety has declined in the Helsinki metropolitan area, with metro stations and shopping centres cited as primary locations of insecurity. Improving perceived safety at metro stations is vital to prevent fear from deterring metro use and to promote sustainable urban development.

This study explored metro passengers' perceived safety at Helsinki metropolitan area metro stations. It investigated how individual factors such as age, gender, previous victimization, frequency of metro use, and residential location, as well as environmental factors such as lighting, cleanliness, maintenance, crowding, services, and station location, affected perceived safety. The study also examined fear of crime and avoidance of metro stations due to safety concerns. Data were collected through a survey conducted in collaboration with HSL utilizing their app and Research Platform, completed by 1,086 respondents.

Previous victimization emerged as the strongest individual predictor of low perceived safety followed by gender. Women with victimization experience formed the most fearful group and were most likely to avoid certain stations. Passengers with mobility limitations also reported somewhat lower perceived safety compared to others. From the environmental factors, poor cleanliness or maintenance, inadequate lighting, and broken infrastructure most negatively impacted perceived safety. Presence of security personnel, visible cameras, and clear signage most effectively improved safety perceptions.

Among stations, Sörnäinen received the lowest safety ratings and was the most avoided. Kontula, Mellunmäki, and Itäkeskus were also perceived as unsafe while Keilaniemi and Koivusaari were rated safest, followed by Lauttasaari, Urheilupuisto, and Tapiola. Stations in Helsinki were perceived as less safe than West Metro stations in Espoo. Location influenced safety perceptions, with stations in areas known for disturbances or negative reputations perceived as less safe.

Keywords perceived safety, metro station, fear of crime, public transport, passenger experience, transit environments, environmental design

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Aalto-universitetet
Aalto University

Tekijä Annika Leinoluoto

Työn nimi Koettu turvallisuus pääkaupunkiseudun metroasemilla

Koulutusohjelma Maankäytön suunnittelun ja liikennetekniikan maisteriohjelma

Valvoja Prof. Marketta Kyttä

Työn ohjaaja Tutkijatohtori Pilvi Nummi

Yhteistyötaho Pääkaupunkiseudun Kaupunkiliikenne Oy

Päivämäärä 31.07.2025 **Sivumäärä** 122 + 25 **Kieli** Englanti

Tiivistelmä

Yksityisautoilusta joukkoliikenteeseen siirtyminen on välttämätöntä kestävien kaupunkien rakentamisessa. Koettu turvallisuus on ratkaisevassa roolissa, sillä turvattomuuden tunne voi vähentää julkisen liikenteen käyttöä todellisesta turvallisuudesta riippumatta. Koettu turvallisuus on heikentynyt pääkaupunkiseudulla, ja juuri metroasemat ja ostoskeskukset koetaan turvattomiksi paikoiksi. Metroasemien koetun turvallisuuden parantaminen metroasemilla on välttämätöntä, jotta pelko ei estä metron käyttöä.

Tämä tutkimus käsitteli metromatkustajien kokemaa turvallisuutta pääkaupunkiseudun metroasemilla. Tutkimuksessa selvitettiin, miten yksilölliset tekijät kuten ikä, sukupuoli, aiempi uhrikokemus, metron käyttötiheys ja asuinpaikka, sekä ympäristötekijät kuten valaistus, siisteys, kunnossapito, ihmismäärä, palvelut, aseman sijainti ja ikä, vaikuttivat koettuun turvallisuuteen. Lisäksi tutkittiin rikollisuuden pelkoa ja metroasemien välttelyä turvallisuushuolien vuoksi. Aineisto kerättiin 1086 vastaajan kyselyllä yhteistyössä HSL:n kanssa hyödyntäen heidän sovellustaan ja Tutkimusalustaansa.

Aiempi uhrikokemus oli vahvin ja sukupuoli toiseksi merkittävin tekijä heikon koetun turvallisuuden ennustamisessa. Uhrikokemuksen omaavat naiset muodostivat pelokkaimman ryhmän ja he myös välttelivät todennäköisimmin asemia pelon vuoksi. Liikuntarajoitteisten matkustajien koettu turvallisuus oli myös jonkin verran muita heikompaa. Ympäristötekijöistä eniten koettua turvallisuutta heikensivät huono siisteys ja kunnossapito, riittämätön valaistus sekä rikkinäiset asiat asemalla. Turvallisuuden tunnetta paransivat eniten järjestyksenvalvojien läsnäolo, näkyvät valvontakamerat ja selkeät opasteet.

Asemista turvattomimmaksi koettiin Sörnäinen, joka oli myös eniten vältelty asema. Turvattomiksi koettiin myös Kontula, Mellunmäki ja Itäkeskus. Turvallisimmiksi asemiksi koettiin Keilaniemi ja Koivusaari, joita seurasivat Lauttasaari, Urheilupuisto ja Tapiola. Helsingin metroasemat koettiin yleisesti turvattomammiksi kuin Länsimetron asemat. Aseman sijainti vaikutti koettuun turvallisuuteen; asemat alueilla, joiden maine on huono tai joissa esiintyy paljon järjestyshäiriöitä, koettiin turvattomammiksi.

Avainsanat koettu turvallisuus, metroasema, rikollisuuden pelko, joukkoliikenne, julkinen liikenne, matkustajakokemus, liikenneympäristöt

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Preface and Acknowledgements

I want to thank me.

I want to thank my employer, Metropolitan Area Transport Ltd, for trusting and believing in me, letting me choose the topic of my study, and funding this work.

I'm also grateful to Aalto University for giving me the time and space to find my career identity, passion, and purpose, and for allowing me to explore topics beyond engineering. Many people at Aalto have contributed to this journey, but especially important have been Marketta Kyttä, whose inspiring work in this field sparked my interest in the topic, and Pilvi Nummi, who guided me throughout the process.

In addition, I want to thank the Helsinki Regional Transport Authority for making it possible to carry out the survey at this scale and for playing a big part in its success.

And finally, thank you to my family, friends, and especially my husband, for always supporting me in everything I do.

Helsinki, 26.06.2025
Annika Leinoluoto

1 Introduction

The feelings of safety and security are the foundation of travellers' needs (Allen et al., 2019; Ceccato, 2013; van Hagen & Sauren, 2014), shaping their decisions even before the journey begins; if a transport mode is perceived as unsafe, travellers seek alternatives or cancel the trip entirely. Safety refers to protection from unintentional harm, such as slips, falls, and accidents, while security relates to the protection from intentional harm, such as theft, harassment, or violence. However, beyond these objective conditions, individuals' perceived safety plays a decisive role in shaping travel behaviour and overall public transport usage, as safety concerns can lead to reduced mobility, avoidance of certain routes or stations, or opting for alternative transport modes, even in cases where objective risks are low (Hagen & Bron, 2014).

There is often a significant gap between actual safety, which can be measured through metrics like accident rates or crime statistics, and perceived safety, which encompasses the subjective, experienced dimension of safety. This perception is shaped by individual factors like emotions, attitudes, past experiences, and socioeconomic characteristics, as well as external environmental factors, such as the built environment, level of maintenance and cleanliness, and various societal factors. These elements interact to shape how passengers experience metro stations and whether they feel secure while waiting, boarding, and traveling. This gap between safety and perceived safety comes from people's tendency to rely on their feelings rather than statistical analyses when they judge risks in their daily lives (Loewenstein et al., 2001; Raue et al., 2019). In criminological literature, the so-called fear paradox has been debated, suggesting that those who are statistically least likely to become victims of crime are often the most afraid (Hollway & Jefferson, 1997; Stanko, 2012). It has been suggested that those less capable of defending themselves (such as women and older individuals) or recovering from crime (such as the economically disadvantaged) tend to be more afraid, even without a statistical basis for their fear. This highlights the need to take perceived safety seriously in its own right, regardless of its relationship to measurable risk levels. *"Fear does not fit into the dichotomy of rational and irrational. Fear can be understandable from many different perspectives, and it is a problem for the person experiencing it, regardless of its relation to calculated risk"* (Koskela, 2009, p. 89).

Perceived safety lacks a clear definition in research and is often equated with fear of crime or left undefined, leading to varying interpretations across cultural contexts. However, it also encompasses broader factors such as traffic safety, environmental behaviour, and social trust, and should not be narrowly confined to fear of crime. In this study, perceived safety is conceptualized broadly, encompassing multiple dimensions. It includes both fear of crime, such as concerns about theft, harassment, or violence in metro stations, and fear of accidents, such as slipping, falling, or getting injured while navigating the station. Additionally, it accounts for general feelings of anxiety, stress, unease, and restlessness that may arise from being in public transport environments. Concerns related to traffic safety were excluded from the scope of this research, as the focus is limited to metro station environments rather than the metro journey itself.

The right to mobility is a fundamental right, but it can infringe upon other rights, such as the right to health and the right to a good quality environment. One of the primary contributors to this conflict is the high consumption of private vehicles in urban areas, which is two to four times greater than that of public modes of transport. Therefore, increasing the share of public transport in urban mobility is essential for achieving sustainable cities. (Gentile & Nökel, 2016). Currently, cities are predominantly designed around cars, and this car-centricity is responsible for air pollution, congestion, noise pollution, traffic accidents, and unhealthy lifestyles. These consequences infringe upon other fundamental rights, such as the right to a healthy and high-quality environment, which are just as important as the right to mobility. Therefore, in order to achieve social and ecological sustainability, cities have an obligation to use urban planning, legislation, and policy measures to shift urban mobility toward more sustainable options, particularly rail-based public transport, to ensure the realization of these rights. It is crucial to eliminate any factors that compel individuals to choose private vehicles over environmentally friendly alternatives such as walking, cycling, or public transport. This serves as the motivation for this research: to ensure that poor safety perceptions do not deter people from using public transport.

Greenhouse gas emissions are widely recognized as being responsible for global climate change, with CO_2 contributing 85% of the total greenhouse gas emissions in terms of produced volume (Gentile & Nökel, 2016). In Finland, transport accounts for about 20% of CO_2 emissions, with road transport making up approximately 95% of that (Suomen virallinen tilasto (SVT), 2021; Traficom, 2024a; VTT, 2021). The carbon footprint of Finnish mobility is largely driven by private car use, which accounts for over half of road transport emissions (VTT, 2021). Walking and cycling are the most sustainable transport modes in terms of both climate impact and public health, followed by rail transport, which has the lowest emissions among public transit options (Brand et al., 2021; European Environment Agency, 2020). From an energy perspective, railway transport always consumes less per ton in movement than road transport, due to lower mechanical resistance (Gentile & Nökel, 2016).

Metropolitan Area Transport Ltd (Pääkaupunkiseudun Kaupunkiliikenne Oy, later referred to as KLOY), responsible for facilitating and developing public transport in the Helsinki metropolitan area, is actively working towards carbon neutrality by 2030 through various sustainability initiatives. The Helsinki metro operates entirely on renewable electricity, eliminating exhaust emissions completely (Salojärvi, 2021). To further reduce its carbon footprint, KLOY is enhancing energy efficiency in its operations, infrastructure, and construction. Measures have included installing solar power plants at metro depots, optimizing train driving techniques to reduce energy consumption, and using low-carbon concrete in construction projects. By the end of this year, KLOY will achieve zero emissions from direct operations, including energy consumption in transport services and facilities, as well as fuel use in company-owned vehicles and machinery, and indirect emissions from transport operations and energy consumption in facilities. By 2030, KLOY will reach full carbon neutrality by further eliminating indirect emissions from purchased goods and services, logistics, waste management, business travel, commuting, decommissioning, and demolition, while offsetting any remaining unavoidable emissions. (KLOY, 2025).

Shifting from private cars to public transport is essential in creating more sustainable and healthier cities, not only by reducing emissions but also by improving urban air quality and overall liveability. Despite these benefits, private cars still dominate mobility in Finland: Between 60% and 85% of average daily travel distance is covered by cars, while public transport accounts for 15% in Helsinki and less than 10% in all other urban areas (Liikennevirasto, 2018; Traficom, 2024b). These figures highlight the urgent need for policies and infrastructure changes that support a transition to more sustainable transport options.

In addition to aforementioned benefits, public transport plays a crucial role in improving transport safety, as there is an inverse relationship between public transport usage and traffic fatalities (Gentile & Nökel, 2016). Ensuring that public transport, particularly rail-based systems, is accessible to everyone is crucial for public health, safety, and environmental sustainability. This accessibility includes guaranteeing that travellers feel safe throughout the entire journey, including the time spent at metro stations.

Based on surveys on perceived safety, conducted by the City of Helsinki, it is known that poor safety perceptions in the city are particularly concentrated around rail transport stations and shopping centres (Keskinen & Laihinen, 2017). Among the places mentioned by Helsinki residents as frightening, 68% of the responses focused on shopping centres or train and metro stations (Väliniemi-Laurson & Rönnberg, 2019). Areas surrounding the central railway station and its metro station, as well as the metro station in Sörnäinen, were repeatedly reported as unsafe environments in previous surveys (Keskinen et al., 2023). The most unsafe areas identified in surveys done by Helsinki Regional Transport Authority's (Helsingin Seudun Liikenne, later referred to as HSL) are Kamppi, Kallio, Sörnäinen, and Itäkeskus, all of which have metro stations (HSL, 2024b).

Overall, perceived safety in Helsinki has generally decreased in recent years (Helsingin kaupunki, 2024, 2025c; Mustonen, 2025). This same trend has been observed in commuter trains, where passengers' feelings of insecurity have steadily increased since 2023 (Kivinen, 2025). Harassment experienced in public spaces is especially more common in Helsinki than elsewhere in Finland (Helsingin kaupunki, 2025c). Furthermore, differences in safety perceptions between different population groups have increased (Helsingin kaupunki, 2025a; Mustonen, 2025). Women tend to be more afraid than men, and an individual's experience of societal advantage or disadvantage has been shown to be linked to their perception of safety, as has age, with differences between residential areas also increasing (Helsingin kaupunki, 2025a, 2025b; HSL, 2024b).

Therefore, given that safety perceptions in Helsinki have deteriorated and insecurity appears to be concentrated specifically around metro stations and shopping centres, many of which are connected to metro stations, it is crucial to study perceived safety at metro stations in the Helsinki metropolitan area. Since differences in feelings of safety among various population groups have increased as well, this research will also focus on examining how safety perceptions at metro stations differ among different population groups and investigating whether there are certain groups that fear more than others, thus requiring prioritization in efforts to improve perceived safety at metro stations.

1.1 Motivation for Research

I work with KLOY in their asset management unit, more specifically in a team responsible for managing properties such as metro stations. One of my responsibilities is handling customer feedback, which involves reviewing passengers' experiences and suggestions for improvements. Engaging with these customer perspectives alongside a university course on perceived safety in urban planning, led by my supervisor, inspired my thesis topic. I wanted to study more precisely the perceived safety of our metro stations, who experiences fear, how it influences passengers' travel behaviour and in what ways, whether poor safety perceptions deter metro use and what improvements passengers see as most effective. My ultimate goal is to produce knowledge about the current situation to provide KLOY with a solid knowledge base to support future renovations and construction projects. I will also offer recommendations to KLOY on actions that could be taken to ensure all passengers feel safe and that no one is forced to choose another mode of transport due to safety concerns.

This study was entirely designed and conducted by me, including the creation of the survey used to collect data on passengers' safety perceptions and the factors influencing them. I proposed this topic to my employer, KLOY, who enthusiastically agreed to fund it, as they share my perspective on the importance of perceived safety in public transport. Beyond funding this thesis, KLOY provided access to their internal system data used in the study, including information on completed and planned renovations at metro stations, daily maintenance records, and data on disturbances, incidents, and actions taken by security personnel at metro stations. HSL's contribution was limited to the technical execution of the survey, utilizing their Research Platform to distribute it to metro passengers via the HSL app. This thesis is conducted for KLOY as the commissioning entity, with the purpose of directly benefiting them. As I continue my career with KLOY after graduation, I aim to further these efforts collaboratively, ensuring that all metro users experience a safe and secure travel environment.

1.2 Scope and Research Questions

This study focuses on perceived safety at metro stations in the Helsinki metropolitan area and the various factors influencing it. Perceived safety is understood as a multidimensional concept that goes beyond simply the fear of crime. It includes all concerns passengers may have about their safety when at a metro station, such as fear of crime, fear of accidents, general anxiety, stress, unease, restlessness, or any other negative emotions that make individuals feel unsafe. The study emphasizes passengers' subjective experiences, including their feelings, perceptions, and personal judgments, rather than objective safety indicators like crime statistics.

The scope of the research is primarily limited to metro station premises, including the indoor environment and immediate surroundings, such as nearby services, or lack of them, that may influence perceived safety. Although it does not examine safety perceptions during the journey to the station or inside metro trains, the study includes certain contextual factors related to the station's location, such as the area's income level and general reputation, to explore potential associations.

The factors analysed in this study include both individual characteristics of metro passengers and environmental features of the station premises. Particular attention is given to aspects that can be influenced by KLOY, the property owner and operator.

The aim of the research is to provide KLOY with practical recommendations on how to improve perceived safety at metro stations, identify which stations would benefit most from improvements, determine what kinds of measures might be most effective from the viewpoint of passengers, and highlight which groups of passengers are most affected by low safety perceptions and should therefore be prioritized when planning future actions.

The research questions this study aims to answer are:

1. **What individual, environmental, and situational factors influence metro users' perceived safety at metro stations?**

I study how characteristics of passengers themselves and the conditions they encounter at metro stations shape their perceptions of safety. The individual factors examined in this study include age, gender, mobility limitations or the use of mobility aids, previous experiences of victimization at a metro station, frequency of metro use, and the general residential area of the respondent.

The environmental factors considered in this study include station lighting, presence of security cameras and security personnel, signage and timetables, the functionality of elevators and escalators, cleanliness and overall maintenance of the station, ongoing renovations, and the music or nature sounds played in the station environment.

The situational factors examined include the number of people present at the station and the type of users each metro station and its surroundings attract. I also analyse security staff and police records of disturbances at metro stations to determine whether those with the lowest perceived safety also have the highest number of reported incidents, to determine whether perceived safety corresponds with actual safety-related events at the stations.

2. Are there metro stations perceived as unsafe, and how could their safety perceptions be most effectively improved?

I aim to identify which metro stations are generally perceived as less safe by passengers, and whether any specific station stands out due to particularly negative safety experiences. I also explore how perceived safety could be improved by examining various factors present at metro stations and their impact on passengers' perceived safety. This helps determine which factors are considered most influential, and how they could be addressed at the stations with the poorest safety ratings. These findings form the basis for the recommendations provided to KLOY.

This study also examines different demographic groups to identify who feels the most unsafe. Based on this analysis, I consider whether certain groups should be prioritized in safety improvement planning, by implementing the measures they find most effective.

3. How do metro stations' age, services and location relate to safety perceptions?

I examine how broader physical and locational features of metro stations relate to perceived safety. I aim to identify whether a station's age or location are linked to lower perceived safety. I examine whether stations are connected to shopping centres and what types of services are available at the station and its immediate vicinity, and their relation to safety perceptions. I also explore whether the reputation and median income level of the area surrounding a station influence how safe the station is perceived to be, and in what ways.

2 Background and Previous Research

2.1 Importance of Safety Perceptions in Public Transport

Perceived safety is fundamental to urban mobility, societal participation, and overall quality of life (United Nations, 2017). Concerns about safety often lead urban residents to isolate themselves from public spaces and services, limiting their engagement with city life and reducing the liveability of urban areas (Deníz, 2019). Safety and security, encompassing protection from both crime and accidents, are essential criteria for evaluating the quality of public transport (Dragu et al., 2013; Transportation Research Board, 2003). When travellers' requirements are represented by a pyramid similar to Maslow's hierarchy of needs (Maslow, 1954), safety and security form the foundation at the base of the pyramid. Without these, travellers are unable to appreciate higher-level qualities such as speed, comfort, and ease of travel (Allen et al., 2019; van Hagen & Sauren, 2014). Thus, if travellers perceive a trip to be unsafe or unreliable, they are likely to avoid it or choose a different mode of transport, as safety is a prerequisite for making travel decisions (Hagen & Bron, 2014).

Public transport is a cornerstone of equitable and sustainable urban mobility. Many urban residents depend on public transport for their mobility, including **"transit captives"**, individuals who have no reasonable alternative to public transport due to economic, physical, or social constraints. Unlike those who choose public transport for convenience or environmental reasons, transit captives are reliant on these systems regardless of quality, reliability, or safety. This group often include women, low-income individuals, and those with limited mobility. This group is disproportionately represented among those who feel unsafe compared to individuals with other transport options and should therefore be prioritized in transport planning to ensure equal access to mobility and participation in urban life (Ceccato, 2017a; Ceccato et al., 2022; Guimarães et al., 2019; Yu & Smith, 2014).

When passengers feel more secure while traveling and waiting at transport stations, ridership can increase by up to 30%, with some studies indicating a rise of at least 10%, as research has shown that safety concerns are directly linked to public transport usage (Badiora et al., 2020; Cozens et al., 2004; Cozens & Van der Linde, 2015; Crime Concern, 2004; Delbosc & Currie, 2012). Fear of crime, particularly at night, can lead passengers to avoid certain routes, restrict travel to daytime hours, or stop using public transit altogether if alternatives are available (Cozens et al., 2003a; Crime Concern, 2004; D'Arbois De Jubainville & Vanier, 2017). Unsafe transit environments can also push users toward less sustainable options, such as private cars, undermining efforts to promote environmentally friendly mobility and sustainable cities (Ceccato et al., 2022; Ding et al., 2020; UN-Habitat, 2019).

Public transport stations are particularly susceptible to criminal activity and are often places where safety concerns are most pronounced. These environments are inherently prone to crime due to the high volume of people, and the specific physical design of stations. Metro stations bring together large crowds, especially during peak hours, increasing the number of potential victims for offenders. The crowded nature of these spaces makes it easy for offenders to blend in, providing opportunities to commit crimes such as pickpocketing or groping. The open and highly accessible design, with multiple exits, allows offenders to escape unnoticed, making it difficult to detect or respond to criminal activity. Research indicates that transport stations are more prone to crime such as theft, violence, harassment, hate crimes, aggressive panhandling, acting as “crime generators” or “crime attractors” due to their social and physical characteristics. This increased criminal activity greatly affects passengers' perceived safety. (Block & Davis, 1996; Brantingham & Brantingham, 1995; Brantingham & Brantingham, 1993; Ceccato et al., 2022; Clarke, 1996; La Vigne, 1997; Levine et al., 1986; Smith & Cornish, 2006; Strandbygaard et al., 2022; Sundling & Ceccato, 2022).

2.2 Design Frameworks to Improve Perceived Safety

The design of public transport stations and the surrounding built environment significantly influence safety perceptions (Cozens, 2002; Cozens et al., 2004; Cozens et al., 2003a, 2003b; Delbosc & Currie, 2012; Gilling, 1997; Schmucki, 2002; M. J. Smith, 2008; Smith & Clarke, 2000; Vilalta, 2011). Not only can good design improve perceived safety and reduce the fear of crime, but it can also lead to an actual reduction in crime rates. One of the most commonly used approaches to reduce crime and fear of crime in and around public transport stations is **Crime Prevention Through Environmental Design** (CPTED) (Batley et al., 2012; Carr & Spring, 1993; Cozens, 2002; Cozens et al., 2004; Cozens et al., 2003a, 2003b; La Vigne, 1996; La Vigne, 1997; Loukaitou-Sideris & Banerjee, 1994).

CPTED was first introduced by Clarence Ray Jeffery in **1971** (Jeffery, 1971). The core principles of this approach were summarized into four strategies: surveillance, access control, territoriality, and maintenance (Cozens et al., 2005; Crowe & Institute, 1991; Shach-Pinsly, 2019). Surveillance involves designing spaces to enhance visibility, increasing the likelihood that potential offenders will be observed, by, for example, focusing on lighting, maintaining clear sightlines, and using surveillance cameras (Cozens & Van der Linde, 2015; Ziegler, 2007). Access control refers to mechanisms that regulate who enters and exits a site or building, using methods such as fencing, walls, and controlled entry systems (Atlas, 2008; Cozens et al., 2005). Territoriality fosters a sense of ownership and responsibility among users by clearly defining spaces through signage and barriers that distinguish between public and private areas, encouraging individuals to intervene when witnessing a crime and leading offenders to perceive a higher likelihood of being observed and reported (Atlas, 2008; Cozens & Van der Linde, 2015; Newman, 1973).

Maintenance ensures that spaces remain clean, orderly, and functional, conveying the message that the area is cared for and actively monitored, which can deter vandalism and other forms of crime.

An alternative framework for understanding crime is **Routine Activity Theory** (RAT), introduced by Cohen and Felson in **1979**. RAT states that crime is more likely to occur when three key elements converge: a motivated offender, a suitable target or victim, and the absence of a capable guardian (Cohen & Felson, 1979). RAT suggests that in order to decrease crime, motivated offenders must be discouraged by promoting guardianship, and this can be achieved with ensuring a space has legitimate routine activities; "recurrent and prevalent activities (such as grocery shopping and commuting) which provide for basic population and individual needs" (Cohen & Felson, 1979). There is evidence to suggest that spaces encouraging routine activities not only have lower crime rates but are also perceived as safer (Branas et al., 2018). Another study has identified the positive relationship among legitimate routine activities, increased guardianship, and perceived safety (Hollis et al., 2013). People in protected spaces with increased guardianship have lower uncertainty, receive more information, and feel more powerful, leading to higher levels of perceived safety (Nasar & Bokharaei, 2017; Nasar & Fisher, 1993).

However, RAT is not without its critiques. A key limitation of RAT is that it does not clarify which specific routine activities help reduce crime risk or how the social context of particular urban spaces contributes to crime rates (Jiang et al., 2018). By emphasizing situational factors, the theory overlooks broader structural and societal influences on crime. Additionally, the theory has been criticized for not accounting for the unequal and non-random distribution of motivated offenders, vulnerable victims, and capable guardians in our society, suggesting that probability is a factor that should also be considered. Moreover, individuals perceive risks differently depending on the social conditions they encounter during their routine activities (Pratt & Turanovic, 2016). Research shows subjective feelings of safety and insecurity to be highly situational and related to individuals' routine daily activities (Doran & Burgess, 2011; Solymosi et al., 2015). This variability in risk perception highlights how RAT overlooks the significance of the context in shaping individuals' perception of safety, which can be influenced by the type of routine activities and the social context they interact with, in addition to RAT ignoring the probability factor in the three elements: a motivated offender, a suitable target or victim, and the absence of a capable guardian.

Another influential crime prevention and safety perception framework used in urban planning is Wilson and Kelling's **Broken Windows Theory** (BWT), introduced in **1982** (1982). BWT highlights the importance of addressing visible signs of disorder to give the impression that a space is looked after and cared for, thereby discouraging criminal activities. BWT suggests that disorder in the environment signals that a space is neglected, and that the community is not actively maintaining order in the area. Perceptions of disorder mainly stem from objective signs such as graffiti, litter, vandalism, and broken or unrepaired features (Osgood et al., 1996; Sampson &

Raudenbush, 2004; Seymour et al., 2010; Troy et al., 2016). This type of disorder has been shown to encourage deviant and criminal behaviour, causing average citizens to withdraw, which can accelerate neighbourhood decay and diminish quality of life (Keizer et al., 2008; O'Brien, 2015).

In addition to fostering criminal activity, disorder also significantly influences people's perceptions of safety. Visible signs of disorder are more strongly linked to people's fear of their environment than actual crime rates or victimization risks (Hinkle & Yang, 2014; Skogan, 2012). Prior studies have theorized that disorder is associated with poor safety perceptions and fear of crime because it gives the impression that no one cares about the space, thus lowering the perceived cost of committing crimes, making people feel threatened and perceiving local safety as low (Hinkle & Yang, 2014; Jiang et al., 2018; Kotabe, 2014; O'Brien et al., 2014). This relationship between disorder and perceived safety is cyclical in a sense that disorder reduces perceived safety, poor perceived safety leads people to avoid certain spaces, avoidance causes further neglect, increasing disorder, ultimately creating a cycle of crime and neglect (Foster et al., 2014; Welsh et al., 2015). To break this cycle, BWT suggests that visible signs of disorder must be removed, and signs of order need to be added. By changing the physical appearance of a space, a positive social message can be delivered, improving perceptions of safety.

While BWT has been widely accepted and applied in urban planning, some studies argue that the theory oversimplifies the relationship between disorder and crime, suggesting that environmental disorder alone is not a reliable indicator of crime risk or fear of crime, but instead assert that the social conditions of the environment are the main drivers of deviant behaviour and crime (Gau & Pratt, 2010; Taylor, 2001). Additionally, a lack of social cohesion has been found to be more closely associated with violent crime than physical disorder (O'Brien, 2015).

Over time, the first mentioned CPTED has evolved into a more comprehensive approach, often referred to as **the second generation of CPTED**, which emphasizes social cohesion and community engagement (Saville & Cleveland, 1997). This approach recognizes that physical design alone is insufficient; focusing on social atmosphere is also crucial for enhancing perceptions of safety. It encourages community participation through well-designed public spaces and supports local activities that bring people together, thereby enhancing natural surveillance. Natural surveillance increases "eyes on the street" by relying on everyday people rather than just security professionals, heightening the perceived risk of being observed and deterring criminal behaviour. Recent advancements in CPTED theory incorporate seven key concepts: territoriality, surveillance, image management, activity support, access control, target hardening, and geographical juxtaposition (Cozens, 2016; Cozens & Van der Linde, 2015). Image management focuses on creating a clean and well-kept environment that appears supervised and cared for. This enhances perceptions of safety and deters criminals (Wilson James & Kelling George, 1982). Actions such as the rapid removal of graffiti and the prompt repair of vandalism contribute to this sense of order and control (Smith & Clarke, 2000; Vilalta, 2011). Activity support aims to encourage legitimate activities in public spaces to naturally deter criminal behaviour by thoughtfully designing urban spaces and using local events and functions to attract legitimate users. This increases natural surveillance, making criminals less likely to offend due to the increased risk of being seen (Atlas, 2008). Target hardening aims to make criminal activity more difficult at the building scale by using stronger doors and windows, as well as more efficient locks and alarms, thereby increasing the effort required to commit crimes (Atlas, 2008; Gilling, 1997; Ziegler, 2007). Geographical juxtaposition refers to the influence surrounding land uses and activities have on safety and emphasizes the importance of strategically aligning the built environment with its surroundings and spatial dynamics to enhance natural surveillance and decrease opportunities for crime. However, since the influence of the surrounding environment is often overlooked in CPTED literature and in the design of urban spaces, it is possible that the surroundings of public transport stations significantly influence safety perceptions, a view supported by research in environmental criminology (Bottoms & Wiles, 1997; Cozens, 2016; Cozens, 2011).

2.3 Previous Studies

Ceccato, Gaudelet, and Graf (2022) conducted a systematic review of transit safety research, analysing English and French literature from 1970 to 2020. While studies on this topic date back to the early 1970s, the field gained momentum in the mid-1990s alongside developments in criminology, psychology, urban planning, and architecture. Research expanded steadily, peaking after the 2010s and covering an increasingly diverse range of topics, with a growing emphasis on perceived safety. Initially, studies primarily examined crime and victimization, but over time, the focus shifted towards perceived safety, particularly concerning gender and the intersectionality of safety across different social groups. This change reflects a growing recognition of the critical importance of individuals' perceptions of safety in transit environments and their influence on various aspects of travel behaviour, as well as on the planning, organization, and operation of public transport.

Research literature focusing on safety perceptions or fear of crime can be divided into two main groups. On one hand, focus has been on examining *who* is afraid, studying the characteristics of individuals or groups that feel unsafe. On the other hand, research has focused on *where* fear is experienced, emphasizing the importance of context. This approach has directed attention to the built environment, public transport spaces or residential neighbourhoods and the communities that inhabit these areas. (Brunton-Smith & Sturgis, 2011; Hale, 1996; Kemppainen et al., 2014).

A significant trend in recent research is the heightened focus on women's transit safety, along with broader examinations of passenger experiences, including those of "transit captives." Common themes in the literature include fear of crime, anxieties related to surveillance, and the "whole journey approach," which considers safety throughout the entire trip. The review identified five key research domains, which are: the relationship between transit environments and various types of crime, safety perceptions of public transport users, temporal aspects of crime and perceived safety, the intersection of technology and safety, and management practices related to crime and safety interventions. Today, transit safety has evolved into an interdisciplinary field involving sociologists, criminologists, urban planners, engineers, and other experts, all contributing to a deeper understanding of perceived safety. These domains underscore the complex interplay between perceived safety and the physical and social dimensions of transit environments, highlighting the evolving focus of transit safety research on the subjective experiences of users.

2.3.1 Individual Factors

A substantial body of research in both criminology and transport literature has examined factors that make people more or less likely to feel safe in various situations. Research has consistently shown that individual factors, such as demographics, psychological traits, and socioeconomic status, significantly influence safety perceptions. Scholars find that for example women, older adults, people with disabilities, those in poor health or economic disadvantage, and previous crime victims are more likely to be concerned about their personal safety and report higher levels of fear of crime (Alexander & Pain, 2012; Box et al., 1988; Crime Concern, 2002, 2004; Currie et al., 2010; Garofalo & Laub, 1978; Iudici, 2015; Iudici et al., 2017; Levine et al., 1986; Lynch & Atkins, 1988; Pantazis, 2000; Ross & Jang, 2000; Sham et al., 2012; Smith & Pain, 2008; Yates & Ceccato, 2020). Individual factors also affect how safety and security measures are perceived, as this varies between individuals (Coppola et al., 2021).

Some studies have shown that perceived and actual crime rates are correlated (Loukaitou-Sideris et al., 2009), while other studies have found that these two factors do not always align when it comes to how individuals experience safety. In fact, research has demonstrated that subjective perceptions of safety and crime tend to have a greater impact on satisfaction than actual crime statistics (Dassopoulos & Monnat, 2011; Hipp, 2009). Certain demographic groups tend to fear crime in public spaces more, even if they are statistically less likely to be victims, such as older adults who often experience heightened anxiety about crime, which can lead to social isolation (Crime Concern, 2004; Feltes, 2003).

In some studies, individual factors such as demographic variables have been shown to be more important than crime-related, psycho-social variables, or environmental factors like the characteristics of stations and their surroundings in predicting feelings of fear and the likelihood of victimization (Toseland, 1982).

- **Gender**

Research shows that among the various individual factors, gender has a significant influence on safety perceptions and fear. Studies worldwide show that women declare lower safety perceptions than men (Ceccato, Langefors, et al., 2021; Chowdhury & Van Wee, 2020; Lois et al., 2018; Ouali et al., 2020; Stark & Meschik, 2018; Sundling et al., 2014; Wayland et al., 2022; Zegras et al., 2015) and are much more fearful than men when it comes to fear of crime (Day, 2001; Gordon). This effect is well-documented, with Ceccato et al. (2022) reviewing five decades of English and French literature on transit safety and finding 100 publications showing women feel less safe than men while transiting, with some research arguing that women feel three times less safe. This trend is also evident in rail-based environments, where studies often focus on gender differences, finding that women feel more unsafe than men when transiting (Ceccato, 2013; Ceccato, Langefors, et al., 2021; Ceccato & Loukaitou-Sideris, 2022; Cheng, 2010; Coppola & Silvestri, 2020; Cozens et al., 2003a, 2003b; Kennedy, 2008; Libardo & Nocera, 2012; Lois et al., 2018; Ouali et al., 2020; Reichow & Friemel, 2020; Santoro et al., 2020; Shirgaokar, 2019; Vilalta, 2011; Zegras et al., 2015). Customer satisfaction data from 28 world cities (2009-2018) showed that in metros, women are 10% more likely than men to feel unsafe (Ouali et al., 2020), and in rail stations, women are over twice as likely to feel unsafe compared to men (Ceccato, Sundling, et al., 2024). One study found however that in the context of train transit, the gender difference was not significant (Yavuz & Welch, 2010).

Transgender and gender-nonconforming individuals feel particularly unsafe and fear the reactions of other passengers (Lubitow et al., 2020; Nourani et al., 2020), often experience harassment (Lubitow et al., 2020) and high rates of violence (Browne & Lim, 2010; Doan, 2010; Gordon & Meyer, 2007; James et al., 2016; Valentine, 2007), which challenges their access to safe public spaces and transport. Passengers identifying as LGBTQI+/Non-binary/Other run a 3.4 times higher likelihood of feeling unsafe at the station than the other passengers, and are largely more victimized; 54% more likely compared to women and 135% more likely compared to men (Ceccato, Sundling, et al., 2024).

One study noticed that the prospect of harassment or violence on public transport are lessened for those transgender and gender nonconforming individuals who are being read by others as white and as a man (Lubitow et al., 2020). These findings underscore how perceived gender presentation and race intersect with gender identity to shape experiences of safety. While previous research has established that women generally feel less safe in transit environments than men, and that transgender and gender-nonconforming individuals report high levels of fear and victimization, it is particularly those perceived as feminine or as gender minorities who are most affected. A recent Swedish study found that women who identify as LGBTQI+ report the highest levels of fear in transit environments, whereas LGBTQI+ men do not exhibit the same pattern. In fact, men overall, regardless of LGBTQI+ identification, reported feeling the safest of all travellers (Ceccato, Gliori, et al., 2024).

Gender also influences what people are afraid of; men fear thefts or violence, while women fear sexual attacks (Ceccato & Loukaitou-Sideris, 2022), which is substantiated by the well-documented prevalence of sexual harassment and violence women face during their daily commutes (Ceccato, 2017b). Public spaces, such as public transit, are formed in ways that enforce gender norms and produce inequalities (Cresswell & Uteng, 2016; Cresswell, 1992), which is reinforced by women's fear leading them to avoid public spaces and men's lack of fear reinforcing the perception of public spaces being men's territory (Dunckel Graglia, 2016; Hollander, 2001; Lim & Fanghanel, 2016; Stanko, 1990).

Fear impacts women's travel choices and movement around the city (Loukaitou-Sideris et al., 2009), with public transport stations being specific settings where they anticipate being at risk (Valentine, 1990). Fear of crime also shapes who moves through public spaces and when, as those who fear crime tend to go out less than others (Lee et al., 2016). This has been shown to influence, for example, the use of parks (Türtseven Doğrusoy & Zeynel, 2017). A study conducted in Barcelona found that women from ethnic minorities, in particular, are underrepresented in public spaces. One consequence of the fear of crime is withdrawal from public spaces, which in turn limits social life and quality of life, further intensifying fear (Pérez-Tejera et al., 2018). This leads to time-based avoidance, such as avoiding using public transport during certain times, and space-based avoidance, avoiding certain transit lines or stations (Vanier & d'Arbois de Jubainville, 2017). Women worldwide are often "transit captives", meaning they rely on public transport for their only option for mobility (Ceccato, 2017a; Guimarães et al., 2019; Yu & Smith, 2014). This is because women are more likely than men to avoid walking (Loukaitou-Sideris & Eck, 2007), especially after dark (Atkins, 1989; Ross, 2000), and are less likely than men to own a car (Loukaitou-Sideris, 2014). Studies have shown that transit captives are 1.3 times more likely to be victimized compared to those who have alternative means of transport (Ceccato, Sundling, et al., 2024). Despite these increased risks and their preference to drive or take taxis due to safety concerns, many women are forced to rely on public transport (Loukaitou-Sideris et al., 2009; Lynch & Atkins, 1988; Stanko, 1990; Wekerle & Whitzman, 1995).

This same observation of gender's influence on safety perceptions has been noted in the Finnish context as well. According to an analysis of data from a safety survey done by the city of Helsinki, the combination of gender and age was the most important explanatory factor for feelings of insecurity (Kemppainen et al., 2014). Specifically, among women aged 15–24, 30% reported feeling unsafe in their neighbourhood on weekend evenings, compared to 18% of all respondents and only 9% of men in the same age group. This shows that young women are particularly vulnerable when it comes to perceptions of safety. Gender alone, without age being a factor, is also a key determinant: men rarely report feeling unsafe in these surveys, and age does not sufficiently explain the gender gap in safety perceptions. Similar findings were made in a survey focusing on safety perceptions on the Helsinki commuter rail, where women were observed to experience more insecurity and be afraid more often at train stations compared to men (HSL & VR, 2023).

The gendered nature of poor safety perceptions is the most consistent finding in previous research, but there is no consensus on its interpretation. Explanations for women's more frequent reports of insecurity have been sought from a variety of factors, such as fear of sexual crimes in public spaces, violence experienced in private settings, the physical size difference between sexes, gender-specific risk assessment behaviours, or the effects of gendered stereotypes in the social construction of masculinity (Austin & Furr, 2002; Brownlow, 2005; Brunton-Smith & Sturgis, 2011; Ceccato, 2012; Hale, 1996).

- **Age**

Age significantly influences perceptions of safety and fear of crime, with older individuals generally expressing greater fear than younger populations (Crime Concern, 2004; Feltes, 2003), despite being statistically less likely to be victimized (Aiken, 1998; Baker et al., 1983; Development, 1998; Fattah, 1993; Fattah & Sacco, 2012; Hindelang, 1978; Killias & Clerici, 2000; Lamnek, 1991; Lewis & Salem, 1986; Matcha, 1997; Pantazis, 2000). This heightened fear among older adults is often associated with behavioural consequences, including social isolation and reduced physical activity (Centers for Disease Control and Prevention (CDC), 1999; Crime Concern, 2004; Feltes, 2003), and lifestyle changes such as avoiding going out at certain times or using specific routes or transit lines (Brownson et al., 2000; Ceccato & Bamzar, 2016; Jackson & Gouseti, 2012; Troped et al., 2001), and avoiding walking, severely limiting their mobility (Gallagher et al., 2012; Sallis et al., 2009).

In transit environments, older individuals report feeling less safe than other age groups (Bon et al., 2011; Loukaitou-Sideris et al., 2009). However, findings on the relationship between age and perceived safety are inconsistent. For example, while some research suggests safety perceptions decline with age (Ouali et al., 2020; Reichow & Friemel, 2020; Zegras et al., 2015), others indicate that the youngest, especially young women who fear sexual harassment and violence, may feel the most unsafe in specific contexts, such as at night or during weekends (Gekoski et al., 2015; Kennedy, 2008; Lois et al., 2018; Natarajan et al., 2017; Nourani et al., 2020; Vanier & d'Arbois de Jubainville, 2017; Wiebe et al., 2015). Contrarily, other studies find no significant relationship between age and perceived safety (Ferraro & LaGrange, 1992; Morse & Benjamin, 1996; Ross & Jang, 2000; Yavuz & Welch, 2010). This heightened fear among older individuals may partly stem from their increased physical vulnerability and reduced ability to defend themselves or recover from potential victimization (Pain, 2000), making perceived threats feel more serious even when actual risk is low.

- **Frequency of Metro Use**

Higher travel frequency has been associated with feeling safer (Benjamin et al., 1994; Delbosc & Currie, 2012) as well as with more years of ridership (Yavuz & Welch, 2010). This has been suggested to be due to increased familiarization over time, with surveys showing that individuals feel most vulnerable traveling in environments and on modes of transport that are unfamiliar to them (Department for Transport, 1997; Yavuz & Welch, 2010). Familiarity with the terminal (supported by (Vanier & d'Arbois de Jubainville, 2017; Wallace et al., 1999; Yavuz & Welch, 2010)) was found to be the most important determinant of fear of crime among travellers (Fakhrahmad et al., 2022).

Ouali et al. (2020) noted that those who travelled either very often or very rarely felt more unsafe, while Vanier and d'Arbois de Jubainville (2017) found that infrequent users felt the safest, and those who travelled more often (but less than once a week) felt the least safe. Yavuz and Welch (2010) and Currie et al. (2013) found no relationship between travel frequency and perceived safety, highlighting the lack of agreement on this issue.

Frequency of use also influences how easily riders notice security/safety measures implemented, such as increased security personnel or video cameras, with more frequent riders noticing these measures with greater probability (Wallace et al., 1999).

- **Metro Station Closest to Home**

The type of neighbourhood a person comes from, also plays a role in safety perceptions. People from disadvantaged neighbourhoods tend to report higher levels of fear regarding crime in public spaces, including metro stations (Loukaitou-Sideris, 2006; Vilalta, 2011). Residents of economically disadvantaged neighbourhoods have also been found to fear victimization and injury in transit environments more than others (Ross, 2000).

Additionally, those living in high-crime neighbourhoods feel less safe when on their way to the station (Ceccato, Langefors, et al., 2021), but individuals from better neighbourhoods feel more unsafe when using public transport, possibly because they perceive public transport situations as more dangerous compared to the safety of their home (Delbosc & Currie, 2012). Furthermore, those living farther from the city centre feel less safe on public transport (Delbosc & Currie, 2012).

In the context of the Helsinki metropolitan area, a study examining perceived safety in Helsinki and Espoo found that the unemployment rate in a given postal code area was positively associated with feelings of insecurity (Kääriäinen, 2002). Insecurity was found to be concentrated in areas where other forms of disadvantage also accumulate. This relationship was explained by the fact that people living in such areas are more likely to witness threatening situations, such as disturbances caused by intoxicated individuals or public arguments, which decreases safety perceptions.

- **Previous Victimization**

There is some disagreement within the research literature about the extent to which safety perceptions are affected by previous victimization. Some studies demonstrate a direct relationship between experiencing or observing crime and perceptions of safety (Ceccato, 2013; Crime Concern, 2002, 2004; Ferraro, 1995; Hale, 1996; Hirtenlehner & Farrall, 2014; Mawby & Gill, 1987; Otis, 2007; Reed et al., 2000; Vilalta, 2011; Yates & Ceccato, 2020) with passengers previously victimized (e.g., through theft, robbery, threats, hate crimes, sexual harassment, stalking, or aggressive panhandling) being almost five times more likely to report feeling unsafe during transit (Ceccato, Sundling, et al., 2024). In contrast, other studies have found that previous victimization does not significantly affect feelings of safety (Box et al., 1988; Feltes, 2003; Toseland, 1982), while Ceccato, Langefors, et al. (2021) found that previous victimization had a negative effect on safety only when it involved a sexual crime. Ceccato et al. (2021) observed that previous victimization from property crimes increases the likelihood of being a victim of sexual violence while in rail-bound public transport, whereas this effect was not found for all types of prior victimization. This may be due to greater exposure to unsafe environments with low social control and socioeconomic disadvantage. Notably, this effect was observed only among women. Victimized women were 3.7 times more likely to report sexual victimization in transit than other women, while no such effect was found among male riders.

Beyond personal victimization, secondary victimization, such as witnessing violence or knowing someone who has been a victim, can also influence perceptions of safety. For example, social perceptions of safety, particularly those from family and friends, can influence how women perceive their personal safety while waiting at terminals (Chowdhury & Van Wee, 2020). The influence of secondary victimization is so strong, that some research has found that being attacked or threatened does not affect perceptions of safety any more than witnessing an attack, threat, or feeling threatened (Currie et al., 2013). Furthermore, some studies suggest that these secondary experiences are even more strongly associated with fear than direct victimization (Hale, 1996). It has been observed that knowing someone who has been a victim significantly heightens levels of fear and anxiety, while personal victimization has only a minor influence on fears (Feltes, 2003).

Some studies note that time spent on public transport is more closely associated with victimization than safety perceptions, which are primarily influenced by visual cues from the transit environment and surrounding neighbourhoods (Kang et al., 2023; Salesses et al., 2013). Additionally, some have found that while both men and women are strongly affected by prior experiences with transit safety problems, these experiences tend to affect women's perception of safety more than men's in transit environments (Yavuz & Welch, 2010), with victimized women being more likely to take precautions (Stark & Meschik, 2018). Previous victimization also leads to a 39% higher likelihood of time and space avoidance compared to those not victimized (D'Arbois De Jubainville & Vanier, 2017).

- **Mobility Limitations**

People with disabilities demonstrate lower safety perceptions compared to others (Crime Concern, 2002; Loukaitou-Sideris et al., 2009; Sundling et al., 2024; Toseland, 1982; Wasfi & Levinson, 2007; Yavuz & Welch, 2010), with unsafe feelings induced by discrimination, vulnerability, and exposedness related to both staff and other passengers (Wayland et al., 2022). People with disabilities are more afraid than others to go out after dark due to fear of crime (Ceccato, 2015; Ceccato & Bamzar, 2016; Crime Concern, 2002; Loukaitou-Sideris, 1999), and fear of harassment and negative attitudes from other passengers further restricts their mobility by acting as barriers limiting their travel frequency (Sundling et al., 2014). Out of different disabilities, those with reduced mobility felt the most unsafe (Sundling et al., 2024). This is concerning as disabled individuals are already more at risk of exclusion from public transport than others due to inaccessibility, especially for travellers with restricted mobility, or unaffordability, with some facing barriers up to 15 times greater compared to those without disabilities (World Health Organization (WHO), 2023).

Individuals with disabilities, particularly those with reduced mobility, are significantly more likely to be victimized in transit than those without disabilities (Iudici et al., 2017; Sundling et al., 2024). People with reduced mobility had not witnessed others being victimised more often than others and yet had been more victimised themselves, meaning this cannot be explained by, for example, living in a more violent environment (Sundling et al., 2024). Women with disabilities are especially vulnerable to harassment and sexual violence (Hughes et al., 2012), with over 50% of women with disabilities in Europe, Australia and North America having been subjected to some kind of physical violence, compared to a third of women without disabilities (Brownridge, 2006).

Despite the heightened safety concerns and vulnerabilities faced by individuals with disabilities, particularly those with reduced mobility, research on how disability affects safety perceptions remains scarce. Disability is often treated as a secondary category in safety studies, overshadowed by factors like gender and race (Watermeyer & Swartz, 2023). A systematic review of perceived safety in train travel found that only one out of 52 studies focused on individuals with disabilities, even though they are a particularly vulnerable group in the transport system (Sundling & Ceccato, 2022). This lack of attention is problematic, as individuals with disabilities represent a highly diverse group with unique needs depending on the nature of their disabilities, which cannot be addressed through studies targeting the average traveller (Sundling et al., 2024).

- **Ethnicity**

Some studies have observed that individuals belonging to ethnic minorities are more likely to feel fearful when walking alone in their own neighbourhoods. One suggested explanation is that certain minority groups, such as Asians or African Americans in the United States, are more likely than Whites to live in neighbourhoods with higher crime rates (Crime Concern, 2002;

Johnston, 2001). Being part of an ethnic minority is also associated with greater exposure to violence, which may contribute to heightened fear of crime (Rasmussen et al., 2004). In the context of public transport, research in the United States has shown that ethnic minorities are more likely to report feeling unsafe while using public transport, particularly Asians, who tend to express more safety concerns than members of other ethnic groups (e.g. (Buckley, 1996; Loukaitou-Sideris & Eck, 2007)).

However, the findings are not always this straightforward. One study found that men of non-White ethnicities reported lower perceived safety when traveling by train, an effect that was not significant for women (Yavuz & Welch, 2010). Another study found that ethnic minority groups reported significantly lower levels of perceived safety on buses compared to Whites, regardless of gender, an effect not observed in train safety estimations (Yavuz et al., 2007). It was theorised that perhaps bus users may be more exposed to neighbourhood conditions than train users, which could influence their perceptions of safety, an explanation supported by previous research (Crime Concern, 2002; Johnston, 2001; Rasmussen et al., 2004; Sampson & Raudenbush, 2004). Similar results were found in the United States and Brazil, where non-White students reported greater fear than their White counterparts (Ceccato & Loukaitou-Sideris, 2022). However, this pattern was not observed in Sweden (Santoro et al., 2020). A different Swedish study, based on a larger sample, found that immigrants, defined as those born outside of Sweden, reported feeling less safe than native Swedes (Ceccato, 2013).

- **Income Level**

Research has shown that individuals with lower incomes are more likely than others to feel fearful when out alone on the streets after dark (Pantazis, 2000). When it comes to public transport, it has also been found that people with higher incomes feel safer using trains, whereas those with lower incomes report lower perceived safety in that context (Yavuz & Welch, 2010). It has been suggested that this is due to the fact that individuals with lower socioeconomic status often live in areas with higher crime rates, which can negatively affect their sense of safety (Yavuz et al., 2007). Moreover, they typically have less access to material and social resources than those from higher socioeconomic backgrounds, which may further contribute to their feelings of fear and vulnerability, especially given that they already tend to experience greater vulnerability in life due to fears of job loss, health problems, and financial insecurity (Pantazis, 2000; Yavuz et al., 2007).

A contrary effect of income on safety perceptions has also been observed in a study on train safety, where higher-income individuals were more likely to report lower levels of perceived safety (Yavuz et al., 2007). The authors theorized that this may be because people with higher incomes are less dependent on train transit for their mobility compared to lower-income individuals and are therefore more likely to be choice riders. As such, they may be more sensitive to perceptions of transit safety. Supporting this theory, a significant negative correlation was found between household income and dependence on public transit.

2.3.2 Environmental Factors

Environmental factors at transit stations play a significant role in shaping passengers' perceptions of safety. Environmental factors at stations affecting safety perceptions do not only include the built environment but also human activities taking place at the station and its surroundings. Presence of amenities that facilitate natural surveillance, such as shops and restaurants, influence safety perceptions positively, as well as formal surveillance, such as security personnel or surveillance cameras. (Ceccato, Sundling, et al., 2024). Darkness, desolation, poor maintenance, litter, graffiti, and lack of opportunities for natural surveillance by the general public or the occupants of surrounding establishments are, for example, all linked to greater levels of fear (Atkins, 1989; Loukaitou-Sideris, 2006; Loukaitou-Sideris et al., 2009).

- **Lighting**

Research consistently shows that good lighting enhances perceived safety and is a crucial component of the overall feeling of safety as well as fear of crime to passengers in transit stations (Badiora et al., 2020; Ceccato & Paz, 2017; Cozens et al., 2003a, 2003b; Deníz, 2019; Kennedy, 2008; Kim, 2021; La Vigne, 1996; Libardo & Nocera, 2012; Loukaitou-Sideris, 2014; Mahmoud & Currie, 2010; Stark & Meschik, 2018). Lighting is particularly important for women's perceived safety, as it has a greater positive impact on them than on men, with many women feeling unsafe in poorly lit environments (Chowdhury & Van Wee, 2020; Loukaitou-Sideris, 2014; Orozco-Fontalvo et al., 2019; Reed et al., 2000; Wallace et al., 1999). Lighting is also consistently the most suggested improvement in surveys aimed at enhancing safety, often cited as the top or second most important factor in transit environments (Badiora et al., 2020; Cozens et al., 2003a; Nourani et al., 2020; Reed et al., 2000). However, exceptions exist, as Ceccato & Uuittenbogaard (2014) found that lighting had no significant impact on perceived safety at metro stations.

Lighting plays a crucial role in enhancing perceived safety by increasing visibility and reducing opportunities for criminal activity. Studies have shown that poorly illuminated stations with dark corners are statistically linked to higher occurrences of sex crimes (Ceccato & Loukaitou-Sideris, 2021; Ceccato & Paz, 2017). Additionally, enhancing lighting can reduce vandalism in public transport (Grabosky & James, 1995, as cited in (Badiora et al., 2020)). However, studies have also revealed an association between higher visibility and increased vandalism, possibly due to higher passenger flows (Ceccato & Uittenbogaard, 2014).

While good lighting is crucial for improving safety, it's important to note that more light isn't always better. Excessive brightness can create a "fishbowl effect," where individuals inside a well-lit area can be seen by others, but due to glare, cannot see outside, increasing their vulnerability and fear, rather than enhance safety (Burnett & Pang, 2004; Ceccato, Sundling, et al., 2024; Shen et al., 1998). Good illumination has been observed to reduce crime (Ceccato et al., 2022; M. J. Smith, 2008; Tilley, 1993), however, in cases of the "fishbowl effect", lighting has been shown to increase crime (Burnett & Pang, 2004; Scarborough Women's Centre, 1991; Shen et al., 1998), and some research found inconclusive results or no significant effect on crime (Ceccato et al., 2022; Ceccato, Näsman, et al., 2021; Liggett et al., 2001). Therefore, well-balanced, appropriate lighting is essential to ensure safety without unintended negative consequences. For example, sideway cornice-mounted lighting has been observed to have a greater impact on perceived safety (Burnett & Pang, 2004).

- **Camera Surveillance**

Security cameras have mixed impact on perceived safety. While they are generally favoured for their potential to enhance safety (Cozens et al., 2003b; Debrincat et al., 2017; Loukaitou-Sideris, 2014), their positive effect is conditional on visibility: people cannot feel safe if they don't know the cameras exist (Ceccato, 2013; Riley & Dean, 1985; Vanier & D'arbois, 2018). Of various safety measures, video cameras are the most noticeable to riders, but their impact on safety perceptions is less significant than that of other measures, such as increased police presence and lighting improvements (Wallace et al., 1999).

Surveillance cameras are perceived mainly by men (Coppola & Silvestri, 2020), while women notice them less and are less likely to be comforted by their presence (Kim, 2021; Vanier & D'arbois, 2018; Yavuz & Welch, 2010). Coppola and Silvestri (2020) found cameras to be a significant safety variable only for males. It has also been observed that security cameras may have a greater positive impact on older adults' perceived safety than younger age groups (Wallace et al., 1999).

Camera surveillance is associated with a modest but significant decrease in crime, particularly property, vehicle, and drug crimes (Piza et al., 2019), and can reduce violence in metro stations (Moreira & Ceccato, 2021). However, research shows conflicting results, and in some transit systems, the effect is not evident (Priks, 2009; Shellow et al., 1974), often due to cameras being installed together with other interventions, making it difficult to know their influence in the outcome (Tilley, 1993). Cameras have also shown no significant effect on safety when implemented alone (Ceccato, 2013; Loukaitou-Sideris & Fink, 2009; Newton & Bowers, 2007). It has been suggested that cameras alone are insufficient to significantly improve feelings of safety (Pisier-Caillet & Ristea, 2024).

- **Security Guards Visible**

Surveillance by security professionals is one of the most important factors influencing perceived safety in rail bound settings (Ceccato, 2013; Ceccato & Loukaitou-Sideris, 2022). The presence of staff is widely cited in studies on safety perceptions (Cozens et al., 2004; Cozens et al., 2003a, 2003b; Cozens et al., 2002; Libardo & Nocera, 2012; Loukaitou-Sideris, 2014). Passengers who experience a lack of staff at stations are 2.5 times more likely to feel unsafe (Ceccato, Sundling, et al., 2024). Security guards increase safety and are a desired improvement (Ceccato, 2013; Chowdhury & Van Wee, 2020; Kennedy, 2008; Libardo & Nocera, 2012; Yavuz & Welch, 2010). Thomas et al. (2006) found that the availability of staff, whether physically present or by surveillance cameras, was the most valued safety improvement at stations and platforms.

Women passengers have emphasized that the presence of staff provides a level of security that cannot be achieved by technological substitutes like surveillance cameras (Loukaitou-Sideris, 2014). Ouali et al. (2020) observed that the presence of staff in metros significantly increased feelings of safety, but only for women, not the sample as a whole. Gender differences in the impact of added security personnel have also been noted among transgender individuals, who reported feeling unsafe in the presence of transit police officers due to previous negative experiences (Lubitow et al., 2020).

In addition, travellers perceived security problems that they consider the responsibility of station staff, such as vandalism and graffiti, to be more unpleasant than issues they attribute to themselves, like travelling alone or at night, highlighting the importance of staff in transit environments (Shibata et al., 2014).

In the context of the Helsinki metropolitan area, a survey about the perceived safety of public transport conducted at the turn of the year 2023-2024 found that the visible presence of staff was the factor passengers stated improved their safety perceptions the most, especially the presence of security guards (HSL, 2024b). On the other hand, a portion of passengers felt that the presence of security guards can also decrease safety perceptions. The effect the presence of security guards has on passengers' feelings of safety must therefore be studied more in the context of Helsinki public transport. Another survey about safety perceptions that focused on Helsinki commuter rail noticed that the presence of other people such as staff, other passengers, and security guards, was the factor most passengers viewed as increasing their sense of safety (HSL & VR, 2023).

- **Signage and Real-Time Information**

Good signage and adequate information, especially during unexpected incidents at transport stops and terminals, are wanted and important features that increase travellers' safety perceptions, with visibility of signage being a reported concern for transit users (Deníz, 2019; Fink & Taylor, 2011; Kim, 2021). Information, along with comfort, which includes clean vehicles with enough seating and welcoming waiting areas, were the two quality dimensions with the strongest influence on safety perception (Friman et al., 2020). Well-informed and comfortable travellers not only feel safer but also perceive their accessibility as better. Adequate information in transit stations and during critical incidents minimizes the risk of missing connecting transport or not knowing what to do, thus positively affecting safety perceptions, whereas low-quality information contributes to increased risk calculations, decreasing perceived safety. Quality information affects less frequent travellers more, especially when it comes to perceived accessibility (Friman et al., 2020).

Gender differences do exist, but there are conflicting findings. Although on-time information is important for both men and women, it was found to be more important for men's safety than for women (Yavuz & Welch, 2010). Conversely, another study found that real-time information was valued more by women than men, although the majority of both genders valued it (King County Metro, 2012). Women have been observed to attribute higher perceived importance to wayfinding, basic needs, and safety compared to men, and in general tend to seek more diverse services and functions than men (Alreck & Settle, 2002; Du et al., 2021).

- **Poor Maintenance and Littering**

Littering in transit terminals, along with the maintenance and cleanliness of furniture and station areas, are significant factors affecting travellers' perceptions of safety, including fear of crime and heightened awareness of risk (Fakhrahmad et al., 2022; LaGrange et al., 1992; Loukaitou-Sideris, 2012; Tucker, 2003). Cleanliness contributes to feelings of safety, whereas degraded places make travellers, especially casual users, feel unsafe (Cozens et al., 2003a, 2003b; Cozens et al., 2002; Loukaitou-Sideris, 2014; Vanier & d'Arbois de Jubainville, 2017). Poor management and maintenance of transit environments can indicate underlying problems, such as inadequate cleaning practices or poor lighting, that directly affect safety perceptions and increase the risk of victimization (Ceccato et al., 2022; Ceccato & Masci, 2017; Liggett et al., 2001; Loukaitou-Sideris, 2012). Moreover, a well-kept environment can not only enhance safety perceptions but also deter criminals, as areas with more despair are associated with higher crime risk (Cozens & Love, 2015; Liggett et al., 2001; Weisburd et al., 2012; Wilson James & Kelling George, 1982).

The Broken Windows Theory (BWT) (Wilson James & Kelling George, 1982) suggests that visible signs of disorder, such as broken windows, graffiti, or litter, signal that a space isn't cared for and criminal behaviour is tolerated, which can create a self-reinforcing cycle where environmental neglect reduces community engagement in informal social control, thereby encouraging further crime. Maintaining and cleaning urban spaces, including actions like the rapid removal of graffiti and prompt repair of vandalism, can help reduce both crime and perceptions of unsafety by signalling the presence of social control. BWT has significantly influenced crime prevention strategies in urban planning, leading to initiatives aimed at improving cleanliness, repairing infrastructure, and enhancing lighting in public spaces. (Cozens & Love, 2015; Kelling & Coles, 1997; Smith & Clarke, 2000; Vilalta, 2011; Wilson James & Kelling George, 1982).

- **Amount of People Present**

The number of people present in transit stations significantly affects passengers' perceptions of safety. Crowded environments induce feelings of anxiety and increase perceived risk to personal safety in passengers as their personal space is invaded (Cheng, 2010; Cox et al., 2006; Cullen & Cullen, 2001; Greenberg & Firestone, 1977; Schneider et al., 2021; Thomas, 2009; Vanier & d'Arbois de Jubainville, 2017). Crowed transit environments have also been shown to increase fights, pickpocketing, and sexual harassment, especially groping (Ceccato et al., 2015; Ceccato et al., 2022; Loukaitou-Sideris et al., 2001). Poor perceived safety in crowded environments affects women's behaviour, often forcing them to either use women-only carriages, as seen in India, Malaysia, and Japan, or avoid crowded places when possible (Bachok et al., 2014; Dunckel-Graglia, 2013; Horii & Burgess, 2012; Mitra-Sarkar & Partheeban, 2011). However, this is not always possible, and women often have no choice but to commute in crowded conditions despite experiencing high stress (Kash, 2019).

It has also been showed that, in contrast to crowding, the lack of people at transit stations or platforms, along with environmental factors like darkness and desolation, decreases opportunities for natural surveillance, significantly impacting safety perceptions by increasing feelings of fear, anxiety, and concerns about victimization (Atkins, 1989; Loukaitou-Sideris, 2006, 2012). Presence of staff, security personnel, or other passengers is repeatedly shown to be perceived as safer than being alone (Cozens et al., 2003a; Libardo & Nocera, 2012; Loukaitou-Sideris, 2014; Ouali et al., 2020; Shirgaokar, 2019; Stark & Meschik, 2018; Thompson et al., 2012; Vanier & d'Arbois de Jubainville, 2017), and the perception of informal social control is one of the most important determiners of fear of crime (Fakhrahmad et al., 2022). Evidence shows that nearly empty transit environments without informal surveillance do not only increase fear but also certain crimes, such as exhibitionism, sexual assaults, robberies, social disorder, and violent assaults (Beller et al., 1980; Ceccato et al., 2013; Clarke et al., 1996; Colard, 2018; Mohamed & Stanek, 2020).

However, some studies have found inconclusive results or that crowded conditions can decrease crime, reducing overall violence and vandalism (Ceccato et al., 2022; Ceccato et al., 2013; Marteache et al., 2015). Thus, the evidence remains unclear on how the number of people in transit environments ultimately affects perceived safety, suggesting that both crowded and nearly empty conditions can contribute to feelings of insecurity and the occurrence of crime in different ways. It is therefore possible that environments with a moderate number of people, where the space is neither empty nor overcrowded, might feel safer to passengers by offering both a sense of surveillance and personal comfort.

- **Commercial Activities**

Research shows that transit stations are inherently risky and can serve as "crime attractors" or "crime generators" (Bowers, 2014; Brantingham & Brantingham, 1995; Newton, 2018; Sedelmaier, 2003). Their role as hubs for high volumes of movement and their central locations within walking distance of residential, commercial, or working areas make them particularly vulnerable to criminal activity (Ceccato et al., 2022). The surroundings of stations significantly influence crime occurrence (Buckley, 1996), with the presence of risky facilities such as bars, restaurants, stores, ATMs and shopping malls, whether inside or near the station, further increasing crime risk (Ceccato et al., 2013; Clarke & Eck, 2007; Liggett et al., 2001; Yu, 2009). Larger metro stations attract more crime (Ceccato et al., 2013), and for violent victimization the risk is highest in local centres of disadvantaged neighbourhoods (Gerell, 2018). There also appear to be gender differences in victimization by station location; women are at higher risk of victimization in central metro stations, while men are more likely to experience violence at end stations (Moreira & Ceccato, 2021). In addition to these risks, transit stations often attract panhandlers, whose presence has been related to higher feelings of anxiety and fear, further influencing safety perceptions (Ceccato et al., 2022; Ceccato, Sundling, et al., 2024; Strandbygaard et al., 2022; Sundling & Ceccato, 2022).

In addition to their influence on crime occurrence, the surroundings of transit stations also impact perceived safety. While facilities such as shops, bars, and restaurants can increase crime occurrence, they can also increase perceived safety by ensuring a constant presence of people around transit stations, promoting natural surveillance and guardianship (Abenoza et al., 2018; Coppola & Silvestri, 2020; Deníz, 2019; Kennedy, 2008; Libardo & Nocera, 2012). Kennedy (2008) notes that one advantage these facilities have, is that they provide a presence without the tensions associated with authoritative figures. Moreover, design strategies that increase natural surveillance by increasing transparency, such as placing commercial activities inside transit stations and replacing underpasses with ground-level crossings, help reduce fear and enhance perceptions of safety (Loukaitou-Sideris, 1999, 2006).

- **Music or Nature Sounds at the Station**

The impact of sound, including music, and noise pollution on perceptions of safety or fear of crime in transport facilities has not been widely studied. Fakhrahmad et al. (2022) explored various factors affecting passengers' fear of crime in bus terminals, including noise pollution, but noted a lack of prior research specifically linking noise pollution to fear of crime in transport settings. Their findings showed that higher levels of perceived noise pollution, such as the sound of buses and ticket sellers' shouts, were associated with increased fear of crime among travellers. This suggests that reducing noise pollution and carefully considering the use of sound, such as music, in transit spaces could help improve safety perceptions. Sayin et al. (2015) demonstrated that sounds significantly influence perceived safety in public spaces. Their findings revealed that vocal sounds, which are not perceived as threatening, increased feelings of safety. Participants reported higher perceived safety when animal vocal sounds were played compared to instrumental sounds or no sound.

2.3.3 Previous Studies Done in the Helsinki Metropolitan Area

The city of Helsinki recognizes the importance of both actual safety and the perception of safety in residents' quality of life. To monitor these aspects, the city has conducted comprehensive safety surveys every three years since 2003 (Keskinen, 2019). These surveys examine both residents' experiences of victimization and their perceptions of safety. Victimization is assessed in terms of both property crimes and violent crimes, while perceived safety is explored in various contexts, such as movement at different times of day, in different environments, and on public transport. In addition, perceptions of safety are also monitored through the Helsinki Barometer, a smaller-scale telephone survey targeted at adult residents of Helsinki and conducted twice a year, in spring and autumn (Helsingin kaupunki, 2024). Questions about the safety of residential areas have been included in the Helsinki Barometer since the autumn of 2021 (Helsingin kaupunki, 2024).

Helsinki is overall perceived as safe, with 70% of those responding to the Helsinki Barometer reporting feeling safe in their residential areas, even during weekend evenings. However, perceptions of safety have weakened in recent years, and the differences in experiences between different population groups have increased. Women consistently report feeling less safe than men, in residential areas as well as in all forms of public transport (Helsingin kaupunki, 2025b; Keskinen et al., 2023). In the specific context of the city centre during the evening, more women report feeling unsafe than safe. In the case of the Helsinki metro, only 41% of women feel safe using it in the evenings, while 30% feel unsafe (Keskinen et al., 2023). This indicates that much work remains to be done in the area of perceived safety, so that everyone can feel safe and participate in city life regardless of the time of day.

A notable finding from Helsinki's safety surveys is that poor safety perceptions are particularly concentrated around metro stations and shopping centres (Keskinen & Laihinen, 2017). Residents' responses highlight five main types of locations where they feel unsafe: commercial centres, station areas, underpasses, parks, and places that attract intoxicated individuals. Among these, shopping centres were reported as the most common sites of safety concerns, followed by train and metro stations. Given that metro stations are often integrated with or located in close proximity to shopping centres, and that commercial services such as shops, restaurants, and bars are either inside the metro stations or surrounding the entrances, these findings highlight the need for further research into safety perceptions in metro stations across the Helsinki metropolitan area and the role that associated services play in shaping these experiences. It has been theorized that metro stations are perceived as unsafe due to issues with social control. These areas can become focal points for insecurity, attracting groups that are perceived as undesirable, which increases the likelihood of social friction compared to open street environments. Additionally, the varying social density throughout the day, with stations often being practically empty at certain times, can lead to a lack of real-time social control, further contributing to feelings of insecurity. (Väliniemi-Laurson & Rönnberg, 2019).

In addition to the safety surveys conducted by the City of Helsinki, extensive research has been carried out specifically focusing on the connection between poor safety perceptions and proximity to rail transit stations (e.g., (Kemppainen et al., 2014)). HSL, in collaboration with VR, has conducted targeted surveys examining perceived safety in the Helsinki commuter rail, with the most recent study conducted in 2022. Its results were consistent with safety studies conducted by the City of Helsinki. Women were found to feel more unsafe than men and to fear rail stations more frequently. Overall, perceived safety was rated highly, with 89% of respondents agreeing with feeling safe at stations. However, the need to improve perceived safety is also evident in this study, as 38% of respondents reported having felt afraid at a rail station in the past year, with 49% of women reporting this. Fear also influences travel behaviour, as 8% of respondents reported avoiding using Helsinki commuter rail services due to safety concerns. (HSL & VR, 2023).

In addition to the survey focusing on commuter rail, HSL regularly conducts various surveys among public transport passengers, such as customer satisfaction surveys, which often include questions about perceived safety. According to an email survey conducted by HSL at the turn of 2023-2024, passengers generally feel safe when traveling with HSL, with men feeling slightly safer than women (HSL, 2024b).

When looking at HSL's customer satisfaction surveys over the past five years (2020–2024), the results indicate that a clear majority of metro passengers have been satisfied with both the waiting conditions at stations and the absence of security-related disturbances during their journeys. Regarding station environments, between 74% and 82% of respondents selected one of the two highest ratings when evaluating the waiting conditions at metro stations, while only 8% to 13% gave one of the two lowest ratings. Similarly, when asked whether their metro journey had proceeded without any security-related disturbances, between 78% and 83% gave the two highest ratings, indicating that they did not experience any disruptive or disorderly behaviour during their trip. Meanwhile, 8% to 12% selected one of the two lowest ratings. (HSL, 2025a).

2.3.4 Research Gap

While the perceived safety of Helsinki residents and users of the public transport system in the Helsinki metropolitan area has been monitored and analysed through surveys, there is a gap in research regarding metro stations. There has not been an in-depth analysis of safety perceptions at metro stations in the Helsinki metropolitan area or the factors influencing them. Previous studies in Helsinki have primarily focused on the overall development of residents' safety perceptions over time, safety perceptions in different residential areas and the city centre, and public transport surveys that have addressed general safety perceptions, differences between transport modes, or safety perceptions at commuter rail stations. As a result, metro stations have remained largely unexamined.

This study aims to address this gap by providing a detailed analysis of safety perceptions specifically at metro stations in the Helsinki metropolitan area. I will investigate how various individual, environmental, situational, and social factors to understand their impact on perceived safety. Additionally, I will explore how the age, amenities, and location of metro stations relate to users' safety perceptions. I will also compare safety perceptions across stations to identify those with notably lower ratings or those that are avoided due to safety concerns. By identifying which passenger groups are most affected by poor safety perceptions, improvements can be prioritized based on the factors these groups find most influential to their sense of safety. By focusing on these aspects, this study aims to provide a comprehensive understanding of the elements shaping perceived safety at metro stations and to offer insights that support future developments, renovations, and improvements.

3 Methodology

The methodology of this study consists of three parts: the identification of study factors, data collection, and data analysis. The identification of study factors was carried out through a thorough literature review of studies focusing on safety perceptions, particularly in the context of public transport and its stations. Based on the identified factors, I designed a survey targeted at metro users, operationalizing theoretical concepts into concrete, empirically testable questions. Once finalized, the survey questions were reviewed by Aalto University's Research Ethics Committee to ensure ethical research practices and to identify potential risks. After incorporating their feedback, I refined the questions in collaboration with HSL, responsible for the technical execution and publication of the survey, ensuring alignment with their general guidelines. The survey was built in Webropol and distributed through HSL's Research Platform, which enables passengers to receive and respond to surveys via mobile phones during their journeys. It was sent to platform members who had used the metro within the past month. Following data collection, I analysed the results using Webropol and Excel to explore how perceived safety varied between metro stations and among different user groups. I also examined which factors respondents found most influential to their safety perceptions. These findings were used to answer the research questions and to provide practical recommendations to KLOY.

3.1 Identification of Study Factors

To ensure participants could focus equally well on both the first and last questions, and to maximize the number of completed surveys, the survey needed to be short and concise. Since participants answered the survey in a mobile app, questions needed to be brief, easily readable, and suitable for small screens. The survey design was informed by a comprehensive literature review of recent studies on safety perceptions in transit environments worldwide. From this review, I compiled a list of individual and environmental factors influencing perceived safety. Factors were included if prior research demonstrated a significant impact on safety perceptions, if they could be incorporated without ethical concerns, and if they were not overly sensitive or personal so as to discourage participation. Only those factors that meaningfully contributed to addressing the research questions were selected. Additionally, practical insights gained during my employment with the KLOY team responsible for metro station properties helped ensure the survey addressed relevant concerns related to metro station environments.

3.1.1 Literature Review

The literature review was conducted using various academic databases to search for studies on perceived safety, particularly in the context of public transport and its stations. The searches were limited to studies done in English or Finnish. Another search criterion applied in all searches was the publication year, focusing on studies published in the last 10 years, between 2014 and 2024. The academic databases used included Aalto-Primo and Aalto University Research Portal, both of which are Aalto University databases, available to Aalto University students like me. Other academic databases used were Google Scholar, Scopus, and Web of Science.

The literature search was conducted by using Boolean search operators, combining the following keywords: “Perceived safety,” “Safety perception,” “Transport,” “Transit,” “Transportation,” “Public transport,” “Station,” “Transport-hub,” “Subway,” “Metro,” “Underground,” “Rail,” “Built environment,” “Public space” , “Liikenne,” and “Koettu turvallisuus”.

The first search using Aalto-Primo was a broad exploratory search to identify relevant themes and refine the exclusion criteria for subsequent searches. Subsequent searches in other databases applied these refined criteria, reducing the need for multiple filtering steps.

The initial search in Aalto-Primo, combining the aforementioned keywords, returned 5,873 results. It was observed that many studies focused on the effects of the COVID-19 pandemic. To ensure relevance, studies focusing on either the time of the COVID-19 pandemic or its effects were excluded. Subsequent searches were conducted using the Boolean operator “NOT” for the keywords “pandemic,” “covid,” and “COVID-19”. After this refinement, Aalto-Primo returned 4,641 results. The search was further refined by adding keywords related to stations, which narrowed the results to 282. The titles and abstracts of these results were reviewed, and studies were excluded if they focused on topics too specific or not sufficiently related, such as accessibility, mode choice, children, walking, cycling, being on board a vehicle, autonomous vehicles, service quality, e-scooters, sustainability, crime statistics, or the last-mile problem. After this, the journals where the articles were published were checked with JUFO, and those with a JUFO rating of zero were excluded. A total of twenty-one studies were selected for more thorough reading.

A search in the Aalto University Research Portal returned nine results; one study was selected, and eight were excluded based on the title. Google Scholar was used to search for Finnish and English papers. The Finnish search returned 194 results. When using Scopus, 343 results were found using station-specific keywords. After noticing that many results focused on bike or car traffic, the Boolean operator “NOT” was used again to exclude results with the words “bike,” “bicycle,” “e-bike,” “cycling,” “cyclability,” “cycleway,” “cyclist,” “drive,” “driving,” “motor,” “taxi,” “autonomous,” and “car.” This refinement resulted in 163 studies, of which sixteen were chosen for more detailed review.

In total, 62 academic papers were selected for detailed review. To identify additional relevant studies, a backward and forward citation search was conducted. In the backward search, references from the selected studies were reviewed, and relevant sources were added. In the forward search, studies citing the selected papers were examined to identify more recent research on the topic. Further sources were found by searching for specific topics, such as CPTED or safety perceptions in public transport in the Helsinki metropolitan area.

3.1.2 Individual Factors

In this study, various individual factors were considered for their potential influence on safety perceptions. The following factors were included in the survey questions:

- **Gender** was included because existing research consistently shows that gender significantly influences safety perceptions, with women generally feeling more unsafe than men in transit environments (Ceccato et al., 2022). Additionally, gender differences are well-documented in the context of metro stations, making it an important variable to examine in this study (Ouali et al., 2020). While the original plan was to explore whether safety perceptions varied between gender majorities (cis-gendered individuals) and minorities (transgender and non-binary individuals), discussions with HSL led to the decision to omit this distinction from the survey. Instead, the standard gender options used by HSL (woman, man, other, or "I don't want to answer") were adopted. It should be noted when analysing the results that distinction between gender majority and minority cannot be made with certainty, as for example a transwoman may choose "woman" or "other", depending on their personal definition.
- **Age** was included because studies have shown that it influences perceived safety, but findings on its influence vary. Therefore, it was decided to include age to investigate its relationship with perceived safety in the context of metro stations in the Helsinki metropolitan area. This was done by asking participants to select the year they were born. The survey was targeted at individuals aged 16 and older, as the Aalto University Research Ethics Committee recommended this approach. Asking participants younger than 15 would have required parental consent, making it more effective from an ethical review standpoint to limit the survey to those aged 16 and older.
- **Metro Station Closest to Home** was included because it provides insight into the respondent's likely area of residence, which can influence safety perceptions. When respondents evaluate their safety perceptions at their chosen stations, it can then be determined whether any of the

selected stations is the one closest to their home and how familiarity with the station influences their feelings of safety. Participants selected the metro station closest to their home in the survey, or chose “I do not live in the Helsinki Metropolitan Area” or ”I live in the Helsinki Metropolitan Area, but not near any metro station”.

- **Frequency of Metro Use** was included because previous research indicates that individuals who use public transport more frequently tend to feel safer, likely due to increased familiarity with the environment over time. Answer options in the survey were “Daily or almost daily”, “Several times a week”, “Once a week”, “2-3 times a month”, or “Once a month or less often”.
- **Previous Victimization** was included because previous experiences of crime, whether direct or indirect, are strongly linked to heightened feelings of fear and reduced safety perceptions in transit environments. The survey only asks a simple yes/no question about whether the participant has ever been a victim of crime at a metro station and does not request details about the type of crime or a description of the event. This approach was chosen to avoid causing unnecessary stress or triggering trauma that could exceed the normal stresses of everyday life.
- **Mobility Aids or Limitations** were included in the survey because individuals with disabilities, particularly those with reduced mobility, often report lower safety perceptions due to discrimination and vulnerability in transit environments. The survey only asks a yes/no question about whether the participant has mobility limitations or uses any mobility aids. This approach avoids collecting more detailed information that could be considered sensitive health-related personal data while ensuring compliance with privacy regulations.

Certain factors were excluded from the survey due to ethical considerations or their limited relevance to this study. For example, I decided not to include race, ethnicity, and sexual orientation in the background questions, despite some studies suggesting they may influence safety perceptions. These factors were excluded to avoid privacy concerns and ensure the survey remained non-intrusive. Similarly, income level, education, car ownership, and comfort around strangers were excluded because they were not directly related to the research questions, were beyond the control of KLOY at the stations, raised ethical concerns, or were considered too sensitive by HSL.

3.1.3 Environmental Factors

From the literature review, a variety of environmental and social factors influencing safety perceptions at metro stations were identified. In the survey, respondents were asked to evaluate each factor by choosing whether it made them feel “much safer”, “slightly safer, “no effect”, “slightly unsafe”, or "much less safe or afraid". The following factors were included in the questionnaire:

- **Station Lighting** was included because research consistently highlights its critical role in enhancing perceived safety at transit stations. Good lighting improves visibility, reduces fear of crime, and is one of the most frequently suggested safety improvements by passengers. By asking respondents whether poor lighting increases, decreases, or has no effect on their feelings of safety, it is possible to analyse whether insufficient lighting is a common factor at stations rated as unsafe. If lighting is identified as a significant factor, potential improvements can be considered at those stations, as lighting is within KLOY's control.
- **Surveillance Cameras** were included because the presence of cameras has been found to have a positive effect on passengers' perceived safety, as they are often seen as a deterrent to crime. This study aims to further investigate these aspects by examining whether the presence of cameras influences metro passengers' safety perceptions and whether these effects vary among demographic groups.
- **Security Guards** were included as their presence is one of the most important factors influencing safety perceptions in rail-bound settings. However, the presence of security personnel does not increase everyone's safety perceptions; for example, transgender individuals have reported feeling unsafe in the presence of transit police officers due to previous negative experiences (Lubitow et al., 2020). This issue of negative encounters with security personnel has also been observed in Finland. In 2022, significant media attention was drawn to incidents where security guards at train stations in Helsinki, Espoo, and Vantaa were found guilty of assaulting people, primarily targeting vulnerable individuals, such as intoxicated or otherwise defenceless persons (Kirsi, 2024). Although security services at metro stations are provided by a different company than the one involved in these assault cases, the scandal likely influenced public attitudes toward security guards and may have weakened trust in them among some individuals. Therefore, this aspect was included in the survey to examine whether metro passengers perceive the presence of security guards as enhancing, decreasing, or having no effect on their sense of safety, and to identify any differences among various demographic groups.
- **Clear Signage and Timetable Displays** were included because research suggests that clear, up-to-date signage contributes to a sense of order and control, positively influencing safety perceptions (Deníz, 2019; Fink & Taylor, 2011; Kim, 2021). Gender differences have been observed in how real-time information affects safety perceptions. This study sought to assess whether passengers feel signage and timetable displays affect their safety perceptions and whether there are differences between demographic groups, as signage is a factor that KLOY can improve if needed.

- **Out-of-Order Elevators or Escalators** were included because the functionality of such mobility aids can impact safety perceptions, especially for individuals with reduced mobility. Given that KLOY actively manages the maintenance of these facilities and closely monitors customer feedback, this study sought to assess how the operational state of mobility aids influences passengers' safety perceptions.
- **Cleanliness** at the station was included because research indicates that cleanliness and maintenance of public spaces are key factors in shaping safety perceptions. KLOY is responsible for station maintenance and cleanliness, recognizing the importance of these factors in preventing passengers from perceiving the station as uncared for. Therefore, it is crucial to understand how these aspects influence passengers' safety perceptions and to identify any areas for improvement at stations perceived as unsafe.
- **Broken Infrastructure** was included because if elements such as benches, doors, or lights are broken, they can serve as visual cues of neglect and contribute to feelings of insecurity.
- **Visible Maintenance or Renovation Work** was included because ongoing maintenance or renovations can influence safety perceptions in different ways. Since KLOY actively renovates stations, with visible renovation work ongoing at several stations during the survey period, this aspect was included to investigate how it affects safety perceptions at the stations.
- **Crowded Stations** were included because previous studies have shown that crowded environments can lead to discomfort and increased feelings of vulnerability. This factor was included in the survey to assess how crowding affects safety perceptions, which may assist in determining where possible improvements related to safety perceptions should be made.
- **Empty Stations** were included as research indicates that when opportunities for natural surveillance decrease, such as when alone at a station, feelings of fear and insecurity can increase. This factor was included to assess how passengers using metro stations in the Helsinki metropolitan area feel that the number of people at a station influences their safety perceptions and whether there are differences between demographic groups. This was assessed by asking whether the fact that "There are very few people at the station or you are alone" had a positive, negative, or no effect on perceived safety.
- **Music or Nature Sounds** were included because ambient sounds, such as music or nature sounds, can reduce stress and anxiety, creating a calming environment that positively affects safety perceptions and

contributes to an overall sense of safety, in contrast to noise pollution, which has been linked to increased fear of crime in previous studies. Feedback collected by HSL and KLOY shows mixed reactions to music and nature sounds at stations: some passengers find them pleasant, while others describe them as irritating or stressful. These differing opinions make it relevant to examine how such sounds affect perceived safety.

To keep the survey concise, some environmental and social factors were excluded. For instance, the visibility of defibrillators, security control room numbers, and other emergency equipment was not included. While these elements are important for safety, research has shown they have a limited direct impact on safety perceptions at metro stations. Seating availability was also excluded, as it influences perceptions of service quality more than safety and is more relevant to public transport vehicles than stations. Finally, the presence of shops, restaurants, or connections to shopping malls was omitted, despite research suggesting they may influence safety perceptions. However, as this factor is relevant to the study's research questions, it will be analysed based on station characteristics rather than direct survey responses, examining the relationship between stations' safety perceptions and their commercial services to determine whether the presence of shops, restaurants, or shopping malls inside, connected to, or in the direct vicinity of stations is associated with perceived safety.

The survey also included a question asking respondents how often they fear witnessing certain situations at metro stations and how often they fear becoming victims of these situations themselves. These situations included theft or robbery, violence or threats, and sexual harassment. The purpose behind including these questions was to examine whether demographic differences exist in what individuals are afraid of. The inclusion of these questions also allowed for studying how previous victimization affects people's fear of encountering such criminal activities at metro stations. Specifically, adding these questions enabled an investigation into whether those who had been victims of crime at a metro station were more likely to fear witnessing or becoming victims of these incidents themselves, compared to those who had not previously been victimized. These questions were also included because, in a survey conducted by HSL at the turn of the year 2023-2024, responses revealed concerns about becoming victims of violence, robbery, or harassment. Additionally, around 60% of respondents reported encountering disorderly conduct occasionally while using public transport in the Helsinki metropolitan area, while only 20% had never encountered any disorderly conduct at all (HSL, 2024b).

3.2 Data Collection

A survey conducted via the HSL mobile app was chosen as the primary method for data collection. To best answer the research questions, it was necessary to reach as many metro users as possible to gather opinions from a heterogeneous group of participants, as safety perceptions are known to depend greatly on individual factors. The survey served as the main method for this study, but in addition, I utilized secondary data collected within my organization. For instance, information on the timelines of past and planned renovations at metro stations, as well as details of completed maintenance work, was obtained from KLOY's internal databases. Furthermore, I drew on internal organizational data regarding security measures at metro stations and statistics compiled by KLOY on incidents and disruptions occurring at metro stations. These statistics were used to support my analysis and interpretation of the survey results.

3.2.1 The Survey

Conducting a survey is a common method in studies on safety perceptions, especially Likert scale surveys such as this one (Ceccato et al., 2022). These surveys often use Revealed Preference/Stated Preference (RP/SP) approaches with closed-ended questions based on Likert scales to assess travellers' perceptions (Abenoza et al., 2018; Allen et al., 2019; dell'Olio et al., 2010; Hamid et al., 2015; Tyrinopoulos & Antoniou, 2008; Yavuz & Welch, 2010). Respondents are typically asked to express their agreement with statements or their satisfaction on an ordinal scale, such as from 1 to 5 (De Oña & De Oña, 2015; Dell ´Olio et al., 2017). The use of Likert scales in these surveys allows for the collection of detailed and nuanced data on respondents' attitudes and perceptions, making it easy to perform quantitative analysis, compare responses, and create visualizations.

I considered an interview-based method, but I ultimately chose a survey to reach a larger and more diverse sample that better reflects the metro user population. A broader reach increased the likelihood of capturing responses from people of different ages, genders, residential areas, usage frequencies, and experiences, enabling me to conduct a more comprehensive analysis of who feels unsafe, to what extent, and in what contexts. While deeper insights could have been gained through interviews, it would have risked excluding more reserved individuals or those with limited Finnish or English skills. Participation often skews toward more outgoing, articulate individuals with time and motivation. Additionally, my worry was that sensitive topics like fear could be harder to discuss openly in person, whereas anonymity in surveys usually encourages more honest responses. To address the limitation of closed-ended questions not capturing detailed reasoning, I included an optional open-ended question at the end of the survey to allow respondents to elaborate on their thoughts and raise additional points. A full list of survey questions can be found in Appendix 1.

The survey in this study consisted primarily of questions where respondents selected from 2 to 5 response options. Some questions also included an "I don't want to answer" choice. The types of questions where respondents are asked to assess the importance of different factors, indicate how strongly they agree with certain statements, or report how often they experience particular feelings, as included in this survey, are commonly used in studies on perceived safety and the factors influencing it in public transport environments (e.g., (Ceccato, Sundling, et al., 2024; Chowdhury & Van Wee, 2020; Coppola & Silvestri, 2020; Currie et al., 2013; Friman et al., 2020; Ouali et al., 2020; Shibata et al., 2014; Yavuz & Welch, 2010)). Participants were asked to evaluate their general feelings of safety in metro stations, as well as their safety perceptions at specific stations they knew best. To ensure responses were based on actual personal experience rather than assumptions or vague memories, participants selected 1–5 stations they were most familiar with and evaluated only those. This approach prevented assessments based on reputation or general perceptions of a station they had never visited, as well as evaluations influenced by unreliable memories if a respondent had not been there in a long time. In addition, the survey asked respondents about their fear of crime, specifically how often they feared witnessing certain incidents or becoming a victim themselves. It also included a list of 11 factors identified in previous research as influencing perceived safety. Respondents assessed the extent to which these station-related factors influenced their perceptions of safety. Furthermore, background information was collected, including age, gender, the metro station closest to their home, previous victimization experience, possible mobility limitations or use of mobility aids, frequency of metro use, and whether they avoided any stations due to fear. The survey concluded with an optional open-ended question, giving respondents the opportunity to share additional thoughts on perceived safety at metro stations that were not covered by the closed questions.

The decision to use Likert-style questions with verbal response options (see Appendix 1) was based on previous findings suggesting that numerical rating scales tend to encourage more deliberate, analytical evaluations of probability, which may not accurately reflect how people perceive risk or emotion, whereas verbal scales have been shown to correspond more closely to how people intuitively assess probabilities and uncertainties (Raue et al., 2019; Windschitl & Wells, 1996). People generally rely more on intuitive rather than deliberate thinking (Kahneman, 2011). Therefore, verbal scales were used for response options instead of numerical values to encourage intuitive responses. This approach was intended to better capture respondents' genuine emotional reactions and provide a more accurate understanding of how feelings of safety influence travel behaviour and how different factors influence safety perceptions.

In addition, only closed-ended questions were used (with the exception of one optional open-ended question at the end) due to several practical reasons. Closed-ended questions are easier to analyse and compare systematically, reducing the likelihood of misinterpreting the survey answers. They also require less effort from respondents, increasing the chances that participants remain engaged and maintain consistent attention throughout the survey. Moreover, as the survey was conducted via a mobile application, typing longer responses can be inconvenient, error-prone, and time-consuming. To facilitate participation and minimize respondent burden in a mobile format, the use of closed-ended questions was considered the most appropriate approach.

The survey was published on Monday afternoon, March 31, 2025, and remained open for one week. Invitations were sent to everyone who met the following criteria: they were part of the HSL's Research Platform (having enabled notifications and survey invitations in the app), had given consent for the collection of their travel data, and had visited a metro station in the past month. In total, the invitation to participate was sent to 61,934 persons. Out of those, 44,505 saw the invitation, 2,158 opened the survey link, 1,152 began answering the survey, but 33 answered "No" to using the metro and 39 answered "No" to being at least 16 years old, so ultimately 1,086 people completed the survey. The voluntary open-ended question at the end of the survey was answered by 226 people.

3.2.2 HSL Research Platform

HSL has created a Research Platform (Tutkimusalusta), which enables performing digital customer satisfaction surveys and other types of questionnaires. This allows HSL to actively monitor people's movements and customer opinions. The platform was launched in January 2023. Public transport passengers interested in helping HSL develop public transport services can join the platform via the HSL app on their phones. Participation in the platform is entirely voluntary, and you can enable or disable the visibility of survey and research invitations at any time in the app. (HSL, 2024a, 2025c).

The platform's user base consists of two groups: those who have given permission to track their movements and are known only as, for example, a middle-aged man from Vuosaari, without being identifiable or linked to their responses, and those who have additionally given permission to link their movement data to their HSL account, making them identifiable. With the Research Platform, HSL can target surveys to specific metro stations. For example, when a respondent who has consented to movement data collection is detected using a station, they receive a survey or quality assessment task related to that station. Surveys and notifications can also be sent to the platform's user base in a non-location-specific manner, such as sending a survey to a specific group or respondents of a certain age.

I chose to use this Research Platform for my survey due to its large user base. It has been employed in similar studies on safety perceptions in Helsinki metropolitan area public transport, making it a natural choice. Moreover, it allowed me to leverage HSL's expertise in conducting surveys, as I have no prior experience. Although not all platform users use the metro and the survey was not sent to everyone, this method provided a better chance of gathering enough responses for meaningful analysis than other available options. For instance, handing out survey forms to metro passengers would have required them to respond quickly before exiting the train, an impractical approach that could lead to rushed answers or low participation. Another option, posting QR-coded notices at stations, would likely be less effective as people are often reluctant to scan unknown links. This method would also exclude certain demographics, such as older individuals unfamiliar with QR codes. Thus, using this platform maximized the likelihood of collecting a sufficient number of responses and reaching the right audience.

3.2.3 Limitations of the Survey

The survey had several limitations. To ensure it remained concise and suitable for mobile use, many aspects related to perceived safety in metro stations had to be excluded to keep the survey short enough for respondents to complete. Although the Research Platform includes minors, this survey was targeted only at individuals at least 16 years old. Respondents were screened at the start with the question, "Are you at least 16 years old?" Those who answered "no" were excluded from the survey. Additionally, the survey was available only in Finnish, Swedish, and English, limiting participation from speakers of other languages.

Participation was restricted to users who had joined the Research Platform, consented to travel data tracking, and had visited metro stations within the past month. As a result, some metro users, such as those who use the metro infrequently or have not enabled location tracking, were not reached. The mobile format may also have excluded individuals less comfortable with mobile technology, such as some older adults.

Finally, the survey did not include people who do not use the metro at all. They were screened similarly to individuals under 16 years old, with a yes or no question about metro use at the beginning of the survey. While this exclusion was necessary to ensure that respondents could provide informed assessments of safety in metro environments, it is also a significant limitation. Those who avoid the metro due to safety concerns are arguably the most affected by poor safety perceptions at stations, and their perspectives are especially valuable when aiming to improve safety perceptions and ensure that fear does not deter anyone from using the metro. Unfortunately, this group could not be reached through this survey.

Due to the need to keep the survey short and concise, questions about the influence of the time of visit on perceived safety were omitted. Previous research has indicated that perceptions of safety tend to decline at night when it is dark. Time also plays a role in shaping the atmosphere. During weekday mornings, when people are commuting to work, the experience of safety can be very different from weekend evenings or times when metro stations are crowded due to major events, celebrations, or public holidays. Unfortunately, the impact of timing could not be examined in detail in this study. However, to mitigate this limitation, I included an optional open-ended question at the end of the survey, allowing respondents to share their perspectives on perceived safety in metro stations beyond the predefined questions, including how the time of visit influences their experience.

3.2.4 Ethical Considerations

To ensure the survey complied with all ethical standards and to assess any potential ethical risks, an ethical review statement was requested from the Aalto University Research Ethics Committee. The committee reviewed the request and concluded that the study was well planned, with the main ethical risks relating to sensitive data. These risks were effectively mitigated through collaboration with HSL. The committee's decision was that the survey met ethical standards and was accepted, with one minor change. The committee requested that the participant information document be updated to include a statement specifying that HSL would act as the data controller for the personal data used in the study. This change was implemented.

The ethical review committee also consulted with a legal advisor regarding the inclusion of minors in the survey. The legal advisor recommended that the survey should only be distributed to individuals over the age of 15 to avoid unnecessary bureaucracy. Including children in the survey would require parental consent, which would add additional layers of administrative complexity. As a result, I made the decision to restrict the survey to participants aged 16 and above.

Following the committee's evaluation, discussions were held with HSL regarding the survey questions. HSL expressed concerns that some of the proposed questions were too personal or potentially distressing and could be intrusive for certain respondents. As a result, a question regarding sexual orientation was removed. The aim of this question had been to explore whether individuals from sexual minorities perceive metro stations to be less safe than those from the sexual majority, as has been observed in some previous studies. Another question removed was about respondents' comfort levels around strangers in general. This question was intended to examine whether an individual's general personality, such as being more extroverted or introverted, significantly influences their perception of safety. Previous studies have shown that feelings of anxiety or discomfort when around unfamiliar people are among the most influential factors shaping negative safety perceptions in public transport. In particular, how easy or difficult it is for individuals to feel comfortable around strangers has been identified as the most significant individual factor affecting perceived safety (Currie et al., 2013), along with trust in others and feeling safe in one's home and on one's own street (Delbosc & Currie, 2012; Reichow & Friemel, 2020; Vilalta, 2011).

In addition to removing these two questions, one question was revised. Originally, the gender question offered the options of “cis-woman”, “cis-man”, or “other”, but after discussing with HSL, the standard options commonly used in their surveys were adopted: “woman”, “man”, “other”, and “prefer not to answer”. HSL preferred to use familiar terminology to maintain consistency across surveys and expressed concern that the original wording might confuse some respondents or lead to negative reactions. While the original wording aimed to more precisely distinguish gender minorities from gender majorities, the revised options may create ambiguity. For example, one transgender woman might select “woman” while another might select “other,” since “other” could refer not only to non-binary individuals but also to transgender individuals.

Ethical risks related to the processing of data were also carefully considered, including how the data would be handled, in what format, and where it would be stored. These issues were addressed in collaboration with the thesis supervisor, the Research Ethics Committee, and HSL. Ultimately, it was decided that no personal data would be collected in the survey, nor would any data be gathered that could identify respondents in connection with their answers at any point. Respondents were also provided with information regarding the study’s data protection practices and how their data would be handled.

Other potential ethical risks were identified in relation to the analysis of the results. When dealing with demographic data, there is always the risk of misinterpreting or overgeneralizing about certain groups. Particular attention was paid in this study to ensure that no group was depicted negatively, or that overly broad conclusions were drawn from small sample sizes. Consequently, I decided not to include questions regarding respondents' education level, income, or ethnicity or migration background in the survey.

3.3 Data Analysis

The survey data was analysed using the Webropol survey and reporting tool, supplemented by Microsoft Excel. Webropol was chosen because the survey was designed and distributed through its platform, allowing for direct access to visual summaries and response filtering. Excel was used for additional cross-tabulation, comparison, and the creation of custom visualisations to better explore specific trends across stations and user groups. The combined use of these tools enabled efficient handling of a relatively large dataset while maintaining a manageable level of complexity.

The main benefits of this approach included ease of use, fast access to preliminary results, and compatibility with anonymised survey data. However, the analysis was limited by the tools' inability to perform more advanced statistical modelling, such as regression analysis, which would have required exporting the data into specialised software like SPSS or R. Additionally, while individual-level responses were available for analysis, the focus was primarily on grouped data, as this allowed for clearer identification of broader trends and comparisons across different user categories. The use of grouped data also helped streamline the analysis, but it did not preclude the possibility of examining individual responses when needed.

It is important to note that statistical significance testing, such as calculating p-values or confidence intervals, was not conducted in this analysis. The results are based on descriptive statistics, visual summaries, and comparisons between user groups or stations. While these methods allowed for the identification of broad trends and patterns, they do not indicate whether observed differences are statistically significant in a formal sense. As such, any conclusions drawn should be interpreted with caution and understood as indicative rather than definitive.

From an ethical perspective, the analysis respected respondent anonymity at all times. No personal identifiers were collected, and data was stored securely in accordance with Aalto University and HSL data protection guidelines. While this ensured participant privacy, it also meant that certain combinations of variables (e.g., gender, victimisation, and mobility limitations) could not be analysed in detail due to very small subgroup sizes. These constraints were carefully considered to avoid drawing misleading conclusions or unintentionally exposing vulnerable groups through overly specific cross-analyses.

Additionally, the data provided to me consisted only of survey responses, with no personal identifying information or data that could be linked back to individual respondents. I ensured that the data was stored securely on my personal computer and hard drive, and not in any cloud services or online folders. No one else had access to this data except for me, with the exception of HSL, which could review the data through the Webropol tool. This careful data handling was part of an effort to maintain privacy and security while conducting the analysis.

3.4 Context and area of study

3.4.1 KLOY Metro Stations

There are 30 stations in the Helsinki capital region metro system along its 43-kilometer-long track. The metro line consists of the older “Kantametro” section in Helsinki, which runs from Ruoholahti through the city centre to East Helsinki, branching at the Itäkeskus metro station with terminus at Vuosaari and the other at Mellunmäki. The newer 21-kilometer-long West Metro (Länsimetro) track in Espoo extends from Ruoholahti westward to its terminus at Kivenlahti. The stations located in Helsinki are owned by Helsinki City Transport (Helsingin kaupungin liikenneliikelaitos, HKL), while the 13 stations in Espoo are owned by Länsimetro Oy. All stations are operated by KLOY for HSL. HSL is responsible for planning and organizing public transport in the Helsinki region and is the more visible company to metro riders, handling ticket pricing and sales, providing schedules, and offering journey planning services. KLOY, on the other hand, manages the actual operation and maintenance of the metro services, including the upkeep and renovation of stations and tracks, as well as employing metro drivers.

In 2024, the Helsinki metro system saw 68.47 million passengers from January 1 to November 30, compared to 72.9 million during the same period in 2023. The decrease in 2024 was partly due to service interruptions during the summer, when metro services were suspended at Rautatientori, Kontula, Myllypuro, and Mellunmäki stations due to station renovations. When looking at the monthly passenger amounts, in November 2024, there were approximately 7 million metro passengers, while in November 2023, there were about 7.3 million passengers. Looking at the data from 2023, the busiest stations were those located in Helsinki city centre, with Kamppi station having 45,700 daily visitors and the Central Railway Station having 54,000 daily visitors. The least busy station was Finnoo in Espoo, with 1,400 daily visitors. In general, the western metro stations in Espoo see fewer visitors than the metro stations in Helsinki. On average in 2023, the stations on the western metro extension had a total of 112,600 daily visitors, while the older stations in Helsinki recorded 379,100 daily visitors, meaning the West Metro stations attract approximately one-third of the daily visitors compared to Helsinki stations. Among stations along the older track, Kulosaari was the least busy, with 6,300 daily visitors.

Based on internal data regularly collected and compiled by KLOY on metro station disturbances, I retrieved and analysed statistics covering the five-year period from 2020 to 2024. These data include both the number of police assignments and actions taken by metro security personnel at different stations. When examining these internal statistics, it becomes clear that certain stations consistently stand out as more problematic, while others report significantly fewer incidents. Sörnäinen has had the highest number of police assignments throughout this period. In terms of actions taken by metro security personnel, such as removals and other interventions to maintain public order, Sörnäinen also ranks either first or within the top four stations every year. Itäkeskus most often follows Sörnäinen in these statistics. Other stations that frequently appear in the top 10 include Central Railway Station, Kontula, Mellunmäki, Hakaniemi, Vuosaari, and Herttoniemi. The exact rankings of these stations vary depending on the type of intervention and the time period examined.

Overall, metro stations located in Helsinki record more police and security personnel interventions than those in Espoo. Among the Espoo stations, Tapiola and Kivenlahti occasionally appear in the top 10 list for security personnel interventions, although this list is otherwise dominated by Helsinki stations. In terms of police assignments, Tapiola typically records more incidents than Kivenlahti. In some years, stations such as Matinkylä, Otaniemi, Keilaniemi, Kaitaa, Niittykumpu, and Lauttasaari have also recorded police interventions, though their figures remain clearly lower than those observed at the most problematic stations in Helsinki.

Figure 1: Map showing the current metro lines and stations in the Helsinki Metropolitan Area (HSL, 2025b).

3.4.2 Age of Metro Stations

The first metro stations in Helsinki were opened in 1982. These included Central Railway Station, Hakaniemi, Kulosaari, Herttoniemi, Siilitie, and Itäkeskus. These were followed by Kamppi in 1983 and Sörnäinen in 1984. After that metro system was extended to the east with Myllypuro and Kontula opening in 1986, and Mellunmäki in 1989. Ruoholahti station was opened in 1993 and University of Helsinki in 1995, followed by Puotila, Rastila and Vuosaari in 1998, and lastly Kalasatama in 2007.

The western extension was done in two parts. First part from Ruoholahti to Matinkylä was opened in 2017 and included stations Lauttasaari, Koivusaari, Keilaniemi, Aalto-university, Tapiola, Urheilupuisto, Niittykumpu and Matinkylä. The second part continued from Matinkylä to Kivenlahti, and those stations, Finnoo, Kaitaa, Soukka, Espoonlahti and Kivenlahti, were opened in 2022.

Figure 2: Kivenlahti metro station in Espoo, built 2022 (KLOY).

The age difference between older stations in Helsinki and the newer ones in Espoo is clearly visible when visiting the stations. Western stations represent more modern architecture, whereas stations in Helsinki, some over 40 years old, have seen a lot of life and development around them, and are characterized by the neighbourhoods developed around them and their reputations. In contrast, in Espoo, many of the areas around the new stations are still developing and do not yet have such strong identities or reputations.

Figure 3: Herttoniemi metro station in Helsinki, built 1982 (KLOY).

3.4.3 Renovations

The age difference between eastern and western stations means that older stations require more maintenance and large-scale renovations. Recent renovations include Hakaniemi (2016-2019, with further improvements in 2023), Sörnäinen (2021-2023), Kulosaari (2010-2011), Siilitie (2012-2013), Myllypuro (2014-2016), Mellunmäki (2009-2010 and 2021-2022), and the pedestrian tunnel in University of Helsinki (2021 and beginning of 2025, just before the survey was opened). Currently, Kamppi, Central Railway Station, Herttoniemi, and Kontula stations are undergoing visible renovations. Renovations at Rastila and Vuosaari will begin later this year, with Puotila and Itäkeskus awaiting their turn. These renovations reflect the ongoing need to maintain and update older metro stations in Helsinki to meet modern standards and continue serving the growing number of passengers effectively.

In addition to renovations, some escalators or elevators at some stations are not in use, with some being replaced and out of service for a longer period, while others are undergoing lighter maintenance and are out of order only momentarily. However, accessibility has been ensured at these stations during the maintenance of level-changing devices, meaning the stations can still be used normally. The temporary unavailability of some level-changing devices is noticeable to customers and may affect their sense of safety. It should be noted, however, that respondents in the survey of this study were asked to assess their overall sense of safety at metro stations familiar to them, not their sense of safety at the exact moment of answering the survey. Therefore, ongoing renovations and maintenance work at the stations should not significantly impact the survey responses, any more than any other visible maintenance work that has been seen at stations recently.

3.4.4 Type and Surroundings

The Helsinki Capital Region metro system spans 43 kilometres and includes a wide variety of station environments. While all stations serve the same core transport function, the stations' design, services, and neighbourhood context differ significantly. These differences shape the way people view each station and the types of users they attract, which may in turn affect safety perceptions. Some metro stations are integrated directly into shopping centres, allowing passengers to access commercial spaces without leaving the station. These include Itäkeskus with shopping centre Itis, Kalasatama with Redi, Kamppi with the same-named shopping centre, Lauttasaari with Lauttis, Tapiola with Ainoa, Niittykumpu with Niitty, Matinkylä with Iso Omena, and Espoonlahti with Lippulaiva. Other stations are located in close proximity to shopping centres, such as Vuosaari with Columbus, Myllypuro with Mylly, Kontula which is surrounded by an open-air shopping centre, Herttoniemi with Hertta, University of Helsinki with Kluuvi, Central Railway Station with City Center, Aalto University with A Bloc, and Soukka with the same-named shopping centre. Some stations house commercial services like shops and hair salons, and others are surrounded by bars and restaurants that serve alcohol.

The surrounding neighbourhoods of metro stations also differ widely, ranging from newly developed areas in Espoo to the dense city centre of Helsinki and lower-income residential districts in eastern Helsinki. These neighbourhoods vary not only in residents' income levels and the number of services and workplaces they host, but also in public image and reputation. Crime levels and types differ by area, and some stations stand out as hotspots for frequent public disturbances and criminal activity, requiring regular intervention by security personnel. Drug use and trade, for example, are types of crime that are concentrated at certain stations and affect the station's reputation, making these problem stations well-known to the public. In particular, Kontula, Myllypuro, Kulosaari, and Ruoholahti metro stations have been frequently mentioned as areas where residents feel unsafe. In Kontula and Ruoholahti, these concerns seem to be linked more to disturbances caused by nearby restaurants and bars rather than the metro stations themselves (Kemppainen et al., 2014; Väliniemi-Laurson & Rönnberg, 2019).

Income levels in postal code areas surrounding metro stations vary significantly. When examining the stations in relation to the median income of adult residents, the lowest incomes are found in Espoo, in postal code area 02150, which includes the Keilaniemi and Aalto University metro stations. Figures 4 and 5 present the annual median incomes for each postal code area in Helsinki and Espoo. In Helsinki, stations located in lower-income areas include Kontula, Itäkeskus, Mellunmäki, Rastila, Sörnäinen, Puotila, Myllypuro, Hakaniemi, and Herttoniemi. At the higher end of the scale, Espoo's Matinkylä station lies in postal code 02230, which has the highest median income, followed by Kulosaari in Helsinki's postal code area 00570.

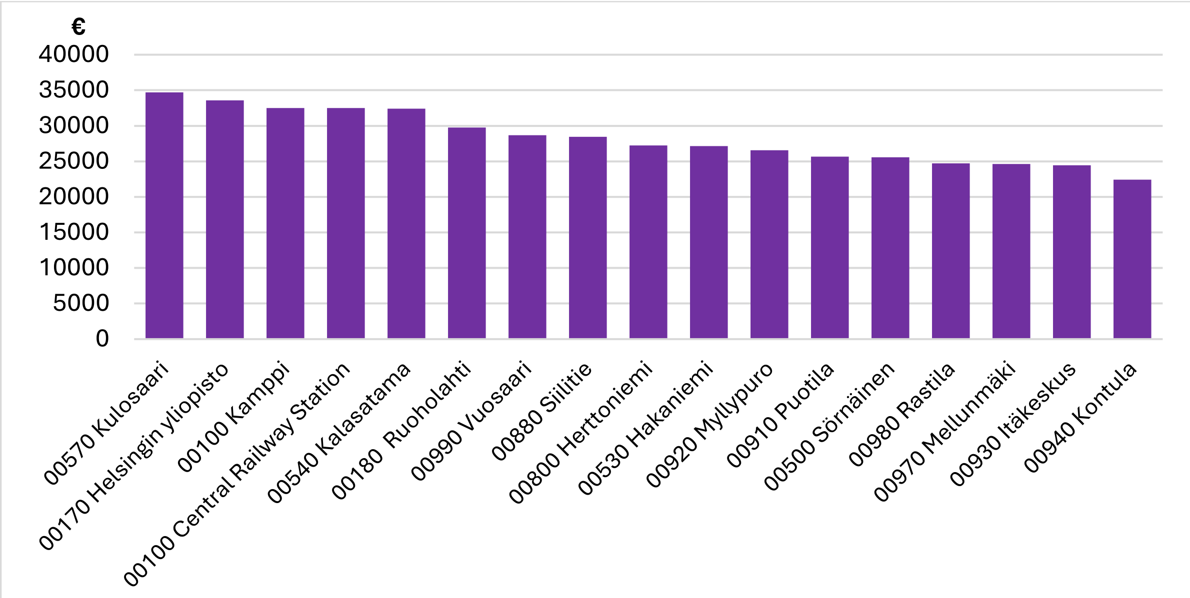

Figure 4: Median income in postal code areas of Helsinki metro stations in 2023 (Tilastokeskus, 2023).

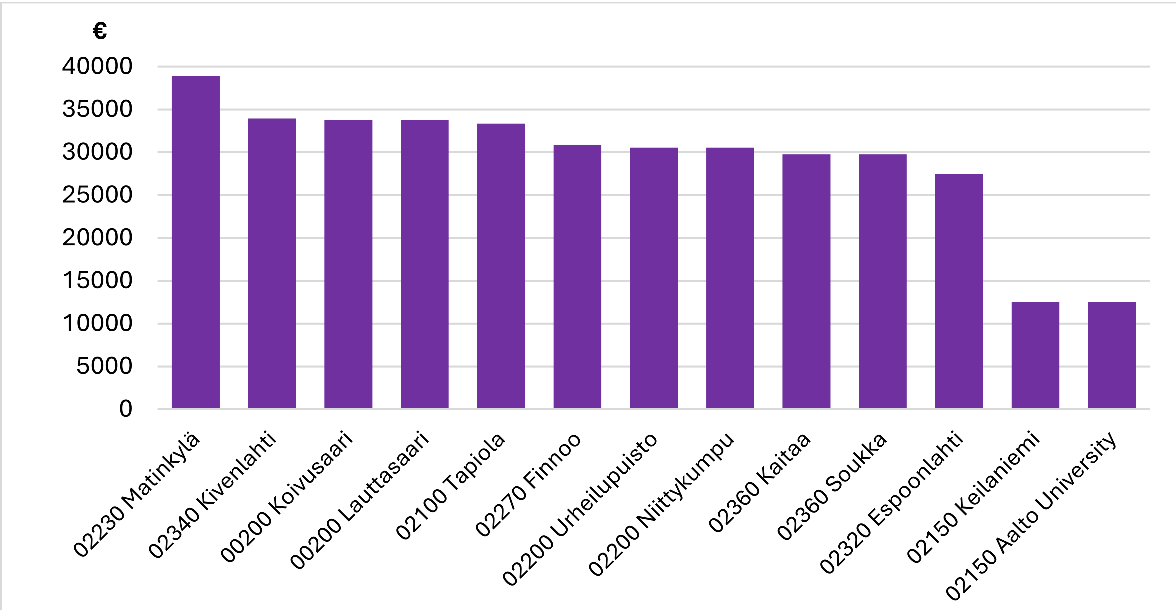

Figure 5: Median income in postal code areas of Espoo metro stations in 2023 (Tilastokeskus, 2023).

4 Results

4.1 Participants

An invitation to participate in the survey was sent to all members of the Research Platform who had enabled location tracking and had visited at least one metro station in the past month. In total, the invitation was sent to 61 934 individuals. Of these, 44,505 saw the invitation, 2,158 opened the survey link, and 1,152 commenced the survey. The first two questions served as screening criteria: 33 respondents indicated that they did not use the metro, while 39 stated that they were under 16 years of age. **Consequently, 1,086 participants proceeded to complete the rest of the survey.** Additionally, 226 participants provided comments in response to the voluntary open-ended question at the end of the survey.

A total of 1,076 respondents identified the metro station closest to their home. **The majority resided in Helsinki**, with 638 (59%) selecting a metro station in Helsinki as the nearest to their residence. The second-largest group comprised those who identified a station in the western metro extension as their closest, amounting to 319 individuals (30%). Additionally, 34 respondents (3%) lived outside the Helsinki metropolitan area, while 85 (8%) resided within the Helsinki metropolitan area but not near any metro station.

The **age distribution** of survey respondents was relatively balanced, except for individuals over the age of 70, who constituted the smallest proportion. The oldest participant reported being born in 1932, while 36 respondents selected 2008 as their birth year, the latest option available due to the minimum age requirement of 16 years. Categorising respondents into age groups based on their birth year, 31% were aged 16–29, 40% were 30–49, 23% were 50–69, and the smallest group, those aged 70 and above, comprised 6% of respondents.

In terms of **gender distribution**, the majority of respondents were women, accounting for 58% (633 individuals). Men constituted 38% (413 individuals). Additionally, 24 respondents selected the option "Other," and 16 preferred not to disclose their gender.

Regarding **metro usage frequency**, 40% reported using the metro daily or almost daily. Additionally, 29% travelled by metro multiple times per week, 13% used the metro once per week, 14% used it 2–3 times per month, and 5% reported using it once per month or less frequently.

When asked whether participants had **a mobility restriction or used any mobility aids**, 31 respondents answered "Yes," while 1,036 responded "No." The remaining participants opted not to answer this question.

As for the **language of participation**, the majority of respondents (81%) completed the survey in Finnish. Swedish was chosen by 4% of participants, while 15% opted to complete the survey in English.

4.2 Overview of survey responses

4.2.1 General Perceived Safety at Metro Stations

The majority of respondents perceived metro stations as generally safe (Figure 6). In response to the statement "I usually feel unsafe or afraid at metro stations," a clear majority, approximately 69%, disagreed, either somewhat or strongly. Around 11% neither agreed nor disagreed, while 21% selected either "strongly agree" or "somewhat agree." Of all respondents (N = 1086), 41 individuals, representing just under 4%, selected "strongly agree," indicating that they feel unsafe at metro stations.

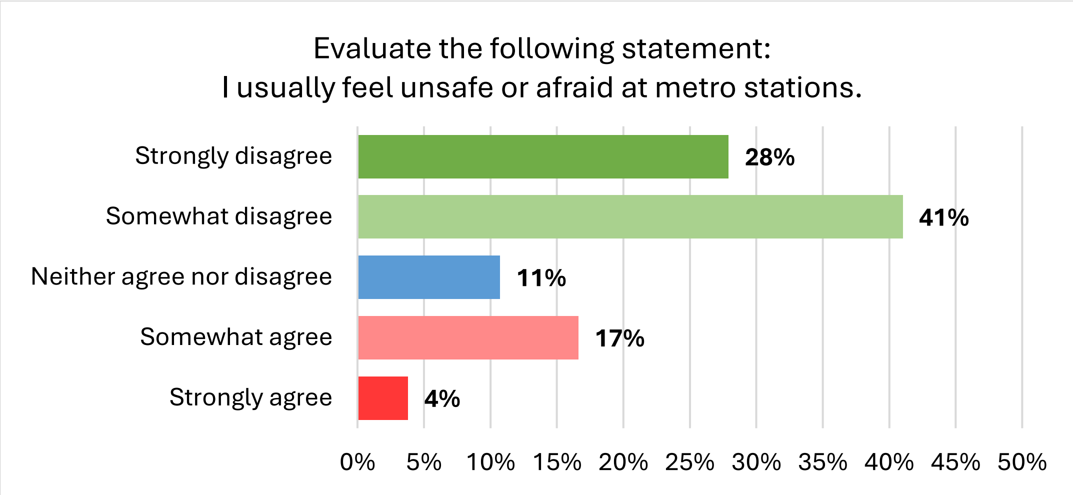

Figure 6: Distribution of responses (N = 1, 086) to the statement "I usually feel unsafe or afraid at metro stations."

When comparing respondents who strongly or somewhat agreed with the statement ”I usually feel unsafe or afraid at metro stations” to those who strongly or somewhat disagreed, those who felt generally less safe at metro stations also feared both witnessing and becoming a victim of all three mentioned types of crime more frequently than those with higher safety perceptions (Figures 7-12). The following figures illustrate these differences in relation to theft or robbery, violence or threats, and sexual harassment.

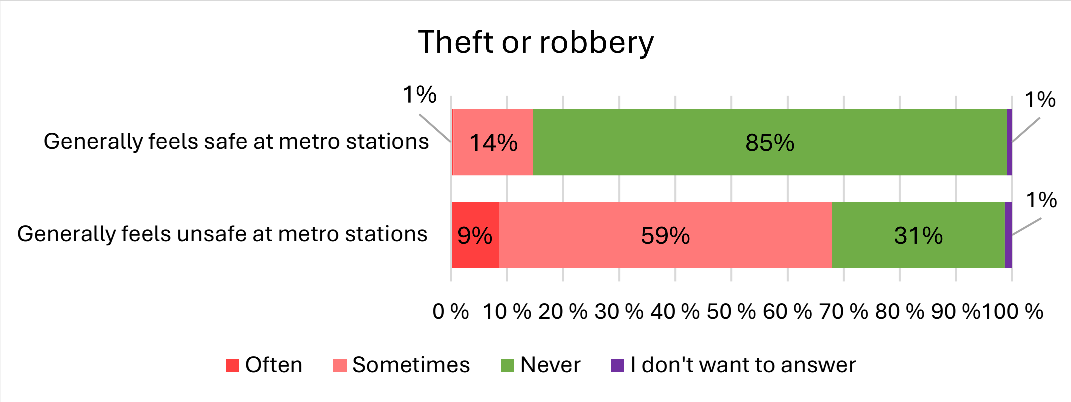

Figure 7: Fear of *witnessing theft or robbery* at metro stations among respondents who feel generally safe (n = 746) versus those who feel unsafe (n = 221).

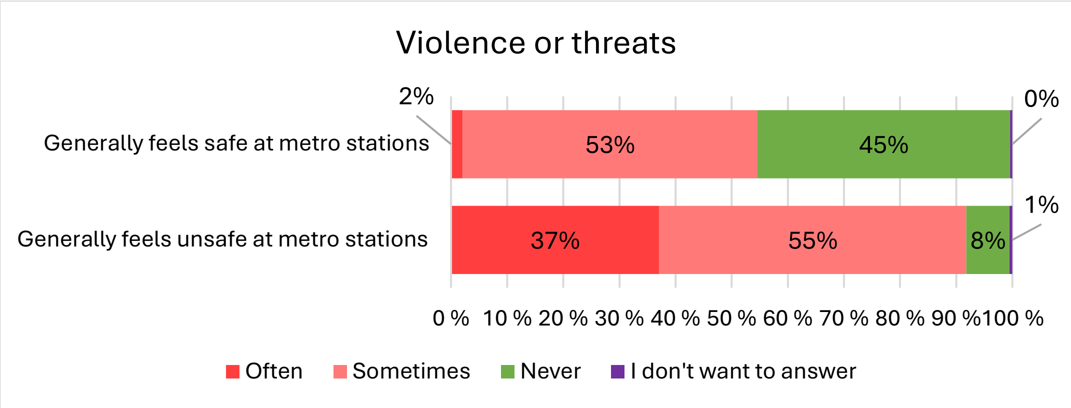

Figure 8: Fear of *witnessing violence or threats* at metro stations among respondents who feel generally safe (n = 745) versus those who feel unsafe (n = 221).

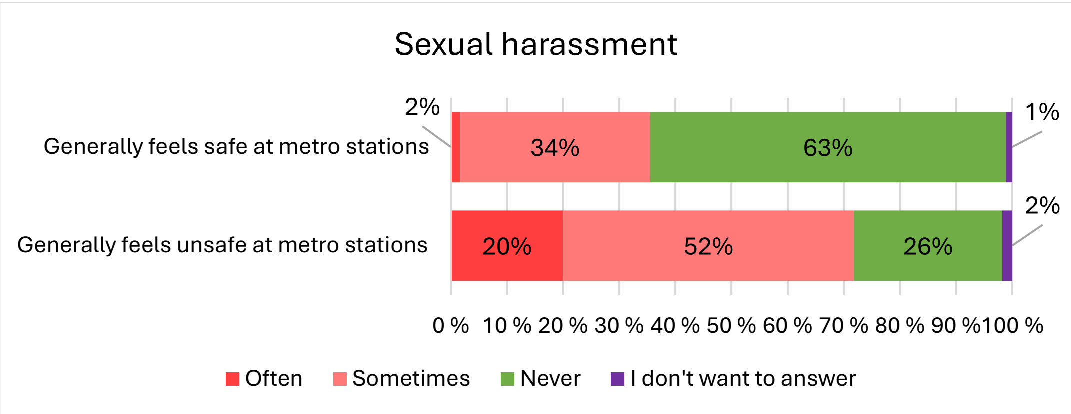

Figure 9: Fear of *witnessing sexual harassment* at metro stations among respondents who feel generally safe (n = 748) versus those who feel unsafe (n = 220).

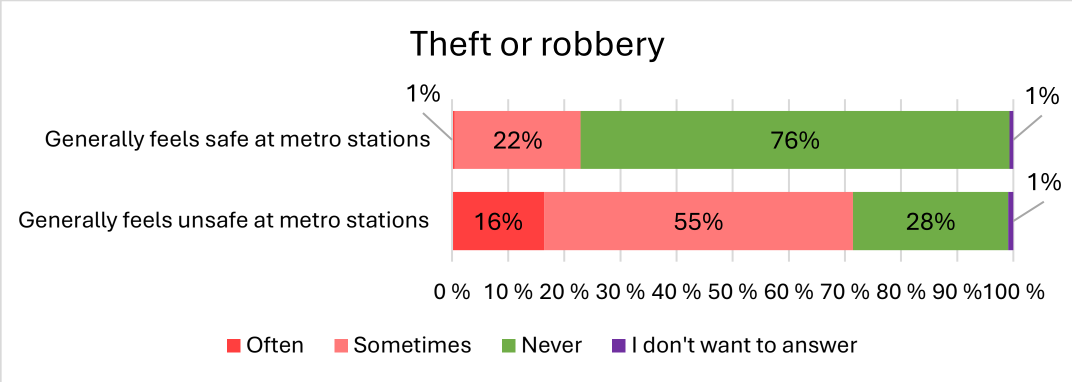

Figure 10: Fear of *becoming a victim of theft or robbery* at metro stations among respondents who feel generally safe (n = 747) versus those who feel unsafe (n = 220).

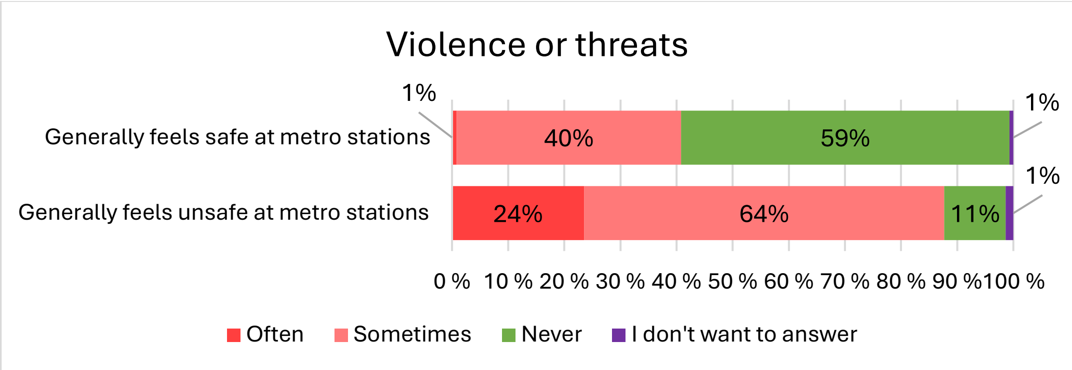

Figure 11: Fear of *becoming a victim of violence or threats* at metro stations among respondents who feel generally safe (n = 747) versus those who feel unsafe (n = 221).

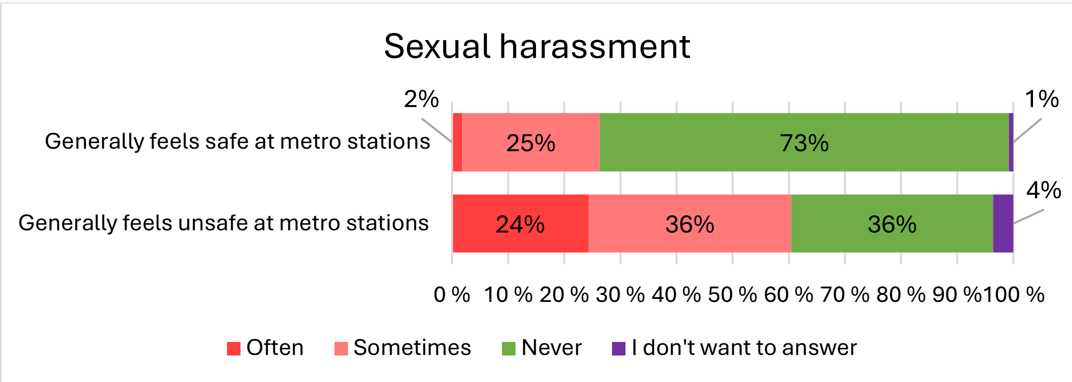

Figure 12: Fear of *becoming a victim of sexual harassment* at metro stations among respondents who feel generally safe (n = 746) versus those who feel unsafe (n = 222).

The demographic characteristics of individuals who felt unsafe at metro stations and expressed concerns about crime revealed clear gender differences. The majority of those who felt unsafe at metro stations were women, whereas the majority of those who generally felt safe at metro stations were men. Previous victimization experiences also appeared to influence the sense of safety at metro stations. A larger portion of those who have been victims at some point belong to the more fearful group, whereas a larger portion of those without victimization experiences belong to the group that generally feels safer at metro stations. Despite these differences in perceived safety, when comparing these two groups, those who generally felt safer and those who felt unsafe at metro stations, no noticeable differences were found in their metro usage frequency, mobility limitations, age distribution, or which metro station the respondent reported living near.

4.2.2 Station-Specific Perceptions of Safety

Participants were asked to choose 1–5 metro stations they were most familiar with. In total, the 1,086 respondents provided 4,863 individual evaluations. The majority (68%) selected five stations, while 17% evaluated four and 12% evaluated three. Fewer than 3% evaluated two stations and fewer than 1% of respondents evaluated only one station. The most frequently evaluated station was Central Railway Station, receiving 722 evaluations, followed by Kamppi with 654. In total, 79% of all evaluations were of stations in Helsinki, while 21% were of stations in the western metro extension. The least evaluated stations were Kaitaa, Keilaniemi, Koivusaari, and Kulosaari, each receiving fewer than 30 assessments (Figure 13).

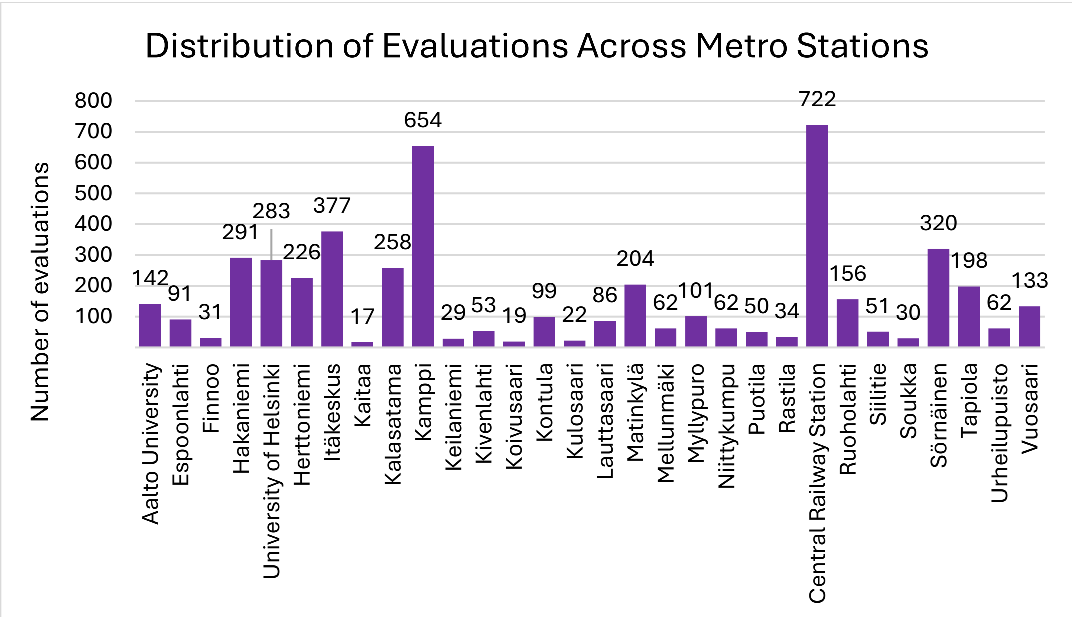

Figure 13: Number of evaluations received by each metro station. A total of 4,863 individual station assessments were submitted by 1,086 respondents.

This distribution of evaluations reflected typical travel patterns within the metro network. West Metro stations generally attract fewer daily visitors than stations in Helsinki, which likely explains their lower number of evaluations. Among the older Helsinki stations, Central Railway Station and Kamppi are the busiest, which corresponds with their high number of evaluations. Kulosaari, in contrast, has the lowest number of daily visitors among the older stations, which is reflected in its low number of evaluations. An exception in the West Metro stations is Finnoo: despite being the least frequented, it was not among the least evaluated stations.

At the Central Railway Station, responses were relatively evenly distributed, suggesting no clear consensus about perceived safety. About 28% of respondents reported feeling safe at the station, and another 28% selected “somewhat safe”. The neutral option, “I don’t feel completely safe, but I’m not afraid either,” was selected by 22% of respondents. Slightly fearful feelings were reported by 18%, while 5% said they felt unsafe or afraid. Kamppi, the next most evaluated station, was perceived as safer. About 44% respondents reported feeling safe, and 31% selected “somewhat safe.” Only 1% selected the least favourable option, “I feel unsafe or afraid.”

When comparing all the evaluations, it is evident that West Metro stations were perceived as safer than those in Helsinki. This is shown in Figure 14.

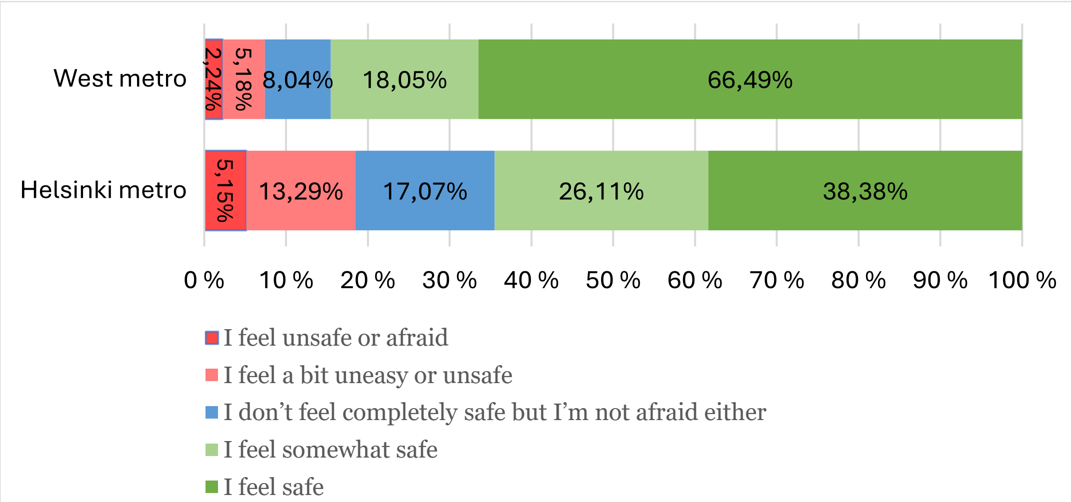

Figure 14: Average perceived safety of station-specific evaluations between Helsinki and Espoo metro stations (N = 4,863 evaluations from 1,086 respondents).

When examining station-specific evaluations, Keilaniemi and Koivusaari were perceived as the safest, as every single assessment given for these stations fell into the two highest response categories: “I feel safe” or “I feel somewhat safe.” Close behind was Aalto University Station, where 97% of assessments fell within these top two response options. Lauttasaari, Urheilupuisto, and Tapiola were also considered safe, with 97%, 95%, and 90% of their assessments falling within the top two rating categories. See Appendix 2 for figures showing response distributions for the safest stations.

Stations where perceived safety was evaluated as lowest were Sörnäinen, with 46% of assessments falling into the two lowest categories: “I feel unsafe or afraid" and "I feel a bit uneasy or unsafe" (Figure 15). Kontula, Mellunmäki, and Itäkeskus were the next lowest-rated stations in terms of perceived safety, with approximately 39%, 39%, and 34% of respondents selecting one of the two least favourable options, respectively. Among the West Metro stations, Kivenlahti was perceived as the least safe, where 26% of responses fell into the two lowest categories (Figure 16). See Appendix 2 for figures showing response distributions for the stations perceived as least safe.

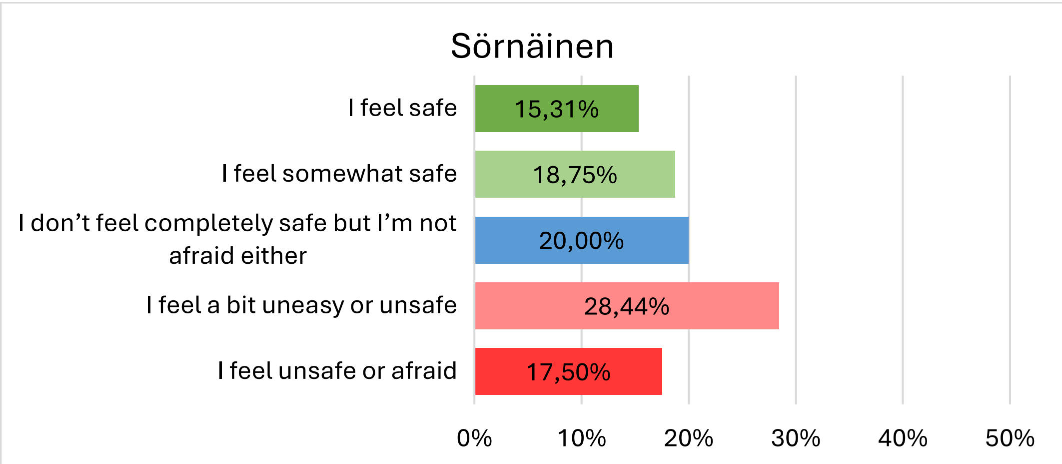

Figure 15: Distrubution of safety perceptions at Sörnäinen metro station (n = 320).

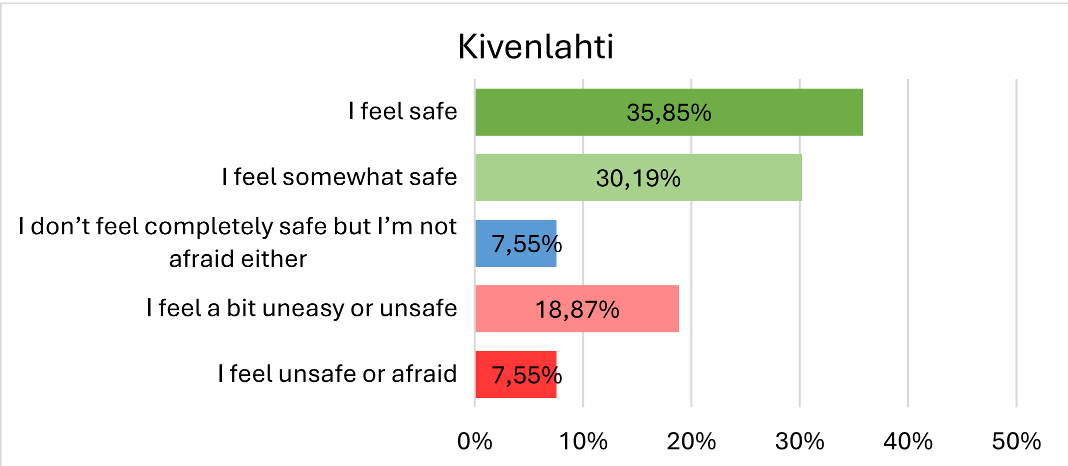

Figure 16: Distrubution of safety perceptions at Kivenlahti metro station (n = 53).

4.2.3 Fear of Crime at Metro Stations

The survey explored respondents' fears of victimization and witnessing specific crimes while waiting at a metro station, focusing on theft or robbery, violence or threats, and sexual harassment.

When asked about witnessing these situations, most respondents reported not experiencing fear. Specifically, 70% never fear witnessing theft or robbery, while 53% never fear witnessing sexual harassment. However, violence or threats were perceived as more concerning, with only 34% selecting "Never", while the majority (55%) stated they "Sometimes" fear witnessing such incidents. Additionally, 10% of respondents reported fearing violence or threats "Often," whereas this answer was chosen by only 6% regarding sexual harassment and 2% regarding theft or robbery. Responses about fear of witnessing each crime type is illustrated in Figure 17.

A separate question assessed respondents' fears of becoming victims themselves. In contrast to concerns about witnessing incidents, sexual harassment and violence or threats were feared less frequently when respondents considered personal victimization. Conversely, concern about theft or robbery increased, with 62% stating they "Never" fear victimization, 33% selecting "Sometimes," and 4% choosing "Often". This can be seen in Figure 18.

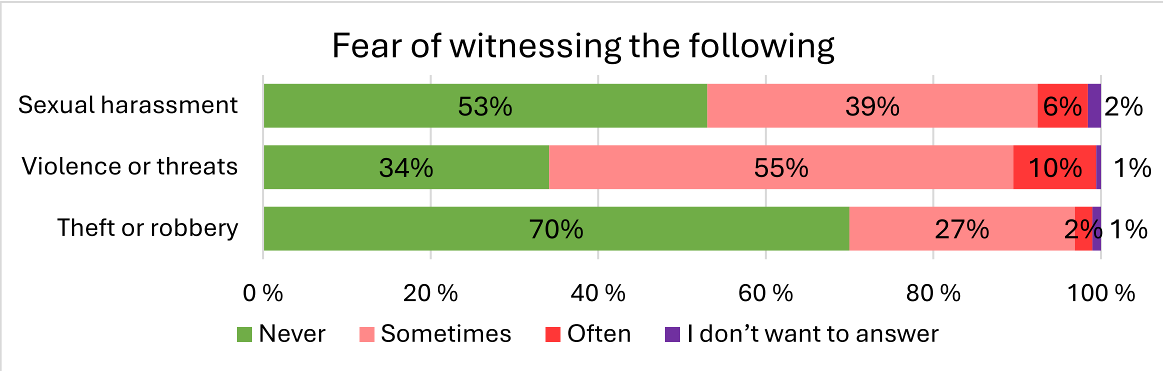

Figure 17: Fear of *witnessing* each three crime types. Number of responses: sexual harassment (n = 1,083), violence or threats (n = 1,081), theft or robbery (n = 1,082).

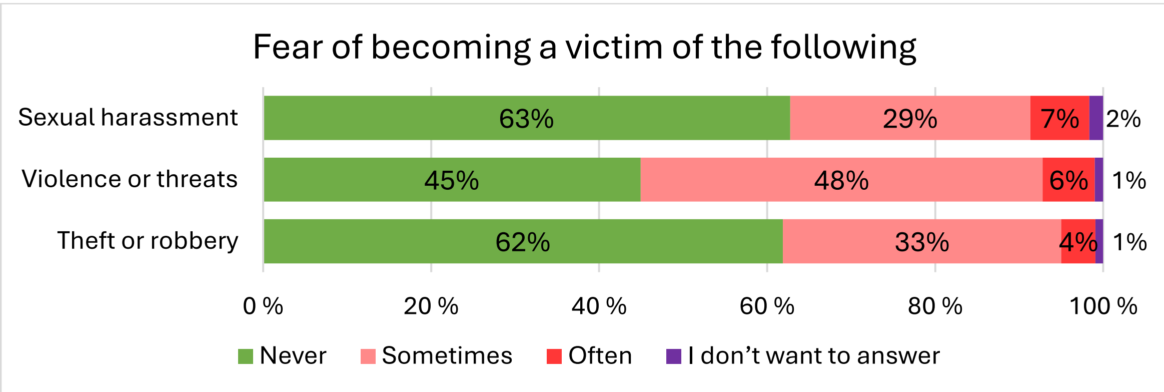

Figure 18: Fear of *becoming a victim of* each three crime types. Number of responses: sexual harassment (n = 1,084), violence or threats (n = 1,084), theft or robbery (n = 1,083).

4.2.4 Avoidance of Metro Stations

When asked about the avoidance of metro stations due to fear, 62% stated that they do not avoid using any metro station due to fear, whereas the rest avoided at least one station. One respondent reported avoiding all 30 metro stations due to fear. 165 respondents (15%) avoided one station, and 75 (7%) chose two stations that they avoid due to fear (Figure 19).

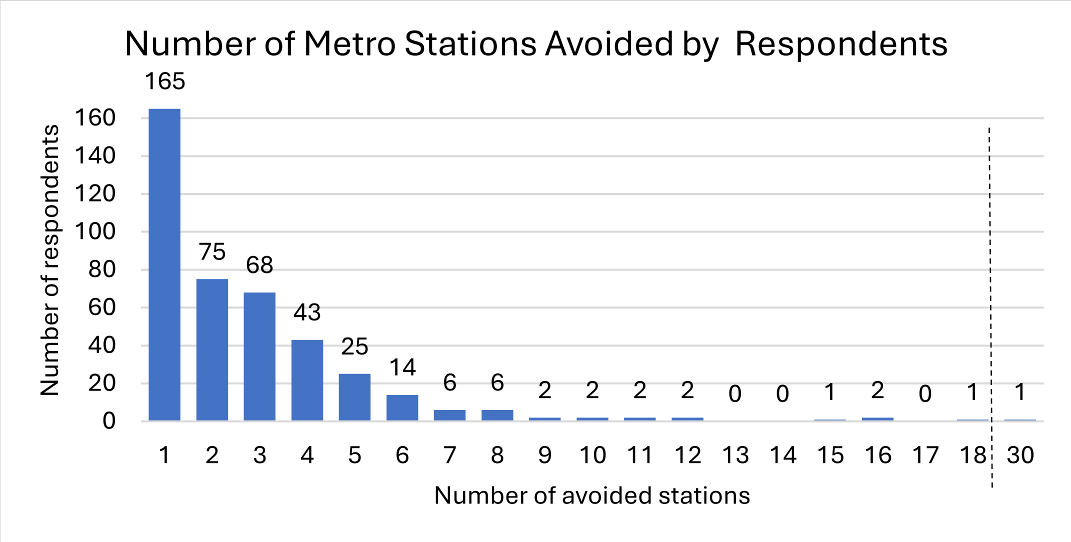

Figure 19: Distribution of respondents based on how many metro stations they reported avoiding due to fear.

The metro station most avoided due to fear was Sörnäinen, with 227 respondents stating that they avoid it. Kontula received the second-highest number of votes, with 195 respondents choosing it, followed by Itäkeskus with 187 votes (Figure 20).

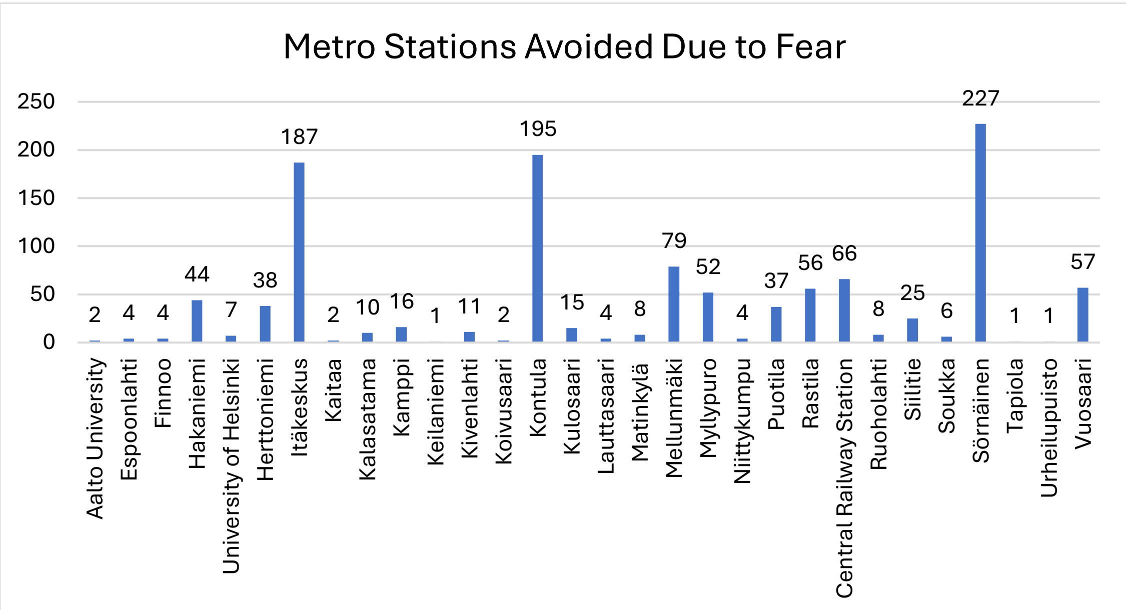

Figure 20: Number of respondents who reported avoiding each metro station.

The responses showed that the group of respondents was not homogeneous. Some metro users experienced stronger feelings of insecurity or even fear in the measurable aspects, while others were more fearless across all areas. Those respondents who reported avoiding at least one station due to safety concerns also generally exhibited lower perceived safety at metro stations overall (Figure 21).

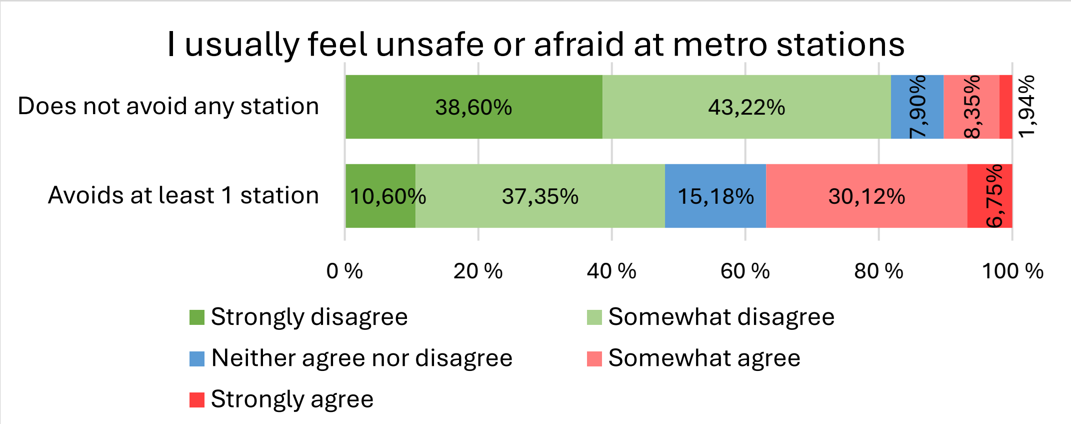

Figure 21: Distribution of responses to the statement “I usually feel unsafe or afraid at metro stations” among respondents who avoid at least one metro station due to fear (n = 415) and those who do not avoid any stations (n = 671).

Respondents who reported avoiding metro stations due to safety concerns also feared encountering crime there more frequently than others. This applies to all three types of crime mentioned and both scenarios: witnessing these crimes and falling victim to them. The distribution of responses related to theft or robbery is shown in Figure 22 (fear of witnessing the crime) and Figure 23 (fear of becoming a victim). Additional figures illustrating the differences in fear of crime for all three crime types between those who avoid at least one station due to safety concerns and those who do not are presented in Appendix 2.

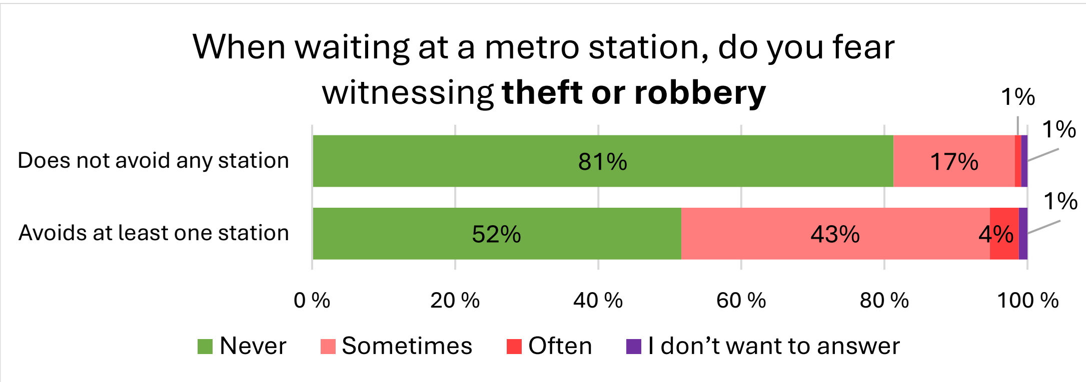

Figure 22: Fear of *witnessing* theft or robbery at metro stations among respondents who avoid at least one station due to fear (n = 413) versus those who do not (n = 669).

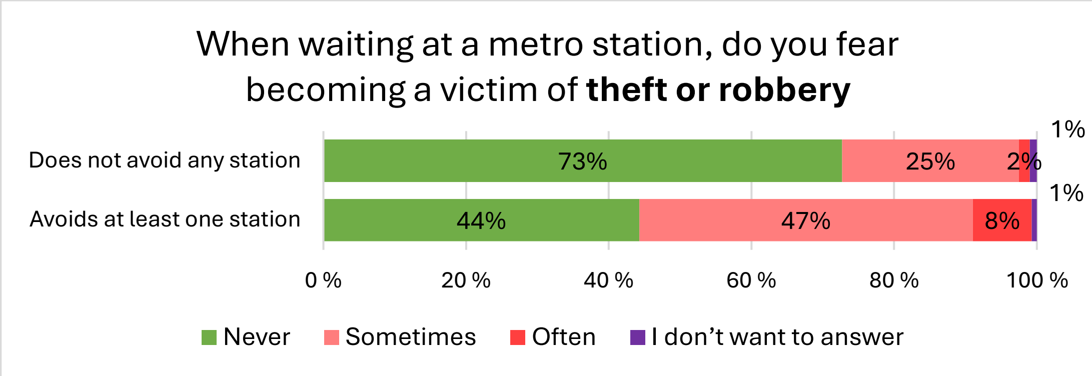

Figure 23: Fear of *becoming a victim of* theft or robbery at metro stations among respondents who avoid at least one station due to fear (n = 413) versus those who do not (n = 670).

Those who stated that they did not avoid any station also reported higher safety perceptions than others across station-specific evaluations. The only exception to this was Koivusaari, where neither group provided any responses regarding perceived safety other than “I feel safe” and “I feel somewhat safe”. However, sample sizes were extremely small.

Among respondents who avoid at least one station, a greater proportion (28%) reported having previously been victimized at a metro station, compared to only 13% among those who do not avoid any stations. Similarly, among those with prior victimization experiences, 57% reported avoiding stations due to fear, whereas only 33% of those without such experiences did the same. Women reported avoiding metro stations due to fear more frequently than men: 44% of women indicated that they avoid at least one station for safety reasons, compared to 29% of men. Younger respondents aged 16–29 were the most likely to avoid one or more stations (47%), while the proportions were lower among older age groups: 36% of those aged 30–49, 31% of those aged 50–69, and 33% of those aged 70 and older reported avoiding stations due to fear. Regarding metro usage frequency, daily users were the most likely to avoid stations (46%), whereas weekly users were the least likely (26%). Looking at place of residence, 46% of respondents living near Espoo metro stations reported avoiding at least one station due to fear, compared to only 29% of those living outside the Helsinki metropolitan area.

4.2.5 Environmental and Situational Factors Influencing Perceived Safety

Out of the 11 listed factors at a metro station, seeing security guards had the most positive impact on respondents’ safety perceptions, with 91% stating that it made them feel either "Much safer" or "Slightly safer." However, the effect on safety perceptions was not unanimous, as 4% reported that it made them feel "Slightly unsafe" or "Much less safe or afraid." The next most reassuring factors were seeing surveillance cameras and clear, up-to-date signage and timetable displays, with 74% and 65% of respondents, respectively, selecting either "Much safer" or "Slightly safer."

The majority of respondents (67%) felt that ongoing maintenance work or renovations at the station had "No effect" on their sense of safety. Similarly, music or nature sounds played at the station were largely perceived as having "No effect," with 58% choosing this option.

The factors most negatively impacting safety perceptions were dirty stations, litter, or visible signs of vandalism, with 85% of respondents selecting either "Slightly unsafe" or "Much less safe or afraid." If the station had poor or insufficient lighting, 75% of respondents chose one of the two most negative options. Other factors that negatively affected perceived safety included something being broken at the station (68%), being in a station with very few people or alone (65%), and out-of-order elevators or escalators (57%), with each percentage representing the total share of respondents who selected either "Slightly unsafe" or "Much less safe or afraid. How respondents felt each factor affected their safety perceptions is illustrated in Figure 24.

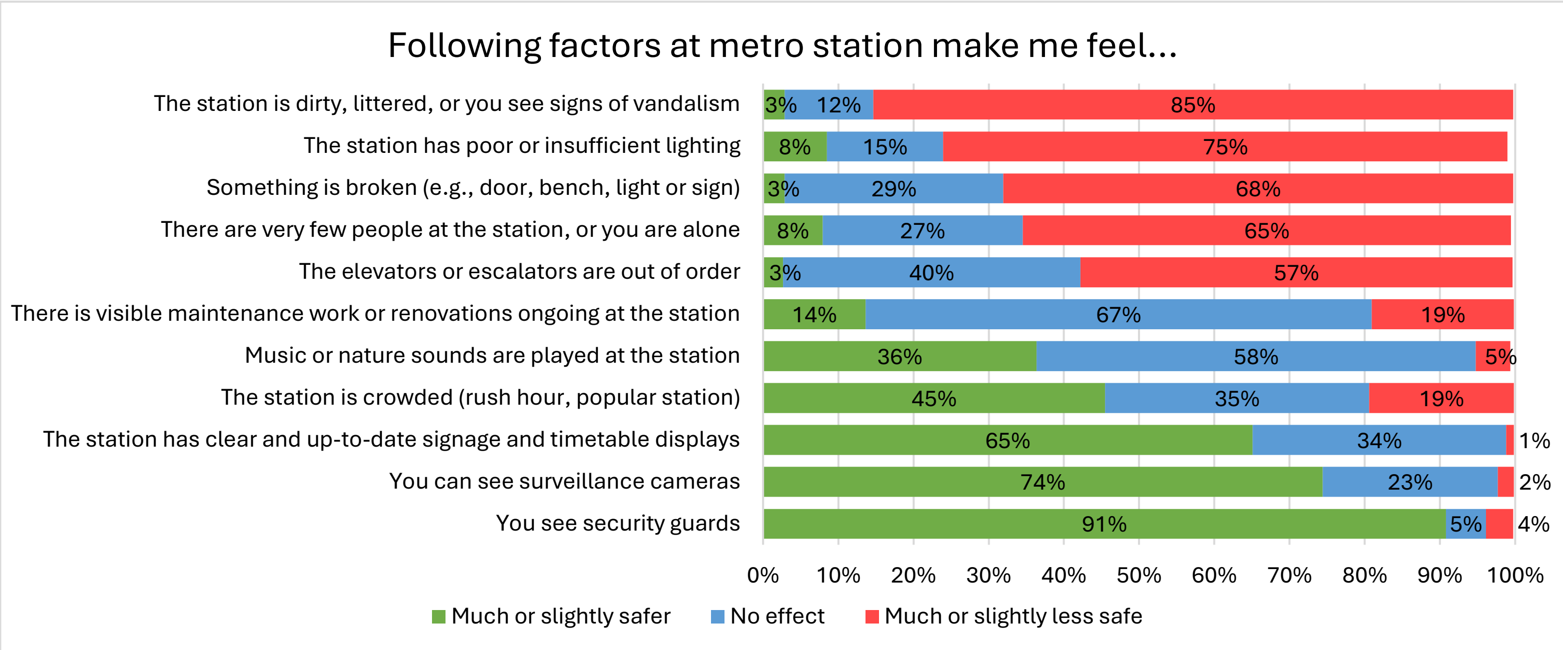

Figure 24: Respondents' perceptions of how various metro station factors affect their sense of safety (N = 1,086).

4.2.6 Additional Perspectives from the Open-Ended Question

A total of 226 respondents answered the voluntary open-ended question at the end of the survey. The most frequently mentioned theme was that the metro station buildings themselves had less impact on perceived safety than the presence and behaviour of fellow passengers. Nearly 50 respondents expressed fear of intoxicated individuals, illegal drug users, and witnessing drug use. The unpredictable behaviour of passengers under the influence of substances was a concern shared by both men and women.

The second most common topic in the comments was the desire for increased security presence. Nearly 30 respondents called for more security personnel, and some also suggested that police presence at stations would help improve safety. However, security guards were not unanimously seen as enhancing perceived safety. Some participants described the behaviour of security guards as arbitrary, reckless, threatening, or even racist. There were calls for security personnel to be more approachable. Some respondents also felt that guards lacked the skills to intervene in threatening situations and instead focused on their phones rather than being alert and responsive. There were specific requests for guards to take more active roles in addressing shouting, sexual harassment, and disruptive behaviour by loud groups of young people. Nine comments specifically mentioned fear of loud groups of teenagers, and almost as many noted that large, noisy groups regardless of age contributed to feelings of insecurity. Some respondents also expressed fear of men in general.

Eleven comments suggested adding ticket gates to metro stations to prevent entry by passengers without valid tickets. Some participants felt that those who caused insecurity, particularly individuals under the influence, often travelled without tickets. They believed that gates or increased fare inspections could help reduce their presence.

The impact of time of day on perceived safety also emerged in the comments. Some participants avoided using the metro at night or during weekend evenings, and many stated that they felt particularly unsafe when traveling in the dark or late hours.

Regarding the physical station environment, cleanliness was frequently mentioned as a factor affecting perceived safety. A dirty station or delays in repairing broken infrastructure were associated with increased feelings of insecurity. Narrow elevators or passageways were also mentioned as factors that reduced perceived safety. Ten comments noted that safety concerns were more prominent inside metro trains than at the stations themselves. The surrounding neighbourhood was also often seen as having a greater impact on perceived safety than the station building. A few respondents suggested that adding commercial spaces at platform level could improve the sense of safety.

4.3 Effects of Personal and Behavioural Factors on Responses

4.3.1 Gender differences in safety perceptions

In responses to the survey question regarding the general feeling of safety at metro stations, a larger proportion of men felt safe at metro stations compared to women. Among men, 42% "strongly disagree" and 32% "somewhat disagree" with the statement "I usually feel unsafe or afraid at metro stations," while among women, the respective proportions were 19% and 46%. However, it cannot be said that men uniformly feel safer than women at metro stations, as a higher percentage of men (4.8%) responded to this claim with "strongly agree" compared to women (3.2%). Respondents who identified their gender as "other" had responses to this question that were more similar to those of women than men (Figure 25).

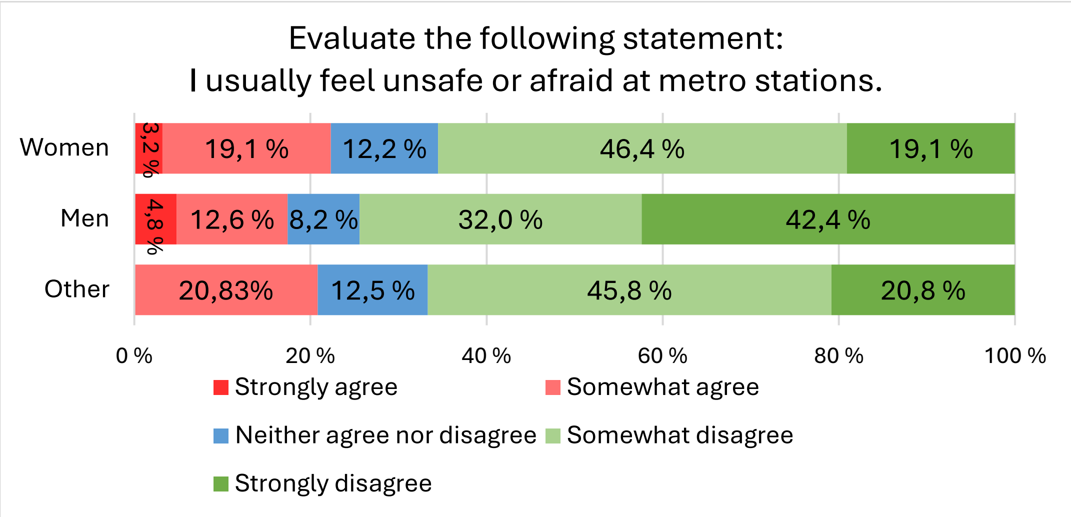

Figure 25: Distribution of responses between three gender groups to the statement "I usually feel unsafe or afraid at metro stations" (women n = 633, men n = 413, other n = 24).

If we exclude the "other" gender group from the comparison due to the small sample size (n = 24) and focus on the differences between women and men, we observe that women feared witnessing all three examined crimes, as well as becoming victims of these crimes, more than men. See Appendix 2 for figures showing the distribution of responses for fear of witnessing and becoming a victim of each crime type among women and men. Both genders feared "violence or threats" more often than other crimes. However, the largest gender difference appeared in the fear of "becoming a victim of sexual harassment," where 11% of women feared this "often" and 43% "sometimes," while among men, these proportions were 1% and 5%, respectively (Figure 26).

The majority of men "never" feared witnessing "theft or robbery" (75%) or "sexual harassment" (69%), and "never" feared becoming a victim of "theft or robbery" (71%), "violence or threats" (55%), or "sexual harassment" (92%). See Figure 27 for gender differences in fear of witnessing sexual harassment. In contrast, the option "never" was chosen by the majority of women only in witnessing and becoming a victim of "theft or robbery" (67% and 57%, respectively). In all other cases, the majority of women feared "sometimes" or "often" witnessing these situations or becoming victims themselves.

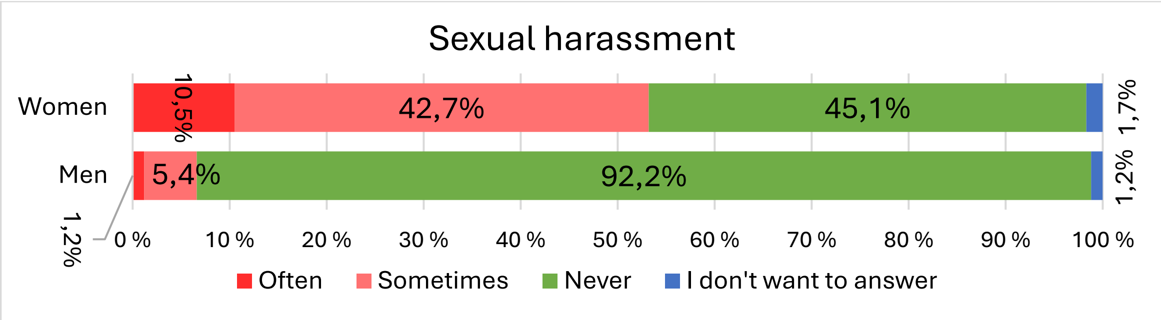

Figure 26: Fear of *becoming a victim of* sexual harassment at metro stations among women (n = 632) and men (n = 412).

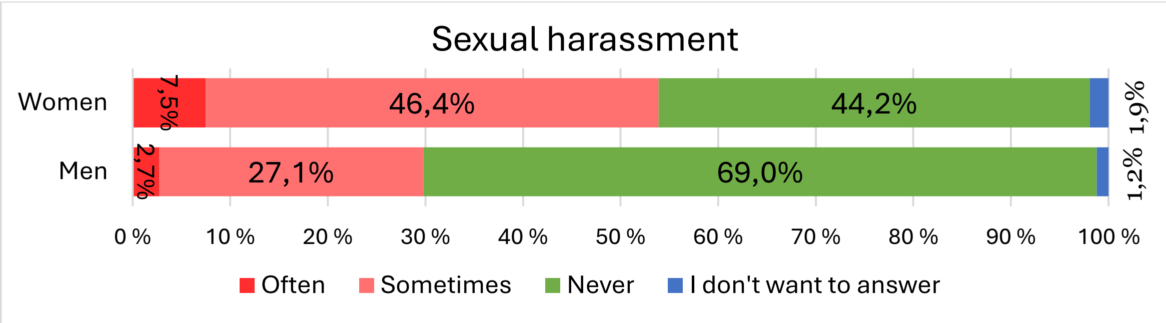

Figure 27: Fear of *witnessing* sexual harassment at metro stations among women (n = 631) and men (n = 413).

Gender differences were also evident when it comes to changes in travel behaviour due to perceived lack of safety, as measured by whether the respondent avoided using a particular station because of fear. A higher proportion of women (44%) than men (29%) avoided using at least one station (Figure 28). Among those who reported avoiding at least one station, 67% were women, 29% were men, 2% identified as "other," and 2% chose not to disclose their gender. In contrast, among those who did not avoid any station due to safety concerns, 53% were women, 43% were men, 3% identified as "other," and 1% did not specify their gender.

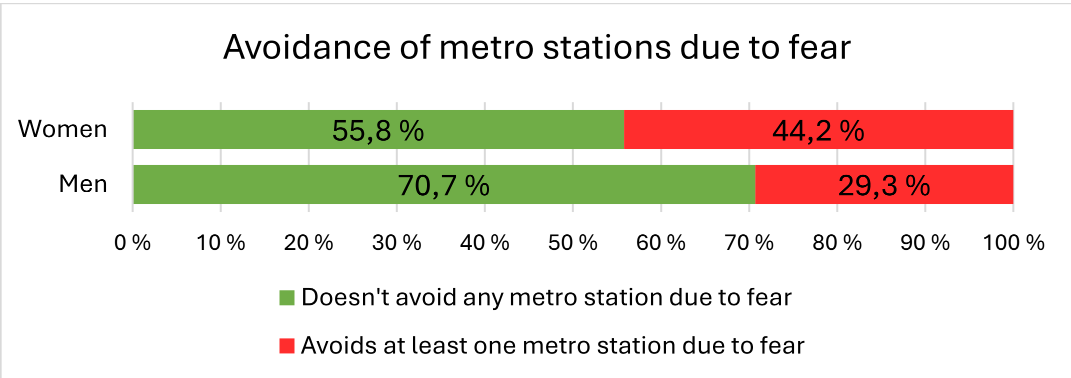

Figure 28: Avoidance of metro stations due to fear among women (n = 633) and men (n = 413).

When examining the factors affecting safety perceptions at metro stations, it was observed that women perceived various factors as having a stronger impact on their safety perceptions compared to men, both positively and negatively. When it comes to factors that enhance perceived safety, women more frequently than men reported that surveillance cameras, security guards, clear and up-to-date signage and timetable displays, the station being crowded, and music or nature sounds being played made them feel "much safer" or "slightly safer."

Similarly, factors that reduce perceived safety affected women more strongly than men. A larger proportion of women than men selected "slightly unsafe" or "much less safe or afraid" in response to "the station has poor or insufficient lighting," "elevators or escalators are out of order," "the station is dirty, littered, or has visible signs of vandalism," "something is broken (e.g., door, bench, light, or sign)," "ongoing renovations at the station," "the station is crowded," and "there are very few people at the station, or you are alone." Men more frequently responded with "no effect" to these various factors compared to women.

The most divisive factor in responses was how station crowding affects perceived safety (Figures 29 and 30). Some respondents felt that crowding increased their safety, with 48% of women and 41% of men reporting feeling "much safer" or "slightly safer." However, others felt that crowding negatively impacted their safety, with 21% of women and 16% of men selecting "slightly unsafe" or "much less safe or afraid." This highlights that neither men nor women form a homogeneous group, as there was considerable variation in responses.

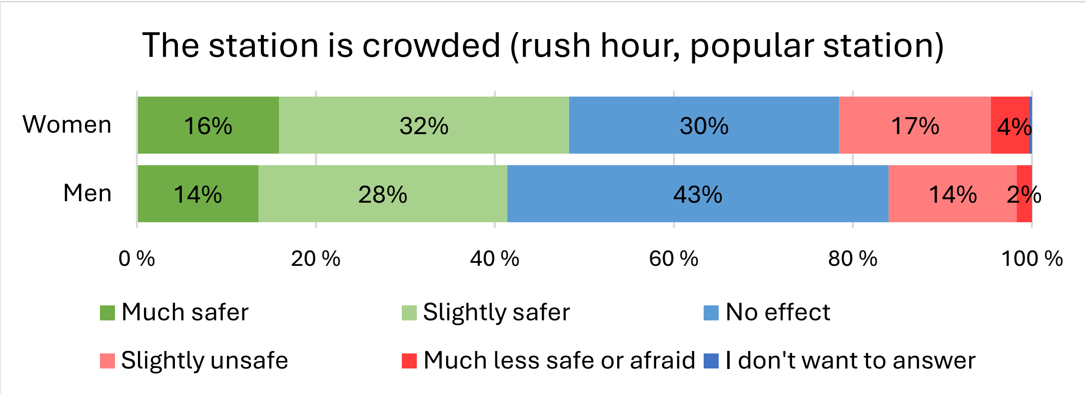

Figure 29: Effect of crowding on safety perceptions among women (n = 633) and men (n = 413).

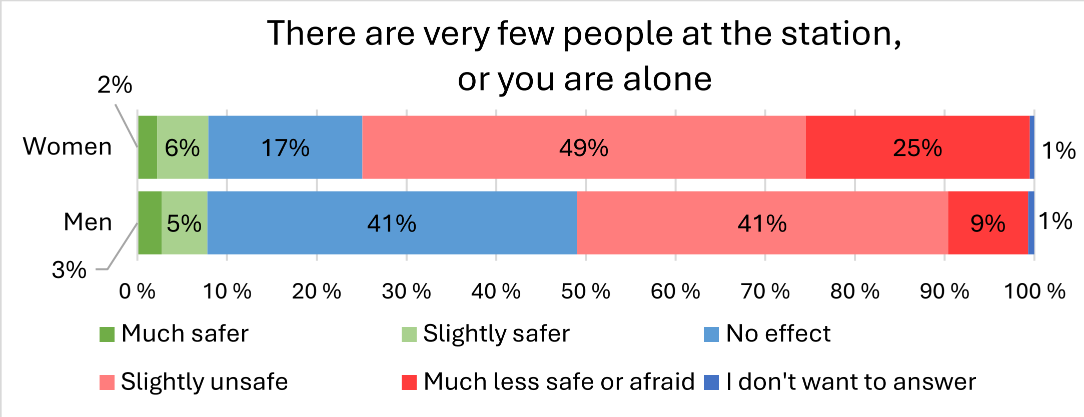

Figure 30: Effect of being alone at a metro station on safety perceptions among women (n = 633) and men (413).

A larger proportion of women than men reported having been a victim of battery, assault, threats, sexual harassment, theft, or another crime at a metro station. Among women, 21% answered that they had been victimized at some point, while among men, this proportion was 15%. Among respondents who selected "other" as their gender, a quarter, 25%, reported having been victimized.

Responses to questions about metro usage frequency and possible mobility limitations or the use of mobility aids were evenly distributed across different gender groups, with no major differences observed.

When examining station-specific assessments, it was observed that, on average, women felt less safe at metro stations compared to men. See appendix 2 for response distributions between women and men in station-specific evaluations.

4.3.2 Impact of Previous Victimization on Perceived Safety

Out of the 1,057 respondents who answered the question, "Have you ever been a victim of battery, assault, threats, sexual harassment, theft, or any other crime at a metro station?" 203 (19%) answered, "Yes." Those who had previously been victimized generally felt less safe at metro stations than others (Figure 31).

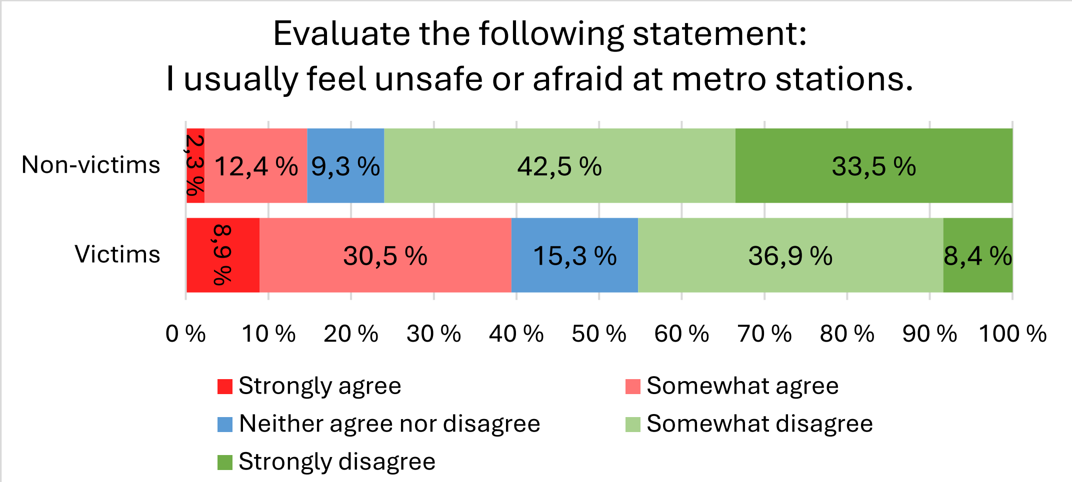

Figure 31: Distribution of responses to the statement "I usually feel unsafe or afraid at metro stations" among respondents who have previously been victimized at a metro station (n = 203) and those who have not (n = 854).

Regarding fear of crime, those who had previously been victimized feared witnessing all three types of crimes mentioned in the survey more than others. The biggest difference was in sexual harassment, where only 26% of respondents with prior victimization stated that they "never" feared witnessing such a crime, compared to 61% of those who had never been victimized at a metro station.

When asked how often respondents feared becoming victims of crime themselves, this trend continued. Previously victimized individuals feared all three types of crime more frequently than others. Regarding sexual harassment, 21% of people with victimization experience reported fearing becoming a victim of it "often", and 38% said "sometimes", whereas among those who had never been victimized, the proportions were 3% and 26%, respectively.

In contrast, the differences between victims and non-victims were less pronounced when it came to the specific factors influencing safety perceptions at metro stations. The clearest distinction emerged in relation to the number of people present at a station. A crowded station divided those with victimization experiences more than others, with 53% of previously victimized individuals feeling "much safer" or "slightly safer", compared to 44% of others. At the same time, a larger share of victims also felt less safe as the number of people increased, with 23% of those with prior victimization choosing the option "slightly unsafe" or "much less safe or afraid", compared to 18% of others.

An empty station made a larger portion of victims feel more unsafe, with 75% reporting increased insecurity compared to 62% of others. Meanwhile, a greater proportion of non-victims (29%) reported that a low number of people at a station had "no effect" on their sense of safety, whereas among victims, only 18% selected this option.

Regarding station avoidance, 67% of individuals who had never been victimized reported not avoiding any station due to fear, while 43% of those who had previously been victimized indicated the same. Conversely, 33% of non-victimized individuals reported avoiding at least one station due to safety concerns, compared to the majority, 57%, of previously victimized individuals.

Individuals who had previously experienced victimization at a metro station were more likely to report feelings of insecurity or fear in such environments. Respondents were asked to what extent they agreed with the statement: "I usually feel unsafe or afraid at metro stations." Among those who had been victimized, 9% strongly agreed and 31% somewhat agreed. In contrast, the corresponding percentages for those without victimization experience were 2% and 12%, respectively. Conversely, 45% of previously victimized individuals somewhat or strongly disagreed with the statement, compared to 76% of those without prior victimization experience. See Figure 31 for the full distribution of responses to this statement.

Victimized respondents also felt less safe across individual stations. This can be seen in Figures 32 and 33, which illustrate responses for Central Railway Station and Sörnäinen. Additional station-specific comparisons are available in Appendix 2.

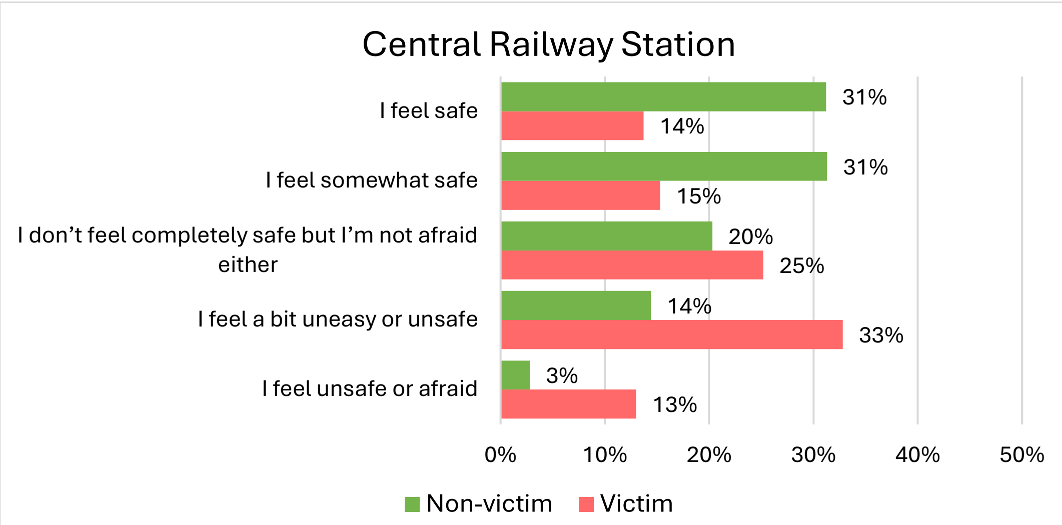

Figure 32: Distrubution of safety perceptions at Central Railway Station among victims (n = 131) and others (n = 577).

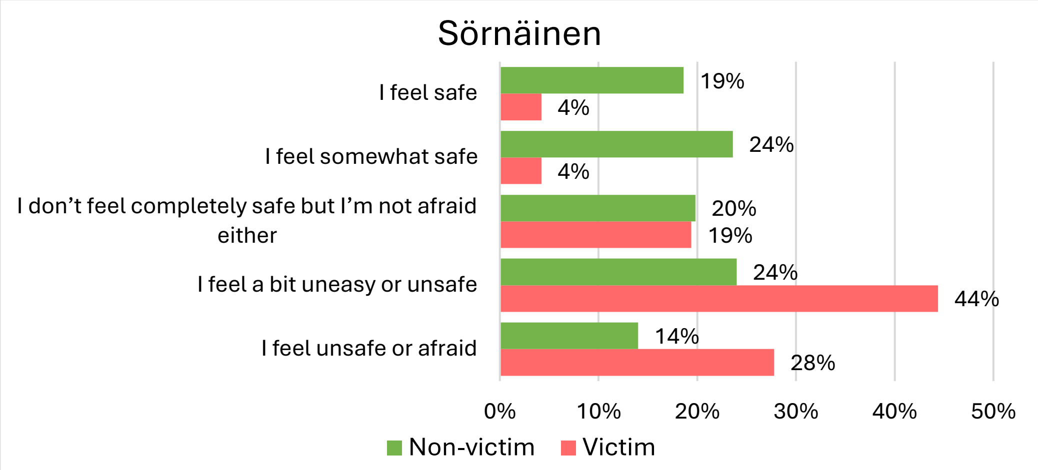

Figure 33: Distrubution of safety perceptions at Sörnäinen metro station among victims (n = 72) and others (n = 242).

4.3.3 Perceived Safety Among Individuals with Mobility Limitations

In the survey, 31 respondents reported having mobility limitations or using a mobility aid. Their responses differed from others when evaluating the influence of various factors at a metro station on perceived safety. Elevators or escalators being out of order had a greater impact on the safety perceptions of individuals with mobility limitations compared to others. A clear majority (74%) of those with mobility limitations felt that out-of-order elevators or escalators made them feel less safe (Figure 34).

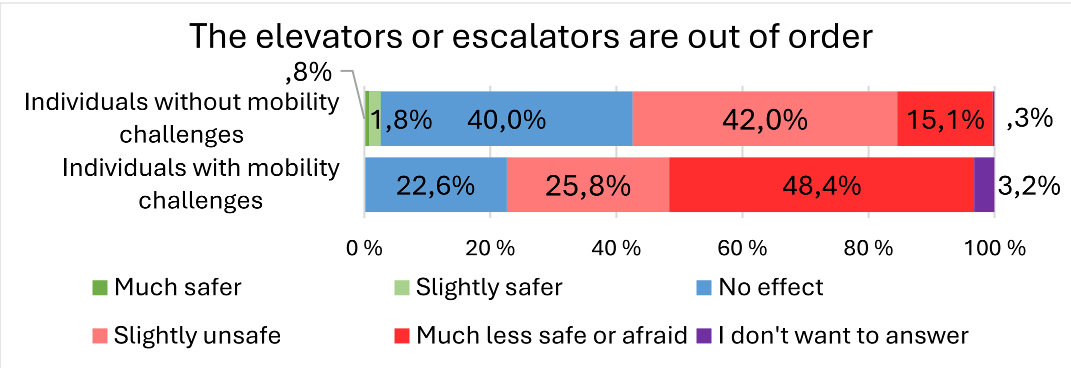

Figure 34: The effect of broken elevators or escalators at metro stations on perceived safety among respondents with (n = 31) and without (n = 1,036) mobility limitations.

Another evaluated factor where responses differed between individuals with mobility limitations and others was the impact of visible maintenance work or ongoing renovations at the stations (Figure 35). The majority of both groups felt this had no effect on their perceived safety. However, 26% of individuals with mobility limitations reported that such work worsened their sense of safety, compared to 19% of other respondents. Among individuals with mobility limitations, 16% felt that visible maintenance work or renovations improved their sense of safety, compared to 13% for others.

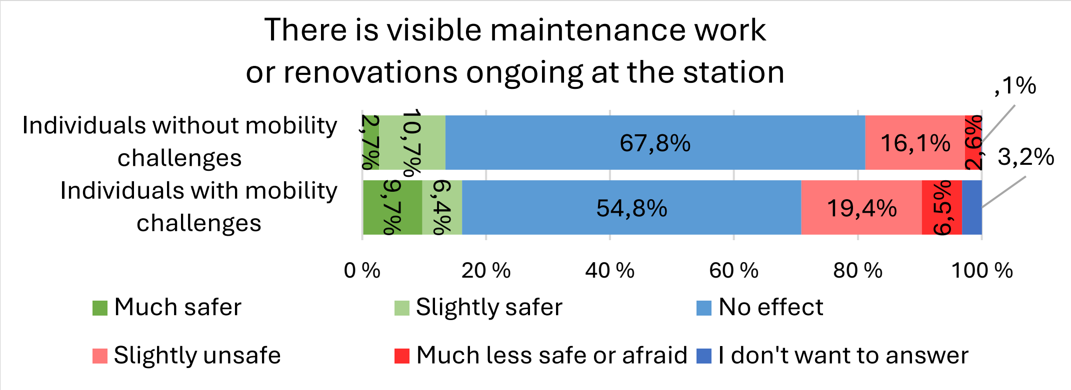

Figure 35: The effect of ongoing renovations at metro stations on perceived safety among respondents with (n = 31) and without (n = 1,036) mobility limitations.

Overall, individuals with mobility limitations felt slightly less safe at metro stations compared to others. Among respondents with mobility challenges, 23% either strongly or somewhat agreed with the statement "I usually feel unsafe or afraid at metro stations," whereas among other respondents, the percentage was 20%. Meanwhile, 61% of those with mobility limitations disagreed with the statement, compared to 69% of other respondents. A figure showing this distribution is presented in Appendix 2. This phenomenon was evident in station-specific assessments, where individuals with mobility limitations generally felt slightly less safe than others. It should be noted that, due to the small overall sample of respondents with mobility limitations (n = 31), and because not all of them evaluated the same stations, the sample sizes in station-specific evaluations were too small for meaningful analysis (in all stations, n < 30). When asked about avoiding metro stations due to fear, a larger proportion of those with mobility limitations (52%) reported avoiding at least one station, compared to 48% of other respondents. A larger proportion of individuals with mobility limitations (26%) had previously been victimized at a metro station compared to others (19%).

4.3.4 Effect of Metro Usage Frequency on Safety Perceptions

Metro usage frequency influenced the avoidance of metro stations due to fear (Figure 36). Among different usage frequency groups, those who used the metro most frequently also had the highest proportion of individuals avoiding at least one metro station. Interestingly, the least avoidance was not observed among those who used the metro the least, but rather among individuals who reported using the metro once a week. In that group, only 26% avoided at least one metro station. Across all usage frequency groups, the majority of respondents stated that they did not avoid any metro station due to fear.

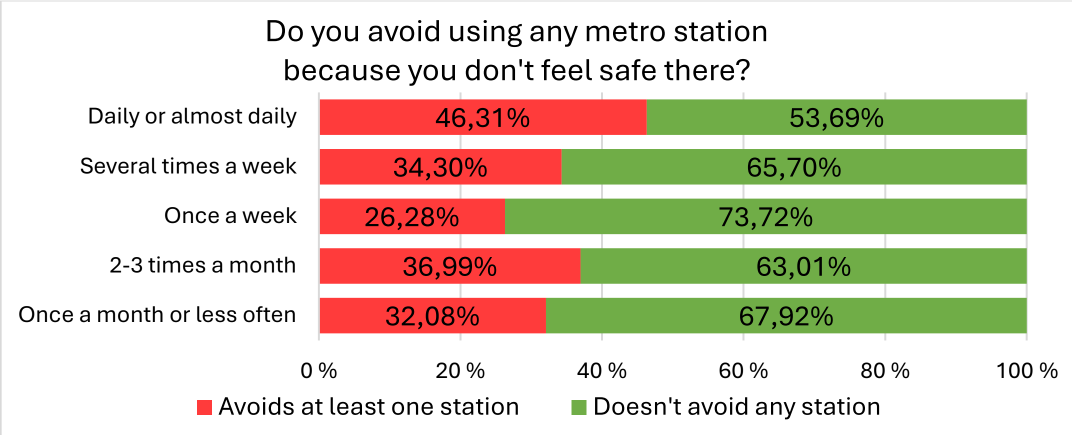

Figure 36: Avoidance of metro stations due to safety concerns across different metro usage frequency groups (n = 1,079).

Metro usage frequency also had an impact on previous victimization. A quarter (25%) of those who travelled by metro daily reported having experienced victimization at a metro station, whereas among other user frequency groups, only 4-18% indicated having such experiences.

The findings on the impact of metro usage frequency on the perception of safety were not entirely consistent or straightforward (Figure 37). For example, when asked about their general sense of safety at metro stations, the most frequent metro users were not actually the most fearful, as one might assume based on the responses about station avoidance. Instead, the group that reported using the metro 2-3 times a month gave the lowest safety ratings, while the group that used the metro once a week exhibited the least fear.

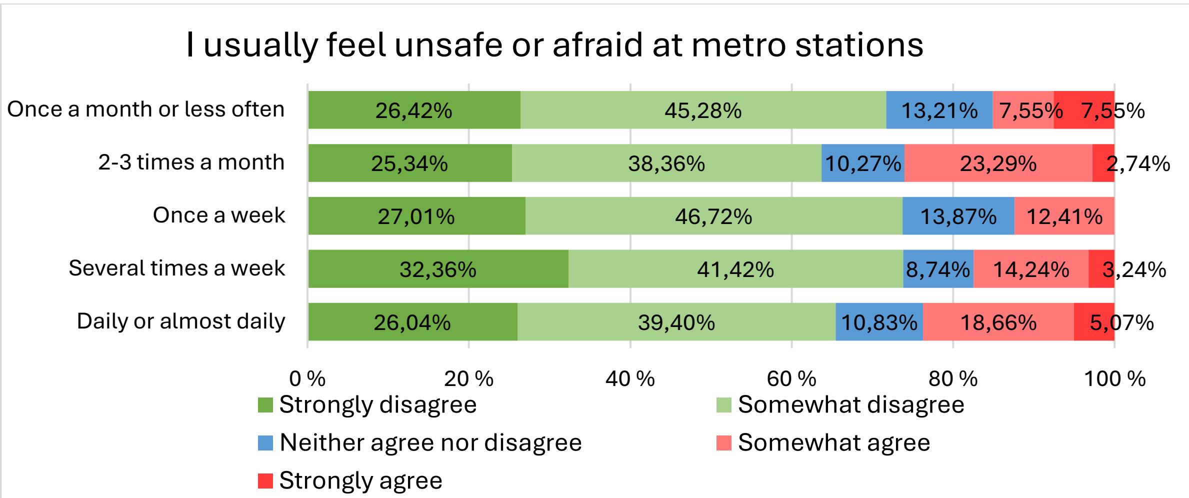

Figure 37: Distribution of responses to the statement "I usually feel unsafe or afraid at metro stations", based on metro usage frequency (n = 1079).

4.3.5 Influence of Place of Residence on Safety Perceptions

When survey respondents were divided into four groups based on their place of residence: those living near Helsinki metro stations (59% of respondents), those near Espoo metro stations (30%), Helsinki metropolitan area residents who do not live near metro stations (8%), and those living outside the metropolitan area (3%), it was observed that non-metropolitan residents generally felt slightly safer at metro stations than other groups, although sample sizes for most stations were too small for meaningful analysis. Among those living near a Helsinki metro station, 21% expressed either strong or partial agreement with the statement “I usually feel unsafe or afraid at metro stations.” Among those living near a West Metro station, the percentage was 20%, and among residents elsewhere in the Helsinki metropolitan area, it was 19%. In contrast, only 15% of respondents living outside the metropolitan area felt this way.

In station-specific evaluations, these differences were less noticeable, and in some cases, sample sizes within these groups were too small for meaningful comparisons. As expected, non-metropolitan residents used the metro less frequently than other groups and primarily evaluated stations in the city centre such as Central Railway Station and Kamppi. Metro stations in East Helsinki, for example, received fewer evaluations from non-metropolitan respondents. At stations where sufficient responses were gathered from all groups, no notable difference was observed between non-metropolitan residents and other groups.

When examining fear of crime, differences could be observed between non-metropolitan residents and others. One such difference was seen in the fear of witnessing sexual harassment, where non-metropolitan residents reported fearing such situations less frequently than other groups (Figure 38). Additionally, they also reported fearing victimization at metro stations less often than other groups. Respondents who live near a metro station feared becoming victims of crime at metro stations more often than other groups.

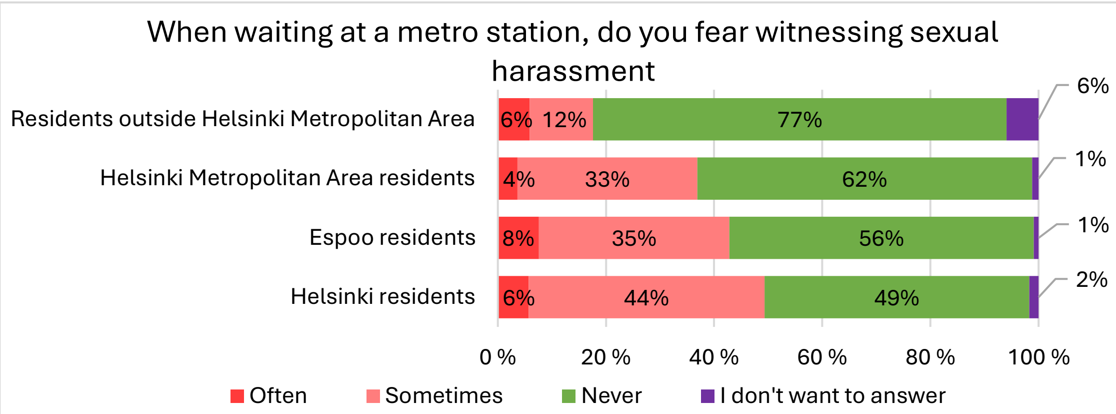

Figure 38: Fear of *witnessing* incidents of sexual harassment at metro stations among different residential groups (n = 1,073).

Among Helsinki residents, 20% reported having at some point been victims of battery, assault, threats, sexual harassment, theft, or another crime at a metro station. The corresponding figure was 19% among Espoo residents, 13% among other residents of the Helsinki metropolitan area, and 6% among respondents living outside the metropolitan area.

To further examine whether place of residence influences perceptions of safety, a more detailed comparison was conducted among metro users living near four different segments of the metro line: Espoo, the Helsinki city centre, the area between the city centre and Itäkeskus, and the eastern branch beyond Itäkeskus. While respondents living near stations on the eastern branch reported the highest levels of fear, and those in Espoo and the city centre felt the safest, the differences between the groups were minor.

In response to the statement "I usually feel unsafe or afraid at metro stations," 72% of respondents living in Espoo and the Helsinki city centre disagreed, compared to 69% of those living between Sörnäinen and Itäkeskus, and 63% of those residing east of Itäkeskus. Agreement with the statement was reported by 23% of those living east of Itäkeskus, 20% of those living in Espoo and between the Helsinki city centre and Itäkeskus, and 19% of those living near city centre stations.

No notable differences were observed in fear of crime based on place of residence, either regarding the fear of witnessing crime or of becoming a victim. For station-specific assessments, the sample sizes within the comparison groups were often too small for meaningful analysis. In cases where a sufficient number of respondents from each group had evaluated a particular station, no consistent patterns were found to suggest that residents from lower-income or more negatively perceived areas had distinctively different safety perceptions compared to those living in more advantaged areas.

Furthermore, no notable differences were observed between these residential segments in terms of the impact of perceived unsafety on travel behaviour, as measured by whether respondents reported avoiding any metro station due to feeling unsafe. The highest level of avoidance was found among respondents living in Espoo, where only 54% reported not avoiding any stations because of fear. In the Helsinki city centre, this figure was 58%, and among residents living along the eastern branch, it was 65%. The least avoidance was reported by those living between the city centre and Itäkeskus, of whom 70% indicated that they do not avoid any station due to safety concerns.

In addition to the more detailed comparison across four metro corridor segments, perceived safety and avoidance behaviour were also analysed using a broader classification, comparing residents living near West Metro stations in Espoo with those living near Helsinki metro stations.

When examining station-specific assessments and comparing the evaluations of those living near a particular station with those from other respondents, no clear pattern emerged indicating that individuals perceive their home station differently than others do or differently than they perceive other stations. For example, residents near the Central Railway station tended to view it as safer compared to respondents from other areas. However, residents near the Sörnäinen metro station perceived it to be just as unsafe as those from elsewhere.

When comparing the responses of those living near West Metro stations with those living near Helsinki metro stations, there was no clear difference in overall perceived safety. However, Helsinki residents feared witnessing violence or threats at metro stations more often than Espoo residents, as well as witnessing incidents of sexual harassment slightly more frequently. Conversely, when asked about the fear of becoming a victim, Espoo residents feared falling victim to theft, robbery, or sexual harassment more often than those living in Helsinki. Meanwhile, Helsinki residents feared slightly more often than Espoo residents becoming victims of violence or threats at metro stations.

Respondents living outside the Helsinki metropolitan area showed the least avoidance behaviour, with 71% of them not avoiding any station due to fear. In contrast, those living near West Metro stations were the most likely to avoid stations, with only 54% saying they do not avoid any. Among Helsinki residents, 65% did not avoid any stations, a figure very similar to the 64% of those living in the Helsinki metropolitan area but not near a metro station.

4.3.6 Intersectionality in Metro Station Safety Perceptions

This chapter explores in more detail how gender, victimization history, place of residence, and mobility limitations intersect to shape perceptions of safety, as these factors were previously noted to have an effect. A larger proportion of those who do not avoid any metro stations due to fear had never been victims of crime at metro stations, whereas those with victimization experiences were more likely to avoid certain stations due to safety concerns and generally reported feeling less safe. Women reported lower safety perceptions than men, both generally and in station-specific evaluations. Women also reported fearing encounters with crime at metro stations more frequently than men and exhibited higher avoidance behaviour due to safety concerns. Furthermore, a larger proportion of women than men had experienced being victims of crime at metro stations. Through an intersectional analysis of gender and victimization experience, it was possible to determine which factor more strongly influenced perceived safety at metro stations.

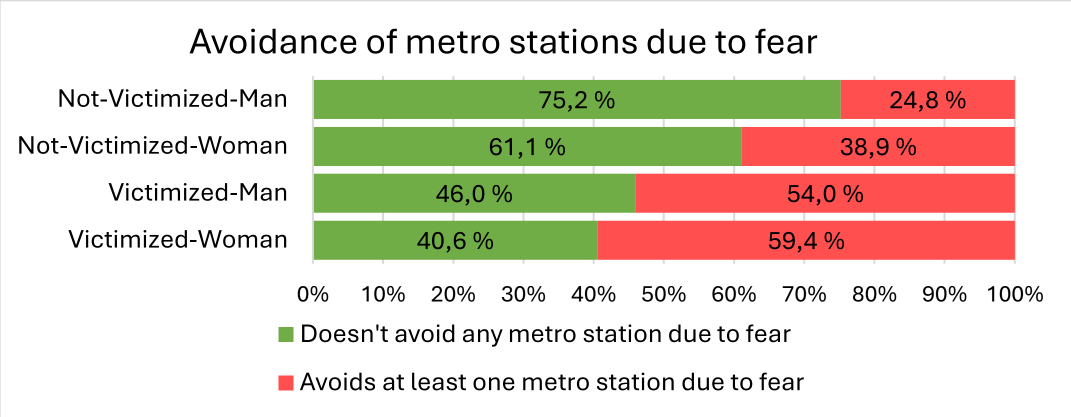

Figure 39: Avoidance of metro stations due to safety concerns by combined effect of gender and victimization experience (n = 1,020).

As shown in the Figure 39 above, women with victimization experiences avoided using metro stations due to fear more than any other group. The second most likely group to avoid metro stations consisted of men with victimization experiences, who avoided stations more than women without victimization experiences. This suggests that victimization experience is a stronger predictor of metro station avoidance than gender alone, as even victimized men reported higher levels of fear and avoidance than non-victimized women.

When examining the fear of encountering or becoming a victim of crime, it was evident that victimization history played a stronger role than gender in how frequently individuals feared witnessing or experiencing crime than gender. The only notable exception was the fear of becoming a victim of sexual crime, where women, regardless of victimization history, reported fearing this crime more frequently than men in both victimized and non-victimized groups. See Appendix 2 for Figures illustrating the effect victimization history and gender have on fear of crime.

The same pattern, in which victimization history has a stronger impact on perceived safety than gender, was also observed in overall feelings of safety at metro stations. This is illustrated by the figure in Appendix 2. When considering not only gender and victimization history but also whether a person lives near a West Metro station or a Helsinki metro station, it became evident that those who felt the safest at metro stations were men living near West Metro stations who had never been victims of a crime at a metro station. Conversely, those who felt the least safe were women living near West Metro stations who had experienced victimization, as well as men living near Helsinki metro stations who had been victims of a crime. The four groups who reported lowest perceived safety were all those with victimization experiences, whereas the four groups with highest safety perceptions were those with no victimization experiences. These patterns are further illustrated by an additional figure in Appendix 2. Once again, victimization history appears to be a more decisive factor in perceived safety than gender or whether a person lives near a West Metro station or metro stations in Helsinki.

When examining the relationship between perceived safety and travel behaviour, it became evident that the highest proportions of people avoiding metro stations due to fear were found among those who had been victims of a crime at a metro station. Conversely, the lowest levels of avoidance behaviour were observed in groups with no history of victimization (See Appendix 2).

Unfortunately, this survey's responses did not allow for a full assessment of the combined impact of gender, victimization history, and mobility limitations. When respondents were grouped based on these criteria, all four groups consisting of respondents with mobility limitations (men and women with victimization history, as well as men and women without victimization history) were too small for a statistically significant analysis (n = 1-16).

Due to the small number of respondents with mobility limitations in the survey, dividing them into multiple groups resulted in sample sizes that were too small for meaningful analysis. When respondents were grouped solely based on victimization experience and mobility limitations, excluding gender from the examination, it became apparent that individuals with mobility limitations who had experienced victimization formed the group with the lowest perceived safety. The next lowest perceived safety ratings came from respondents without mobility limitations who had been victims of a crime at metro stations. Meanwhile, those who had no victimization experience, regardless of mobility limitations, reported feeling the safest. However, it is important to note that the sample sizes of groups including respondents with mobility limitations remained very small.

Due to the small sample sizes, the analysis now focuses on examining the impact of victimization experience on the responses, as it appeared to be the most prominent differentiating factor, rather than analysing the combined effects of victimization and other factors. When analysing the question in which respondents assessed the impact of different factors on their perceived safety at metro stations, it was observed that those with victimization experience found the presence of security personnel to be the most reassuring. The second most influential factor in increasing perceived safety was surveillance cameras, followed by the presence of a large number of people at the station. It is worth noting that even though the station being crowded increased the perceived safety of a larger group of those with victimization experience compared to others, this factor also diminished the perceived safety of a greater proportion of those with victimization experience than the comparison group. Among these factors, visible security personnel enhanced the safety perceptions of a greater proportion of respondents with victimization experience compared to those without. However, the presence of surveillance cameras had a weaker positive impact on perceived safety for those with victimization experience than it did for others. The presence of many people at the station was more relevant for the safety perceptions of those with victimization experience than for other respondents, among whom a smaller proportion felt that this factor increased their sense of safety compared to the victimized group.

The factor that most negatively affected the perceived safety of respondents with victimization experience at metro stations was a dirty or littered environment, which was also the most negatively affecting factor for the comparison group. The second most impactful factor reducing perceived safety appeared to be a station with few people or being alone, which had a stronger impact on respondents with victimization experience than on others (Appendix 2 shows corresponding figures). The third most impactful negative factor was poor or insufficient lighting, which was the second most negatively perceived factor for the comparison group. For the comparison group, the third most negatively perceived factor was broken infrastructure, such as a damaged bench or light fixture. Among respondents with victimization experience, this factor ranked fourth in negatively affecting their perceived safety, as being alone at the station had a stronger impact on their feelings of security.

5 Discussion

5.1 Who Is Most Afraid at Metro Stations?

It should be noted that fear influences who occupies public space. Those who experience the highest levels of fear, and whose mobility is most restricted because of it, are also the ones least likely to be present in public places, including metro stations. In other words, the very individuals who would most benefit from measures to improve perceived safety are often absent from these environments. As a result, the most fearful individuals are likely underrepresented in the survey, and those who avoid the metro entirely due to fear were not reached at all, as this survey was sent only to those who had used the metro in the past month. This should be considered when interpreting the results, as the responses are more likely to reflect the perspectives of individuals who feel safer and more confident in these environments.

5.1.1 Prior Victimization as the Strongest Predictor of Fear

The results show that previous victimization is the most influential individual factor influencing perceived safety at metro stations. Respondents who had experienced battery, assault, threats, sexual harassment, theft, or other crimes at metro stations reported notably lower levels of perceived safety than those without such experiences. Respondents with experiences of victimization were also more likely to report avoiding metro stations due to safety concerns than other respondents. Regarding fear of crime, those who had previously been victimized reported fearing witnessing, as well as becoming a victim of, all three types of crimes mentioned in the survey more frequently than those who had not been victimized. The largest difference was observed in relation to sexual harassment, where previously victimized respondents were significantly less likely to report never fearing either witnessing such incidents or becoming victims themselves, compared to those without prior victimization.

As for the influence of station crowding on safety perceptions, the number of people present affected victimized individuals' perceptions differently from those of non-victimized individuals. Victimized respondents were more divided in their responses: some felt safer in crowded stations, while a notable number felt less safe as crowding increased. In contrast, fewer non-victimized respondents reported feeling less safe due to crowding. Similarly, an empty station tended to reduce feelings of safety more often among victimized respondents than among non-victimized ones. Additionally, more non-victimized respondents said that a low number of people had no effect on their safety perception compared to victimized respondents.

These findings support previous research suggesting that victimization is often associated with lower perceived safety, although some studies have found contradictory results or effects dependent on crime type (e.g., (Ceccato, Langefors, et al., 2021; Ceccato, Sundling, et al., 2024)).

One reason why prior victimization has such a strong effect on perceived safety may be that experiences of victimization can become strongly associated with the specific place where the incident occurred. Metro stations where a person has been assaulted, harassed, or become a victim of another crime can therefore evoke lasting emotional responses, including anxiety and hypervigilance, when visiting metro stations after the incident. This place-based memory of fear can persist even long after the actual event, leading individuals to interpret these environments as inherently unsafe, regardless of any objective improvements in security measures.

5.1.2 Gendered Patterns in Perceived Safety

Gender strongly influenced perceptions of safety, with women reporting substantially more fear than men in general, in station-specific evaluations, and in relation to crime. These findings align with global research indicating that women consistently perceive transit environments as less safe than men do (e.g., (Ceccato et al., 2022)). Gender differences in fear of crime were evident across all three crime types studied, with women fearing both witnessing and experiencing these crimes more often than men. In relation to fear of sexual harassment, a majority of women reported fearing becoming victims often or sometimes, compared to only a very small minority of men. Fear also seemed to influence women's travel behaviour more strongly than men's. A larger proportion of women than men reported avoiding at least one metro station due to safety concerns. Among those who did not avoid any station, a larger portion were women than men. This supports previous research suggesting that perceived insecurity limits women's mobility more than men's (e.g., (Loukaitou-Sideris & Fink, 2009)).

Women were also more affected by various environmental and situational factors at metro stations both positively and negatively, such as lighting, maintenance, and crowding, whereas men more often reported that these elements had no impact on their perceived safety. This is in line with previous research, which has noted, that lighting, for example, has a greater positive impact on women than on men (e.g., (Chowdhury & Van Wee, 2020; Loukaitou-Sideris, 2014)).

Women's heightened vigilance in transit environments stems from social norms and gendered experiences that socialize them to be more alert to potential threats, particularly in public spaces where they are perceived as more vulnerable to crimes like sexual harassment (Cahill et al., 2020). Women's greater sensitivity to risk is also evident in their travel behaviours. Previous research has found that women, particularly those who have experienced victimization, are more likely to take precautions than men (Stark & Meschik, 2018; Yavuz & Welch, 2010), and women who have been victimized are more likely to engage in time and space avoidance (D'Arbois De Jubainville & Vanier, 2017).

In contrast, men tend to downplay or underreport their fear due to social norms that encourage the display of toughness and bravery (Finucane et al., 2013). This social conditioning leads to an internalized reluctance to appear vulnerable, which may result in the underreporting of safety concerns in surveys. Men may feel compelled to project confidence, even if they are fearful, whereas women may be more socially permitted or expected to express vulnerability and fear. This gendered difference in survey responses may explain why women report higher levels of fear, as they may be more willing to acknowledge their concerns honestly, while men may suppress or minimize theirs.

The higher proportion of female respondents in this survey may reflect gendered patterns in public transport use. While women in Finland hold driver's licenses at similar rates to men, they use public transport more frequently across all age groups (Jokela, 2022). This could be due to various factors, such as women being more environmentally responsible than men, or social norms that associate driving with masculinity. Additionally, the topic of safety perceptions in transit environments may resonate more with women than men, as women may view it as a more pressing issue in their lives and, as a result, be more likely to respond to a survey on this topic. On the other hand, the gender gap in survey participation may simply reflect the well-documented tendency of women to respond to surveys more often than men (W. G. Smith, 2008).

Respondents identifying as "other" in terms of gender exhibited distinct vulnerability patterns. Among this group, one in four reported having been victimized at a metro station, the highest of all gender categories. The higher victimization rates reported by gender minorities in this study may be attributed to a combination of social, cultural, and structural factors. Gender minorities, such as individuals who identify as non-binary or genderqueer, often face increased marginalization and discrimination in public spaces, including metro stations (e.g.(Lubitow et al., 2020)). These experiences can result in heightened vulnerability to violence or harassment, as they may not conform to traditional gender norms and are therefore more visible or targeted. These patterns of victimization are consistent with previous research highlighting the disproportionate experiences of gender minorities with violence and victimization in public spaces (e.g., (Lubitow et al., 2020)). However, the small sample size of gender minorities in this study (n = 24) should be considered when interpreting these results.

5.1.3 Intersectional Effects of Gender and Victimization on Perceived Safety

Following the analysis of the strong influence of previous victimization on perceived safety, it is important to highlight the intersection of gender and victimization, as it further shapes safety perceptions in metro environments. Gender and previous victimization appeared to jointly influence perceived safety, with their combined effect contributing to heightened feelings of insecurity. Women who had experienced prior victimization were the group reporting the lowest levels of perceived safety, followed by men with a history of victimization. In contrast, women without such experiences reported higher safety perceptions than victimized men. This suggests that prior victimization plays a more prominent role in shaping safety perceptions than gender alone. The pattern was consistently observed across general safety evaluations, station-specific assessments, and in reported behavioural changes, measured in avoidance of metro stations. These findings are consistent with previous research, which has indicated that prior victimization tends to have a stronger impact on women's perceived safety than on men's and is associated with increased precautionary behaviours and avoidance in transit environments (e.g., (Yavuz & Welch, 2010)).

Furthermore, when examining fear of witnessing or becoming a victim of crime, victimization history emerged as a more powerful predictor than gender for all crime categories, except for sexual harassment. Women, regardless of victimization history, were more likely to fear sexual harassment than men.

In terms of travel behaviour, the highest proportions of respondents who avoided one or more metro stations due to fear were found among those with prior victimization experiences. Women who had been victimized were the most likely to report such avoidance, followed by victimized men. These findings underline that prior victimization, rather than gender alone, has a profound and pervasive influence on both perceived safety and behaviour in metro stations, leading to increased avoidance and heightened vulnerability perceptions.

Together, these results underscore the strong influence of prior victimization on perceived safety and behaviour in metro stations, demonstrating that its impact surpasses gender alone while also compounding safety concerns for both women and men, with women being particularly affected.

This strong association between victimization and perceived safety may also be amplified for individuals who are already in socially or structurally vulnerable positions. For example, those with limited economic resources may lack access to insurance or support systems that would help them recover from incidents like theft. Women may fear sexual violence more acutely, knowing that justice systems often fail to provide adequate protection or accountability. Similarly, individuals with immigrant backgrounds may lack knowledge of their legal rights or experience unequal treatment by authorities, leading to distrust and greater feelings of insecurity. For these groups, the consequences of victimization can be more severe and harder to recover from, which may partly explain why fear is notably more prevalent among those with prior victimization. However, interaction effects between victimization and factors such as poverty or migration background could not be examined due to the small sample sizes in this study and would require more targeted research to be properly assessed.

5.1.4 Other Individual Factors: Mobility Limitations, Age and Metro Usage Frequency

This study found that individuals with mobility limitations or who use mobility aids reported slightly lower levels of perceived safety at metro stations compared to other respondents. Notably, their safety perceptions were more negatively affected by out-of-order elevators or escalators than those of others. Furthermore, visible maintenance work or renovations also had a greater negative impact on the safety perceptions of individuals with mobility challenges. Overall, individuals with mobility limitations were somewhat more likely to feel unsafe at metro stations and more inclined to avoid stations due to fear. Additionally, a higher proportion of individuals with mobility limitations reported being victimized at metro stations compared to those without mobility limitations. These findings align with previous research, which shows that individuals with disabilities, particularly those with reduced mobility, generally report lower safety perceptions and are more vulnerable to victimization compared to those without disabilities (e.g., (Loukaitou-Sideris et al., 2009; Sundling et al., 2024)). In contrast to previous research, which suggests that fear of crime and harassment limits the mobility and travel frequency of individuals with mobility disabilities (e.g., (Ceccato, 2015; Sundling et al., 2014)), this study found no evident relationship between mobility limitations and metro usage frequency, suggesting that their reliance on public transport persists despite lower perceived safety.

When it comes to the experiences of respondents with mobility limitations, the number of evaluations per station was too low to allow for meaningful station-level analysis. As a result, it was not possible to determine whether certain stations were perceived as distinctly more unsafe by respondents with mobility limitations or whether specific accessibility challenges contributed to lower safety perceptions. To address this gap, future studies should prioritize targeted and larger-scale data collection focused on respondents with mobility limitations, enabling detailed analysis of how accessibility challenges affect perceived safety at individual stations.

This study found no clear relationship between age and perceived safety at metro stations. Survey responses showed no notable differences between age groups, and no clear trend emerged suggesting that either younger or older individuals felt more or less safe in particular situations or at specific stations. These findings contrast with much of the existing literature, which often associates older age with greater fear of crime despite lower actual victimization rates (e.g., (Fattah & Sacco, 2012; Feltes, 2003)). However, they align with other studies that have found no consistent or statistically significant effect of age on safety perceptions, especially in transit environments (e.g., (Ferraro & LaGrange, 1992; Yavuz & Welch, 2010)). Age appears to be a less influential factor in perceived safety compared to other individual characteristics, such as gender or victimization history. One possible explanation for the lack of a connection between age and perceived safety in this study could be related to the sample. With only 6% of respondents aged 70 and above, their experiences might not have been adequately represented, which could mask any age-related differences in safety perceptions.

This study found that metro usage frequency had a complex and non-linear relationship with perceived safety. While women and individuals with a history of victimization consistently reported lower safety perceptions, their usage frequency was similar to others, indicating that feeling unsafe does not necessarily reduce how often people use the metro. This is in line with the concept of "transit captives," a phenomenon discussed in various studies on transit safety worldwide, where individuals are dependent on public transport as their primary mode of travel and therefore must use it, even though they are disproportionately represented among those who feel unsafe compared to those with other transport options (Ceccato, 2017a; Guimarães et al., 2019; Yu & Smith, 2014). These individuals, often women, have limited or no alternatives to public transport and continue to use it regularly, despite concerns about their safety.

However, frequency did influence avoidance behaviour: daily users were the most likely to avoid at least one station due to fear and also reported the highest victimization rate. This may suggest that frequent users are more exposed to risk, leading to selective avoidance rather than reduced use overall. Interestingly, daily metro riders, the most frequent users, did not report the highest levels of perceived safety, contrary to the expectation that familiarity increases feelings of security. Instead, those using the metro once a week reported the least fear, while individuals who used it 2–3 times per month reported the highest. This suggests that perceived safety is influenced by more than just familiarity.

This is particularly evident when considering respondents' home stations, which are likely to be the most familiar to them. Despite this familiarity, local residents did not consistently rate their home stations as safer than others. For instance, while local residents felt safer at the Central Railway Station compared to other respondents, this was not the case for Sörnäinen, where nearby residents gave similarly low safety ratings as those who lived elsewhere. These findings indicate that while familiarity with a station might be expected to increase feelings of safety, it does not necessarily guarantee a higher perception of safety.

These findings are consistent with the mixed results of previous research. While some studies have linked higher travel frequency with increased feelings of safety due to familiarity (e.g., (Delbosc & Currie, 2012)), others, like this study, have found no clear or consistent relationship, highlighting the complexity and context dependence of the issue (e.g., (Ouali et al., 2020; Yavuz & Welch, 2010)).

5.1.5 The Role of Residential Location in Shaping Safety Perceptions

This study examined how respondents' perceptions of safety at metro stations varied based on their place of residence. Initially, respondents were divided into four groups based on their proximity to metro stations: those living near Helsinki metro stations, those living near Espoo metro stations, those living elsewhere in the Helsinki metropolitan area, and those living outside the metropolitan area. Among these groups, only modest differences were found in perceived safety. No clear trend emerged in station-specific evaluations, and it should be noted that the group of respondents living outside the metropolitan area was too small to draw meaningful conclusions for most stations. Respondents living outside the Helsinki metropolitan area were less likely to avoid stations due to fear compared to the other groups. When examining fear of crime, differences were found between non-metropolitan residents and other groups. For instance, non-metropolitan residents reported less frequent fear of witnessing sexual harassment compared to other groups, and overall, they feared victimization at metro stations less often. In contrast, respondents living near metro stations expressed greater fear of becoming victims of crime at metro stations.

These results may be partly explained by the fact that only 6% of non-metropolitan respondents reported having experienced crime at a metro station, compared to 20% of those living near Helsinki metro stations and 19% of those living near West Metro stations. Individuals with fewer personal experiences of victimization are, understandably, less likely to fear becoming victims again. In addition, respondents who do not live near metro stations reported using the metro less frequently, which likely results in fewer opportunities to witness incidents of crime at metro stations. Their evaluations also focused primarily on central Helsinki stations, and they rarely assessed metro stations in East Helsinki, which were rated as less safe. This limited exposure to the stations most often perceived as unsafe may contribute to their generally higher sense of safety at metro stations.

A more detailed analysis was conducted by dividing respondents into four groups based on their proximity to specific metro stations: those living near stations in the Helsinki city centre, those living near stations between the city centre and Itäkeskus, those living near stations on the eastern branch of the metro line (i.e., the lines continuing from Itäkeskus to Vuosaari and Mellunmäki), and those living near Espoo metro stations. Respondents living near stations on the eastern branch of the metro line reported the highest levels of fear, while those residing in Espoo and the Helsinki city centre felt the safest. However, the differences between groups were still marginal.

Station-specific evaluations did not reveal any consistent patterns suggesting that residents from more negatively perceived areas had notably different safety perceptions compared to residents of more advantaged areas. Furthermore, there were no notable differences between residential areas in how perceived unsafety affected travel behaviour, measured by whether respondents reported avoiding any metro station. The highest level of avoidance was found in Espoo, while the least avoidance was reported by those living between the city centre and Itäkeskus. When comparing respondents living near Helsinki metro stations and those near West Metro stations, no substantial difference in overall perceived safety was found.

Further analysis divided respondents into two groups based on the median income level of their residential area. Those whose nearest metro station was located in a higher-income area (Kulosaari, Kalasatama, Helsinki University, Central Railway Station, Kamppi, Lauttasaari, Koivusaari, Tapiola, Matinkylä, or Kivenlahti) were compared with those living near stations in lower-income areas (Mellunmäki, Kontula, Myllypuro, Itäkeskus, Rastila, Puotila, Keilaniemi, or Aalto University). Respondents from higher-income areas reported feeling safer at metro stations overall than those from lower-income areas. They also feared witnessing or becoming victims of any of the crimes mentioned less often. This finding is consistent with previous research indicating that individuals with lower incomes are more likely than others to feel fearful and to report lower perceptions of safety in public transport environments (Yavuz & Welch, 2010).

When asked about how specific station-related factors, such as lighting, maintenance, or crowding, affected their perception of safety, a larger proportion of respondents from lower-income areas selected the option "no effect." In contrast, respondents from higher-income areas reported that each factor had a stronger influence, both positively and negatively, on how safe they felt at stations.

There were no differences between the higher-income and lower-income area groups in terms of gender distribution, and the same proportion of respondents in both groups had previously experienced crime at a metro station. However, some differences were found in metro usage frequency: a greater share of respondents from lower-income areas used the metro daily, while those from higher-income areas tended to use it slightly less frequently. This aligns with previous research showing that individuals with higher incomes are generally less dependent on public transport and therefore tend to use it less often than those with lower incomes (e.g. (Lubitow et al., 2017)).

These findings suggest that while the income level of a respondent's residential area is linked to differences in perceived safety at metro stations, the relationship is complex and cannot be explained by socioeconomic factors alone. Respondents from lower-income areas reported feeling unsafe more often, which may reflect their higher metro usage frequency and increased exposure to stations commonly rated as less safe, particularly in East Helsinki. In contrast, respondents from higher-income areas typically used the metro less frequently and evaluated a narrower range of stations, often avoiding areas with lower safety ratings. These usage patterns likely shape their perceptions. Moreover, individuals from higher-income areas appeared more sensitive to environmental factors such as lighting, maintenance, and crowding, while respondents from lower-income areas were more likely to report that these elements had no effect on how safe they felt. This could indicate a form of desensitization or differing expectations of the transit environment. Together, these results highlight that perceived safety is influenced by an interplay of socioeconomic background, travel behaviour, and the characteristics of specific stations rather than just by the nature of one's residential area.

5.2 Variation in Perceived Safety Between Metro Stations

5.2.1 Differences in Station-Level Safety Perceptions

Overall, metro stations were perceived as generally safe, with clear majority of respondents disagreeing with the statement "I usually feel unsafe or afraid at metro stations". Among the environmental and situational factors evaluated, the presence of security guards, surveillance cameras, and clear signage were most often reported to make respondents feel safer. Conversely, dirty stations, poor lighting, and broken facilities were frequently mentioned as factors that made respondents feel less safe. When it comes to station-specific evaluations, West Metro stations were consistently perceived as safer than those in Helsinki. Among all stations, Keilaniemi and Koivusaari received the highest safety ratings. High perceived safety was also reported at Aalto University, Lauttasaari, Urheilupuisto, and Tapiola. In contrast, Sörnäinen was perceived as the least safe station. Other low-rated stations in terms of perceived safety included Kontula, Mellunmäki, and Itäkeskus. Notably, these were also the most avoided stations due to safety concerns: Out of the 1,086 respondents, 227 reported avoiding Sörnäinen, followed by 195 for Kontula and 187 for Itäkeskus. Among the West Metro stations, Kivenlahti received the most negative evaluations, although it was still perceived as safer than the most negatively rated stations in East Helsinki.

These findings are partly in line with earlier safety surveys conducted in Helsinki, which have identified metro stations and shopping centres as the most frequently mentioned locations of perceived insecurity (Keskinen et al., 2023). Notably, Sörnäinen, Kontula, and Itäkeskus, which received the lowest safety ratings in this study, were also among the stations most often mentioned as unsafe in previous research. However, in contrast to previous studies where Kamppi was often perceived as an unsafe area (HSL, 2024b), in this study, Kamppi metro station was considered relatively safe, with a clear majority of respondents feeling safe or somewhat safe there. Furthermore, Kamppi was not among the most avoided stations.

However, these station-level ratings must be interpreted in light of two key factors: the number of evaluations and the profiles of the evaluators. Stations like Koivusaari and Keilaniemi received very few evaluations (19 and 29 respectively), which may have contributed to uniformly positive results. With fewer assessments, there is a higher likelihood that only specific user experiences are captured. Furthermore, only a small number of respondents evaluating these stations had prior victimization experiences, five in the case of Koivusaari and three in Keilaniemi. This likely influenced the results, as individuals with such experiences generally reported notably lower perceived safety.

In contrast, larger sample sizes, as seen with Sörnäinen (314 evaluations), reflect a broader range of experiences and thus provide a more balanced picture. Among Sörnäinen’s respondents, 72 had victimization experiences, and 72% of these respondents reported feeling unsafe at the station. Meanwhile, responses from those without victimization experiences were evenly distributed across all five answer options, highlighting once again how the evaluator, specifically whether they have experienced victimization, strongly influences a station's perceived safety rating.

Other stations perceived as safe, such as Tapiola (198 evaluations) and Aalto University (142 evaluations), received more evaluations than the stations with the highest safety ratings, such as Koivusaari and Keilaniemi. Although one might expect responses to be more evenly distributed across all five answer options due to the larger number of respondents, this was not the case. These stations were overwhelmingly perceived as safe. However, it is important to note the types of respondents who evaluated these stations. At Aalto University, only 19 respondents had victimization experiences, and of these, just one felt unsafe, while the remaining evaluations were mostly in the two highest safety categories, with only two respondents selecting the neutral middle option. Tapiola metro station received evaluations from more victims, with 38 such responses, but only four respondents, one victim and three others, felt unsafe. Thus, at these stations, the evaluator's prior victimization experience did not appear to affect the safety perception ratings. Kivenlahti, the station with the lowest perceived safety among West Metro stations, received 53 evaluations, including 12 from victims. Among the victims, slightly more felt unsafe than safe, but the majority of other respondents felt safe. This suggests that the station is not as feared by the general public as it might seem based on the result that it was "the most feared West Metro station." Rather, it is primarily perceived as unsafe by those with prior victimization experiences.

These patterns suggest that both the number and diversity of evaluations, particularly whether they include crime victims, play a critical role in shaping station-level safety perceptions. Therefore, looking at the overall rating alone may not provide an accurate picture of how safe a station is generally perceived to be by metro users.

5.2.2 Perceived vs. Actual Safety at Metro Stations

When comparing perceived safety with objectively measurable safety, as indicated by the number of police and security personnel interventions, a clear relationship emerges between the two, but it is not without complexities. Sörnäinen, which was perceived as the least safe station, has consistently had the highest number of both police and station security personnel interventions over the past five years. Other stations perceived as unsafe, such as Itäkeskus, Kontula, and Mellunmäki, similarly rank among the highest in terms of reported disturbances. In contrast, stations perceived as safe, including Keilaniemi, Koivusaari, and Aalto University, tend to report low levels of such incidents. From this, it could be concluded that passengers tend to feel safer at stations where fewer incidents are recorded. This broader pattern also holds when comparing the entire Helsinki metro network with the West Metro: overall, West Metro stations are perceived as safer, and this perception aligns with incident data, as police and security personnel are dispatched less frequently to West Metro stations than to those in the Helsinki section of the network.

These findings suggest that safety perceptions are influenced at least in part by visible signs of disorder, the presence of security personnel, or the general reputation of an area. This influence may exist even when individuals have not personally witnessed any incidents. However, the case of Kivenlahti challenges this pattern. Although Kivenlahti is rated as the least safe West Metro station in terms of perceived safety, it has consistently fewer police and security personnel assignments than, for instance, Central Railway Station and Hakaniemi, which are both perceived as safer. Therefore, it cannot be stated unequivocally that measurable safety directly corresponds with perceived safety. In the case of Kivenlahti, the negative perception appears to result from factors other than the actual number of disturbances.

Tapiola provides another interesting example. Although it has a relatively high number of police and security personnel assignments, often more than Kivenlahti, it is still perceived as one of the safest stations. This shows that perceptions of safety do not always align directly with quantitative incident data.

The discrepancy between perceived and actual safety highlights the need to address more than just the frequency of security incidents. Improving safety perceptions also requires enhancing the overall passenger experience as well as the mental images passengers may associate with a station and its surroundings. This includes improvements to the physical environment, increasing the visible presence of security personnel, and building trust in the safety infrastructure of the metro system. These efforts are especially important in areas with a history of safety concerns and are essential for reducing fear and increasing public confidence in public transport.

5.2.3 Influence of Station Location on Safety Perceptions

When analysing the relationship between metro station safety perceptions and the income levels of surrounding areas, a nuanced picture emerges. Stations with the most negative safety perceptions, Sörnäinen, Mellunmäki, Itäkeskus, and Kontula, are all located in lower-income areas. These areas also have a large proportion of government-supported rental housing compared to areas in Espoo, where stations were perceived as clearly safer. This aligns with earlier findings from the Helsinki metropolitan area, which show that feelings of insecurity tend to concentrate in socially disadvantaged areas, where visible signs of disorder are more common (Kääriäinen, 2002). However, notable exceptions suggest that other factors also play a significant role in shaping safety perceptions.

Keilaniemi and Aalto University metro station are situated in areas with some of the lowest median incomes in Espoo, even lower than in East Helsinki, where the previously mentioned stations, Sörnäinen, Mellunmäki, Itäkeskus, and Kontula, are located. Yet, these stations were rated as exceptionally safe. One possible explanation for this contrast lies in the different functions of these areas. Keilaniemi and Aalto University metro station, located in Otaniemi, are dominated by office buildings and university campuses, rather than traditional residential neighborhoods. These areas generally have a more transient and professional population, which fosters a sense of order and control, contributing to positive safety perceptions despite lower median incomes. This sets them apart from East Helsinki, where higher unemployment and lower income levels are associated with perceptions of insecurity.

Areas like Sörnäinen are heavily associated with visible social challenges, including substance abuse. Sörnäinen, in particular, is well known for drug-related activities and has a reputation for insecurity, similar to Itäkeskus and Kontula. In addition to socioeconomic disparities, these areas also have a notable concentration of mental health and substance rehabilitation services, including facilities for assisted living and harm reduction programs, such as needle exchange points. This further contributes to their association with visible social challenges. Meanwhile, areas like Keilaniemi and Otaniemi, home to Aalto University's metro station, lack such services, as their primary functions revolve around business and academia, rather than residential communities or social welfare infrastructure.

Interestingly, not all high-income areas showed consistently high safety ratings. Kivenlahti, despite being a high-income area, had its metro station perceived as less safe than other stations in areas with similar median incomes. This could be due to the station's more isolated location and ongoing construction, as the surrounding area is still under development. For example, the adjacent empty square attracts loitering individuals, which might cause uncertainty among metro passengers. In contrast, stations in areas like Koivusaari, Lauttasaari, Tapiola, and Urheilupuisto, which also have high-income populations, were rated as notably safer. These areas benefit from stable residential environments, established infrastructure, and a sense of permanence, which likely contribute to their higher safety perceptions.

It is worth noting, however, that some stations in wealthy parts of Helsinki, such as Kamppi and Rautatientori, are generally perceived as safe, yet experience a high number of public disturbances. This is evident from the large number of incidents reported by police and station security staff. These stations are among the busiest in the entire metro network, located in the heart of Helsinki, and serve as major transport hubs. As a result, they attract a wide range of people, not just local residents. This highlights that factors beyond income and area development, such as the volume of foot traffic and the nature of the services provided, can also influence safety perceptions.

In conclusion, while there is some correlation between lower-income areas and lower perceived safety, income alone does not fully explain safety perceptions. Factors such as the area's function (e.g., office, university, or residential), the presence of support services, and the area's reputation also play crucial roles. Stations in areas with visible social challenges or negative reputations are often perceived as unsafe, while those in areas with stable residential populations or professional environments tend to be rated more favourably. Therefore, safety perceptions are shaped by a combination of income, area functions, public image, and broader social factors, not income alone.

5.2.4 Station Age and Services in Relation to Safety Perceptions

The survey results also reveal an association between station age and perceived safety. Older stations, particularly those built in the 1980s, such as Sörnäinen (1984), Kontula (1986), Mellunmäki (1989), and Itäkeskus (1982), consistently received lower safety ratings. Despite having undergone major renovations, Sörnäinen still received the worst ratings in terms of perceived safety among all the stations. In contrast, newer stations in the western metro extension, including Koivusaari, Keilaniemi, and Aalto University (opened in 2017), were rated notably safer, with nearly all responses falling into the two highest safety categories. However, it cannot be definitively stated that newer stations are automatically perceived as safer, as Keilaniemi, despite being built in 2022, was perceived as unsafe. Nevertheless, the 30–40-year age gap between these groups is generally reflected in the differences in safety perceptions, with renovations improving physical infrastructure but not necessarily eliminating the impact of station age on user experience.

The presence of shopping centres at or near metro stations does not show a consistent relationship with perceived safety. Among the most avoided and negatively perceived stations, Itäkeskus is connected to the large Itis shopping centre, and Kontula is surrounded by an open-air shopping mall. However, other frequently avoided stations, such as Mellunmäki and Sörnäinen, have no direct connection to shopping centres. Conversely, many of the stations that were perceived as safe, such as Tapiola, Lauttasaari and Aalto University, are connected to shopping centres. Yet, others that are perceived as safe, like Keilaniemi, Koivusaari and Urheilupuisto, are not.

There are also several stations with mixed or moderate safety ratings that are directly connected to shopping centres, including Kalasatama, Niittykumpu, Matinkylä, and Espoonlahti. In addition, stations such as the Central Railway Station, University of Helsinki, Vuosaari, and Myllypuro are located in the immediate vicinity of shopping centres but do not stand out clearly in either the highest or lowest safety categories. These comparisons suggest that the existence of a shopping centre near a metro station is not a reliable indicator of how safe the station is perceived to be.

A clearer pattern emerges when examining the presence of bars and restaurants near metro stations. Stations with the lowest safety ratings and highest levels of avoidance, such as Sörnäinen and Kontula, also have a high concentration of alcohol-serving establishments nearby. Among the stations in the western extension, Kivenlahti was rated the least safe and similarly has several bars in close proximity to the metro station. Encounters with intoxicated individuals are likely more frequent in these areas, which may contribute to the reduced sense of safety. While Itäkeskus and Mellunmäki also have nearby bars, they are not characterized by the same density of nightlife as Sörnäinen and Kontula. Importantly, similar services are present near stations that were not perceived as unsafe, such as Kamppi, the University of Helsinki, and the Central Railway Station. These central stations, although generally considered safe, also have high numbers of police and security personnel assignments, likely due to both the presence of bars and higher foot traffic. This suggests that while the presence of alcohol-serving venues may increase disturbances, it does not always result in a lower perceived safety among passengers.

These results offer a more nuanced view than earlier safety surveys conducted in Helsinki, which have shown that feelings of insecurity are particularly concentrated around railway transport hubs and shopping centres (Keskinen & Laihinen, 2017). For instance, in previous studies 68% of the places mentioned by residents as frightening were shopping centres or train and metro stations (Väliniemi-Laurson & Rönnberg, 2019). However, this study finds no consistent relationship between the presence of shopping centres and perceived safety, as both highly safe and unsafe stations were either connected to or located near shopping centres, while some stations in the vicinity of shopping centres received varying or moderate safety ratings. These findings suggest that while earlier research has highlighted commercial hubs as common sites of insecurity, the relationship between station services and safety perceptions is more complex and may depend on additional contextual factors such as station layout, the level of informal social control, the nature and density of nearby services, as well as the broader reputation and user profile of the surrounding area.

5.3 Recommendations for KLOY

Based on the findings of this study, several targeted recommendations can be made for KLOY to improve perceived safety at metro stations, particularly among those groups who reported feeling most unsafe. Women, individuals with prior victimization experiences, people with mobility limitations, and daily metro users emerged as the most affected by safety concerns. Therefore, interventions should be designed with these groups in mind.

The most effective way to enhance perceived safety is to increase the visible presence of security personnel, particularly during evenings and at stations identified as the most unsafe, such as Sörnäinen, Kontula, and Itäkeskus. Although security patrols are already a key part of metro operations, their presence could be made even more visible, with a stronger emphasis on actively and visibly intervening in situations that cause fear. Some comments from the open-ended question of the survey mentioned unprofessional, unfair, or even racist behaviour from security guards. Therefore, ensuring that all passengers are treated fairly and respectfully at all times is crucial for building trust among users and, in turn, improving perceptions of safety. A single negative experience can shape attitudes and erode both trust and the sense of safety. The presence of security personnel had a more positive effect on women's perceptions of safety compared to men. However, women with mobility limitations and gender minorities did not respond as positively; for some, it even worsened their sense of safety. Still, these groups represented a minority, as the desire for increased security presence was one of the most frequently mentioned suggestions across all comments.

Paying particular attention to lighting design during renovations would help make the station environment feel safer, following the example of the newer stations on the western metro extension where lighting has been excellently designed. In one comment from a woman with mobility limitations, it was mentioned that the escalators at Kamppi metro station have poorly lit areas that cause fear. Ensuring that such areas are eliminated from metro stations could therefore improve perceived safety.

Cleanliness and maintenance are equally, if not more, critical. Stations that are dirty, vandalized, or contain broken infrastructure considerably reduce perceived safety. In this study, the oldest stations and those with the most vandalism, along with stations located in areas with a negative reputation, were the most feared and commonly avoided due to fear. This highlights the importance of ensuring that stations appear well cared for. Rapid removal of litter, prompt repairs of broken infrastructure, and the swift removal of vandalism such as graffiti are particularly important. These findings align with previous research, as the three most influential frameworks in the field, Crime Prevention Through Environmental Design (CPTED), Routine Activity Theory (RAT) and the Broken Windows Theory (BWT), all emphasize the role of maintenance and visual order in reducing crime and improving perceived safety (Cozens et al., 2005; Smith & Clarke, 2000; Vilalta, 2011; Wilson James & Kelling George, 1982). Therefore, these efforts should be prioritized and specifically targeted at stations in eastern Helsinki that were most frequently associated with fear.

Visible surveillance cameras help foster a sense of security and should be maintained to a high standard. Surveillance cameras did not enhance the sense of safety as strongly for those who had previously experienced victimization, both women and men, compared to others. Surprisingly and contrary to previous research findings, cameras had a greater positive impact on men's sense of safety than on women's. Despite these small differences between groups, surveillance cameras were among the most influential factors contributing to a feeling of safety at stations and should therefore be prioritized. The metro system already has an extensive surveillance network, so adding more cameras is not necessary; however, increasing the visibility of existing cameras could further improve perceived safety.

Clear and up-to-date signage was found in the survey to positively influence perceived safety for all passengers, but it was especially influential for women with mobility challenges. For this reason, the metro system's already high-quality station signage and real-time information systems should be maintained, as women with mobility limitations were among the groups who felt the most unsafe.

It is a positive finding that ongoing renovations were generally not seen to reduce perceived safety, which is reassuring given the extensive renovation work currently underway at stations in eastern Helsinki. However, it is crucial to ensure accessibility throughout these renovations, as they had a more negative impact on the perceived safety of individuals with mobility limitations compared to others. Similarly, out-of-service elevators or escalators weakened the sense of safety for passengers with mobility challenges more than for other groups. Ensuring that stations remain fully accessible and that elevators and escalators are functioning even during construction is therefore essential for maintaining perceived safety. Importantly, communication about safety measures should be visible and accessible to passengers, reinforcing the impression that stations are actively monitored and maintained.

Finally, the environment surrounding metro stations also plays a significant role in shaping perceived safety. The types of services located nearby, such as social and support services, low-cost housing, alcohol-serving establishments, together with the overall reputation of the area, influence the kinds of people who spend time in the surroundings and, in turn, affect how safe passengers feel. Since these factors fall largely outside of KLOY's direct control, improving the overall safety and reputation of the area requires collaboration with the City of Helsinki and Espoo, as well as other local stakeholders.

6 Conclusions

This study examined metro users' safety perceptions at stations across the Helsinki metropolitan area, highlighting the influence of individual, environmental, and situational factors, as well as variations in station-specific safety perceptions and the role of station location, age, and surrounding services. Survey responses from 1,086 metro users revealed that while metro stations were generally perceived as safe, notable differences emerged between stations.

The stations perceived as safest were Keilaniemi and Koivusaari, followed by Lauttasaari, Urheilupuisto, and Tapiola. In contrast, Sörnäinen was perceived as the least safe, followed by Kontula, Mellunmäki, and Itäkeskus. When asked about avoidance due to safety concerns, 62% of respondents stated that they do not avoid any metro station, while the remaining 38% reported avoiding at least one. Sörnäinen was the most frequently avoided station, with 227 respondents reporting they avoided it, followed by Kontula and Itäkeskus. Factors contributing to lower safety perceptions included station age, user profiles, socioeconomic conditions and the reputation of surrounding neighbourhoods, as well as visible signs of social disorder. Older stations in Helsinki, especially those built in the 1980s, received lower safety ratings than newer stations in the western extension, even after renovations. Stations located near offices or university campuses, such as Aalto University, were perceived as safer than residential area stations, even in low-income districts. The presence of bars and alcohol-serving establishments was associated with reduced perceived safety, while the presence of shopping centres showed no consistent effect.

Previous victimization was the strongest individual predictor of lower perceived safety, especially among women, who reported higher levels of fear, particularly regarding sexual harassment. Women with past victimization experiences formed the most fearful group, followed by men with similar experiences. No notable differences in perceived safety were observed across age groups. Mobility limitations contributed modestly to lower safety perceptions, with broken elevators and escalators being a particular concern. Metro usage frequency showed a complex pattern: occasional users felt safest, while daily users had the lowest safety perceptions, were the most likely to avoid at least one station due to fear and also reported the highest rates of victimization. Supporting the conclusion that familiarity does not increase perceived safety was the finding that people did not perceive their home stations as safer than others. Although women and individuals with prior victimization consistently perceived lower safety, their metro usage frequency was similar to that of others, indicating that feeling unsafe does not necessarily reduce how often people use the metro.

The survey addressed fear of crime by focusing on three types: violence or threats, theft or robbery, and sexual harassment. Among these, witnessing violence or threats was most frequently feared, followed by witnessing sexual harassment. In contrast, fear of personal victimization was most common in relation to theft or robbery. Women and individuals with prior victimization experiences reported the highest levels of fear across all three categories, particularly regarding sexual harassment.

Key environmental factors that most positively influenced perceived safety were good lighting, cleanliness, and the presence of visible security personnel and security cameras. Conversely, signs of disorder including poor maintenance, litter, vandalism, and broken infrastructure such as lights, doors, benches, or signs, were major contributors to fear. Ongoing renovations at stations had little effect on perceived safety, and background music or nature sounds were similarly perceived as largely irrelevant.

These findings underscore the need for targeted improvements, especially at stations with consistently low safety ratings. Enhancing the presence of visible security personnel, ensuring cleanliness and maintenance, and improving the reputation of surrounding areas could strengthen the overall sense of safety among metro users.

7 References

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Appendix 1: List of Survey Questions

1. Evaluate the following statement:
I usually feel unsafe or afraid at metro stations.

1. Strongly agree
2. Somewhat agree
3. Neither agree nor disagree
4. Somewhat disagree
5. Strongly disagree

2. When waiting at a metro station, do you fear witnessing the following situations:

Theft or robbery:
☐ Often
☐ Sometimes
☐ Never
☐ I don't want to answer

Violence or threats:
☐ Often
☐ Sometimes
☐ Never
☐ I don't want to answer

Sexual harassment:
☐ Often
☐ Sometimes
☐ Never
☐ I don't want to answer

3. When waiting at a metro station, do you fear becoming a victim yourself of the following situations:

Theft or robbery:
☐ Often
☐ Sometimes
☐ Never
☐ I don't want to answer

Violence or threats:
☐ Often
☐ Sometimes
☐ Never
☐ I don't want to answer

Sexual harassment:
☐ Often
☐ Sometimes
☐ Never
☐ I don't want to answer

4. The following factors at a metro station make me feel…

1 = Much safer
2 = Slightly safer
3 = No effect
4 = Slightly unsafe
5 = Much less safe or afraid

1. The station has poor or insufficient lighting
2. You can see surveillance cameras
3. You see security guards
4. The station has clear and up-to-date signage and timetable displays
5. The elevators or escalators are out of order
6. The station is dirty, littered, or you see signs of vandalism
7. Something is broken (e.g., door, bench, light or sign)
8. There is visible maintenance work or renovations ongoing at the station
9. The station is crowded (rush hour, popular station)
10. There are very few people at the station, or you are alone
11. Music or nature sounds are played at the station

5. Select 1-5 metro stations you are most familiar with.

6. Assess how safe you feel at the metro stations you chose.

1 = I feel safe
2 = I feel somewhat safe
3 = I don't feel completely safe but I'm not afraid either
4 = I feel a bit uneasy or unsafe
5 = I feel unsafe or afraid

7. Do you avoid using any metro station because you don't feel safe there?

- Aalto University
- Espoonlahti
- Finnoo
- Hakaniemi
- University of Helsinki
- Herttoniemi
- Itäkeskus
- Kaitaa
- Kalasatama
- Kamppi
- Keilaniemi
- Kivenlahti
- Koivusaari
- Kontula
- Kulosaari
- Lauttasaari
- Matinkylä
- Mellunmäki
- Myllypuro
- Niittykumpu
- Puotila
- Rastila
- Central Railway Station
- Ruoholahti
- Siilitie
- Soukka
- Sörnäinen
- Tapiola
- Urheilupuisto
- Vuosaari
- I don't avoid any metro station due to fear

8. Have you ever been a victim of battery, assault, threats, sexual harassment, theft, or any other crime at a metro station?

- Yes
- No
- I don’t want to answer

9. Do you have any mobility limitations or use any mobility aids?

☐ Yes
☐ No
☐ I don’t want to answer

10. How often do you use the metro?

☐ Daily or almost daily
☐ Several times a week
☐ Once a week
☐ 2-3 times a month
☐ Once a month or less often

11. Select the metro station closest to your home:

☐ I do not live in the Helsinki Metropolitan Area
☐ I live in the Helsinki Metropolitan Area, but not near any metro station
☐ Aalto University
☐ Espoonlahti
☐ Finnoo
☐ Hakaniemi
☐ University of Helsinki
☐ Herttoniemi
☐ Itäkeskus
☐ Kaitaa
☐ Kalasatama
☐ Kamppi
☐ Keilaniemi
☐ Kivenlahti
☐ Koivusaari
☐ Kontula
☐ Kulosaari
☐ Lauttasaari
☐ Matinkylä
☐ Mellunmäki
☐ Myllypuro
☐ Niittykumpu
☐ Puotila
☐ Rastila
☐ Central Railway Station

☐ Ruoholahti
☐ Siilitie
☐ Soukka
☐ Sörnäinen
☐ Tapiola
☐ Urheilupuisto
☐ Vuosaari

12. Birth year: ____

13. Gender:

☐ Woman
☐ Man
☐ Other
☐ I don’t want to answer

14. Is there anything you would like to add about safety perceptions at metro stations?

Appendix 2: Figures

Station-specific evaluations of perceived safety at the safest stations

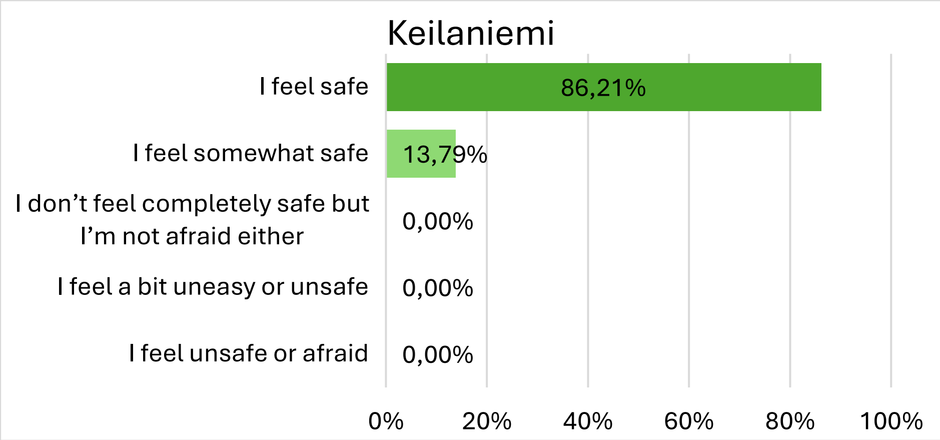

Figure 2.1: Distribution of safety perceptions at Keilaniemi metro station (n = 29).

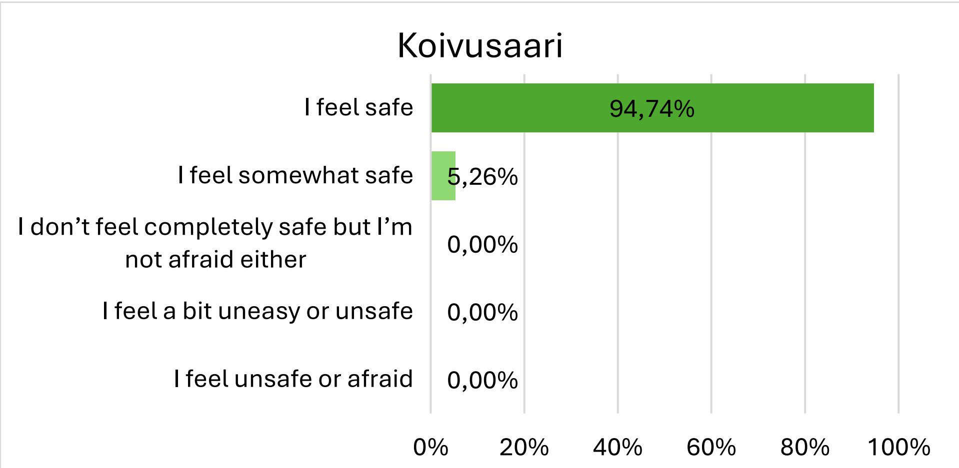

Figure 2.2: Distribution of safety perceptions at Koivusaari metro station (n = 19).

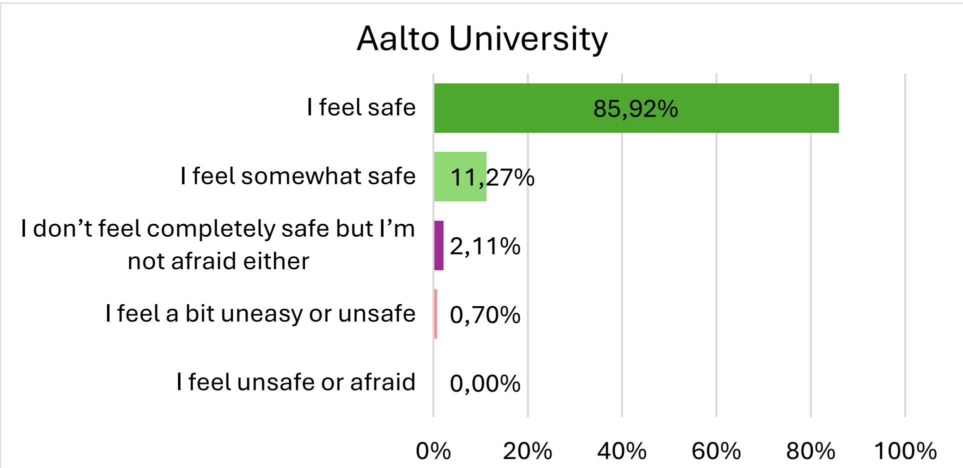

Figure 2.3: Distrubution of safety perceptions at Aalto University metro station (n = 142).

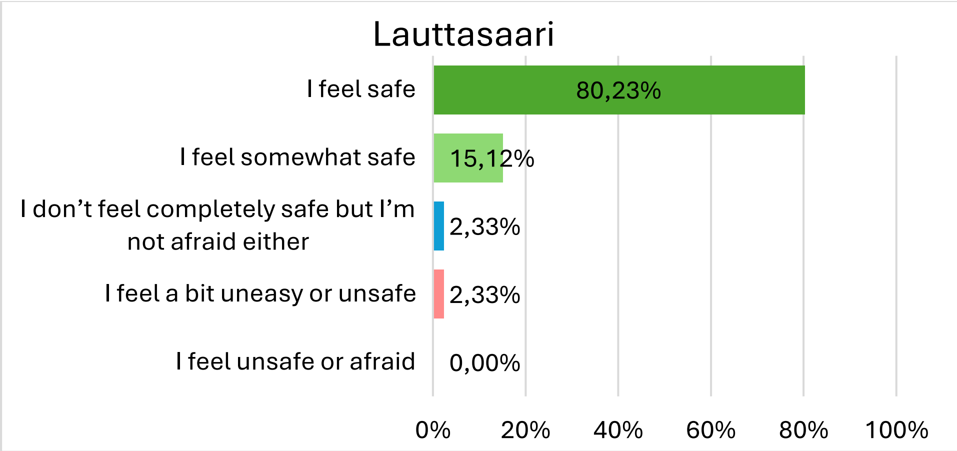

Figure 2.4: Distrubution of safety perceptions at Lauttasaari metro station (n = 86).

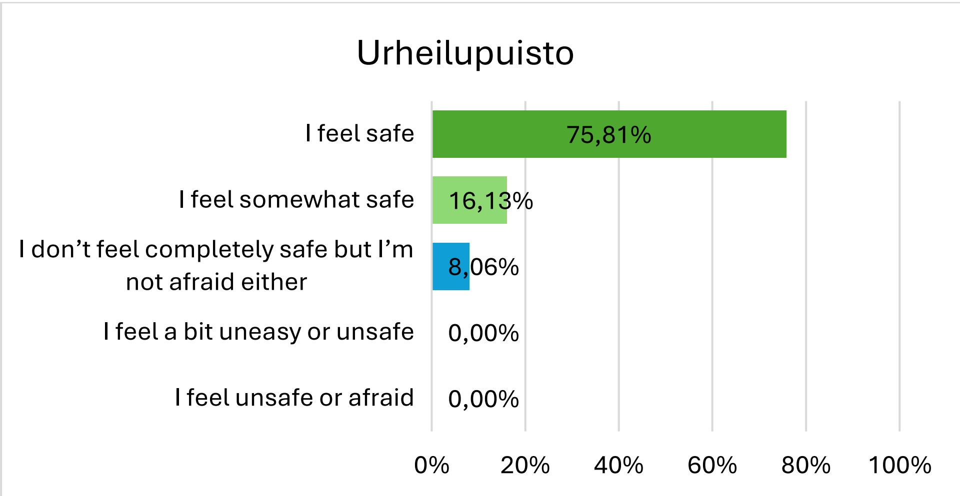

Figure 2.5: Distrubution of safety perceptions at Urheilupuisto metro station (n = 62).

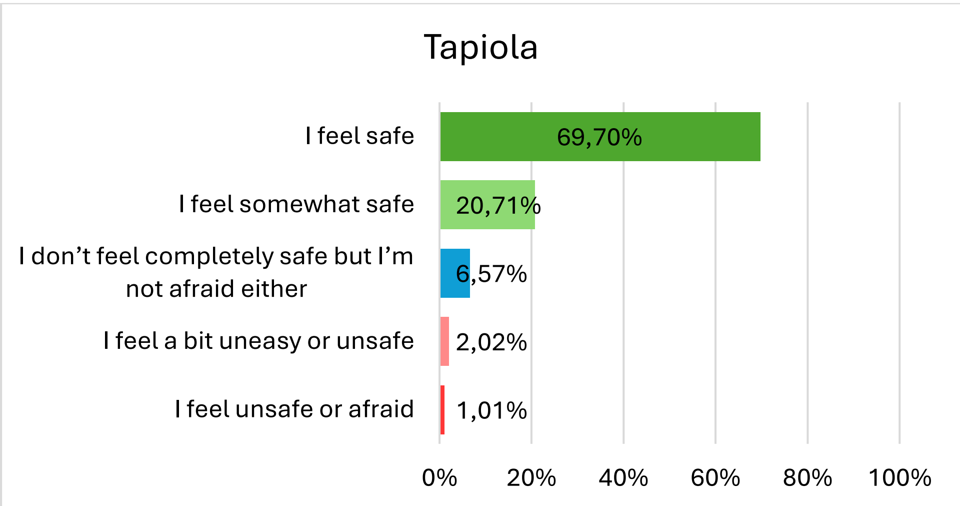

Figure 2.6: Distrubution of safety perceptions at Tapiola metro station (n = 198).

Station-specific evaluations of perceived safety at the least safe stations

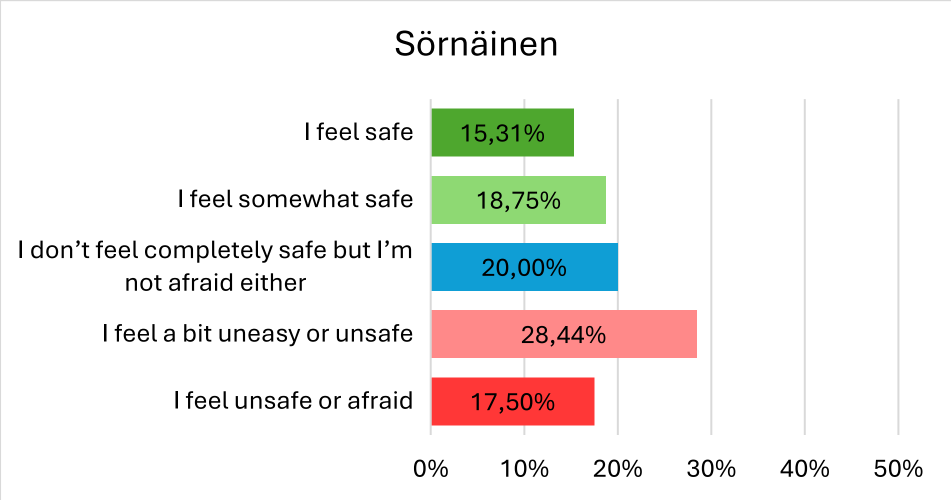

Figure 2.7: Distrubution of safety perceptions at Sörnäinen metro station (n = 320).

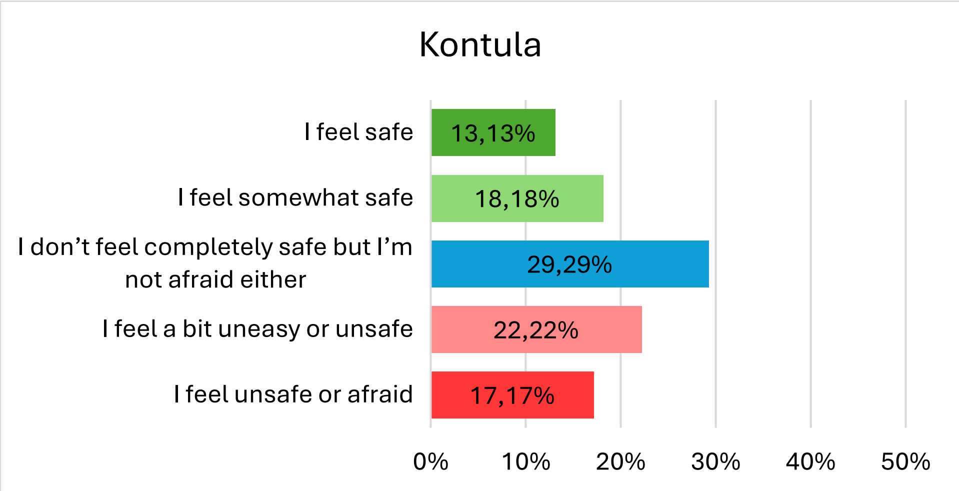

Figure 2.8: Distrubution of safety perceptions at Kontula metro station (n = 99)

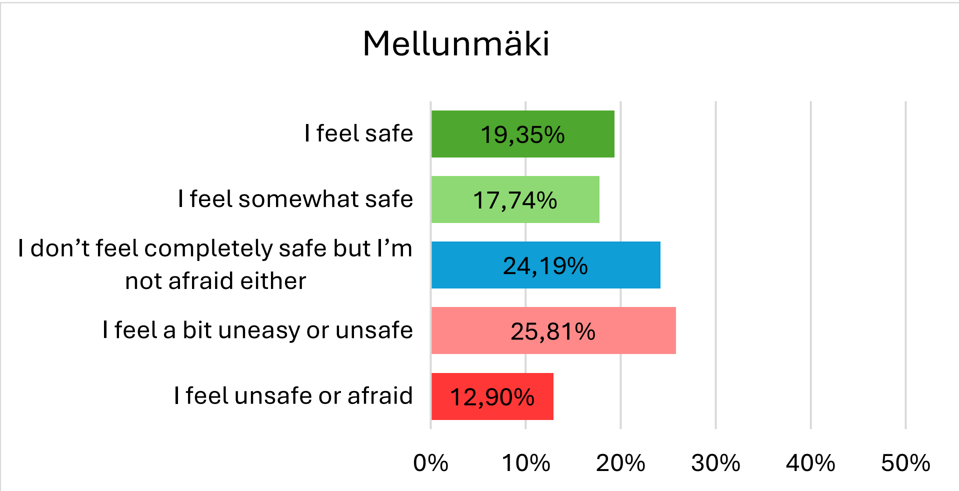

Figure 2.9: Distrubution of safety perceptions at Mellunmäki metro station (n = 62).

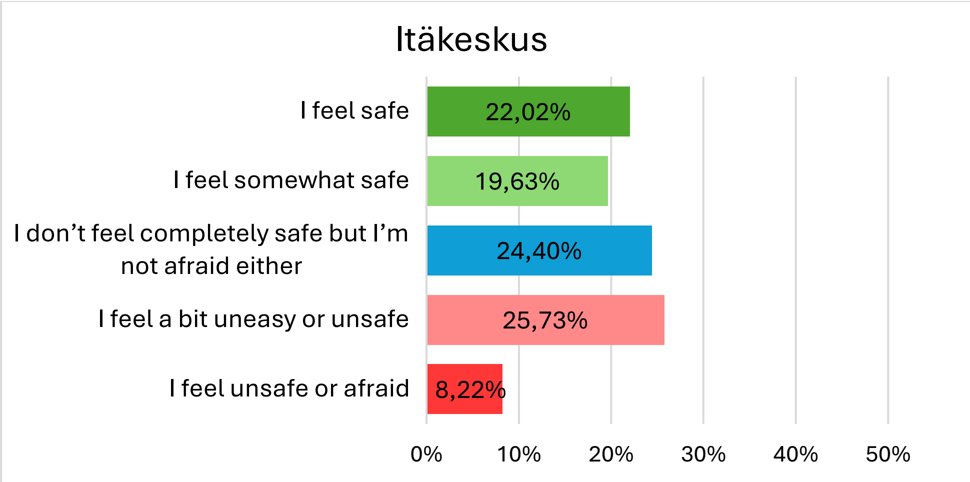

Figure 2.10: Distrubution of safety perceptions at Itäkeskus metro station (n = 377).

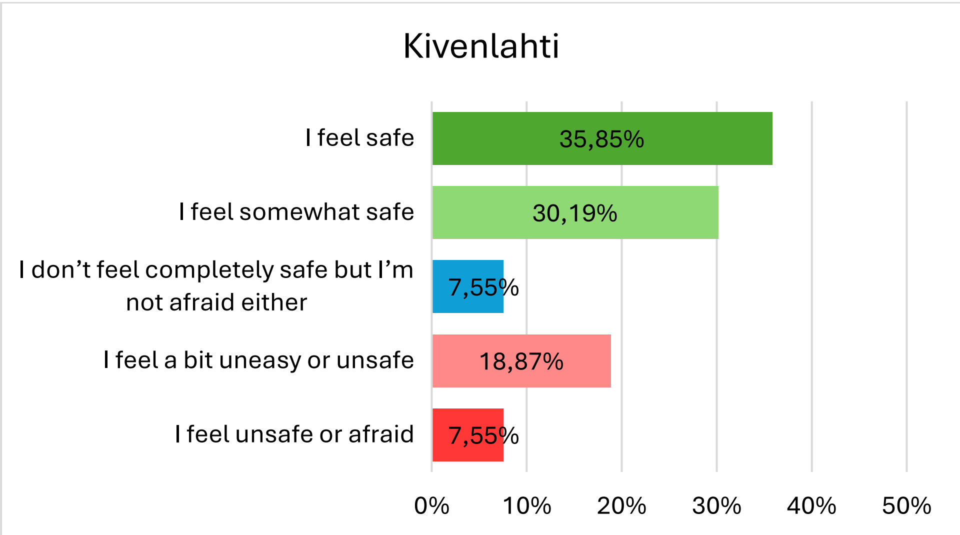

Figure 2.11: Distrubution of safety perceptions at Kivenlahti metro station (n = 53).

Differences in fear of witnessing crime between station avoiders and non-avoiders

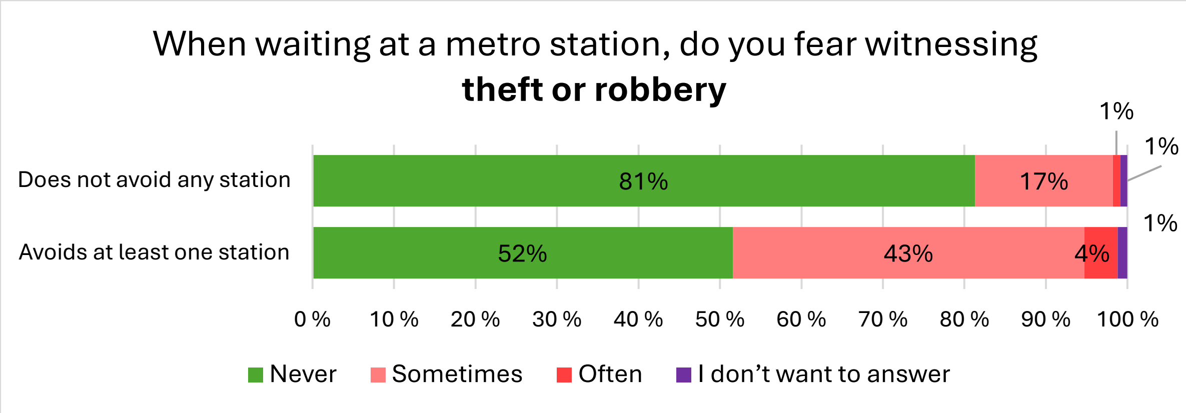

Figure 2.12: Fear of witnessing theft or robbery at metro stations among respondents who avoid at least one station due to fear (n = 413) versus those who do not (n = 669).

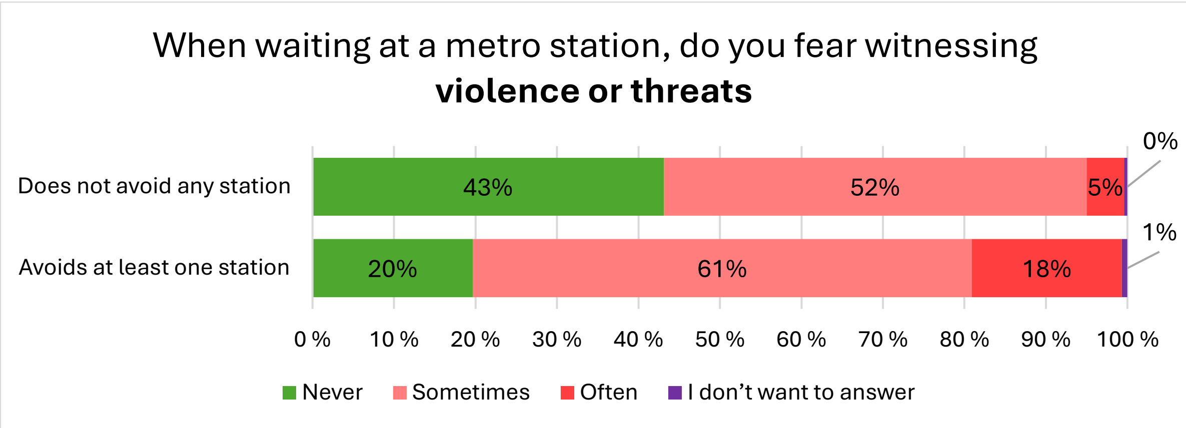

Figure 2.13: Fear of witnessing violence or threats at metro stations among respondents who avoid at least one station due to fear (n = 412) versus those who do not (n = 669).

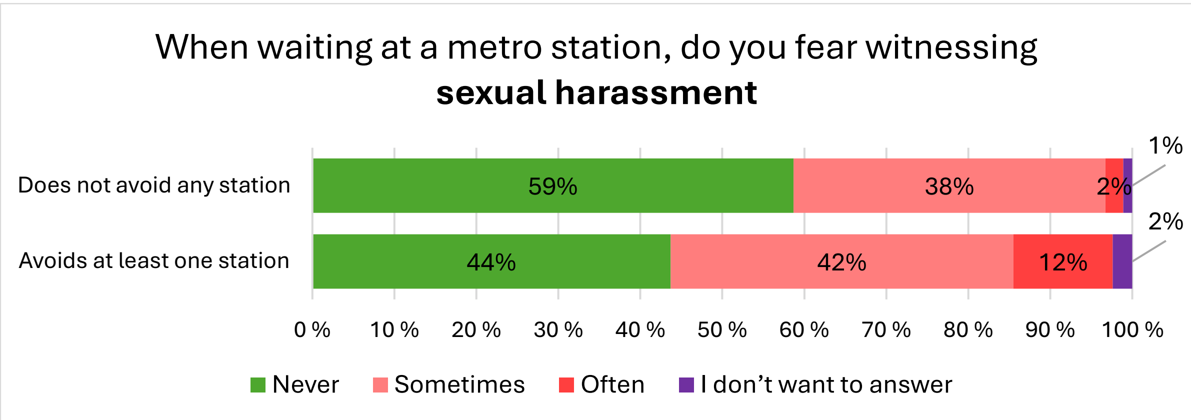

Figure 2.14: Fear of witnessing sexual harassment at metro stations among respondents who avoid at least one station due to fear (n = 412) versus those who do not (n = 671).

Differences in fear of becoming a victim of crime between station avoiders and non-avoiders

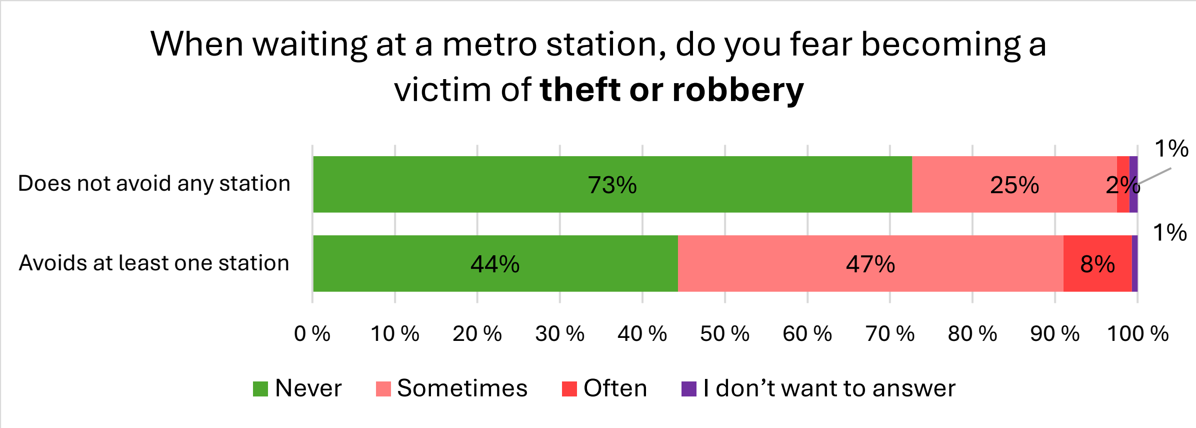

Figure 2.15: Fear of becoming a victim of theft or robbery at metro stations among respondents who avoid at least one station due to fear (n = 413) versus those who do not (n = 670).

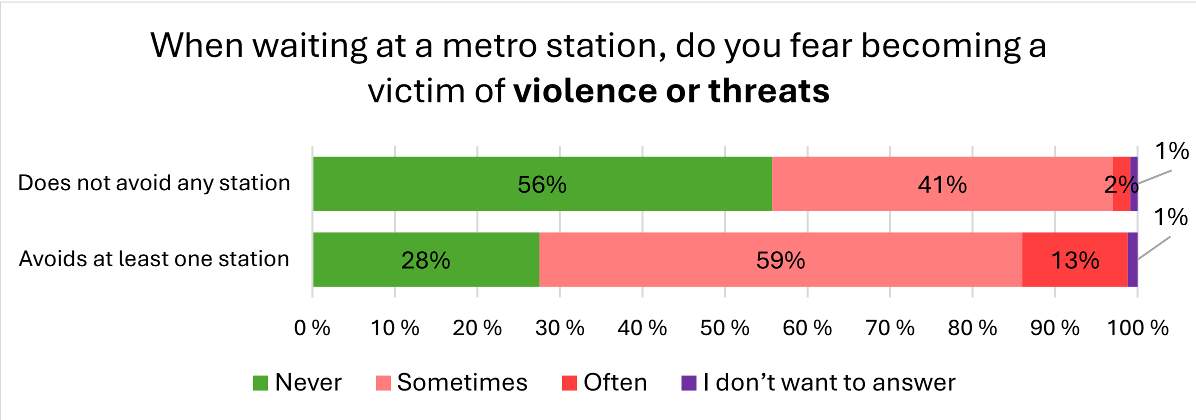

Figure 2.16: Fear of becoming a victim of violence or threats at metro stations among respondents who avoid at least one station due to fear (n = 414) versus those who do not (n = 670).

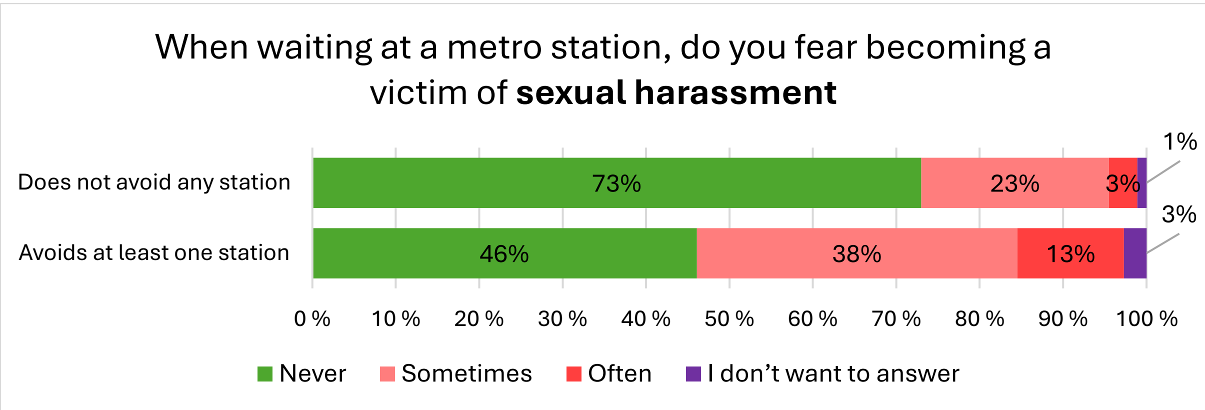

Figure 2.17: Fear of becoming a victim of sexual harassment at metro stations among respondents who avoid at least one station due to fear (n = 414) versus those who do not (n = 670).

Differences in fear of witnessing crime between women and men

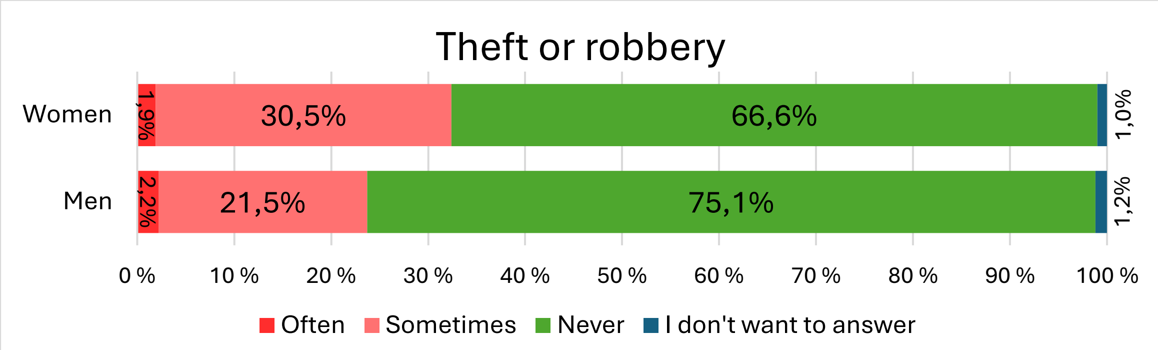

Figure 2.18: Fear of witnessing theft or robbery at metro stations among women (n = 629) and men (n = 413).

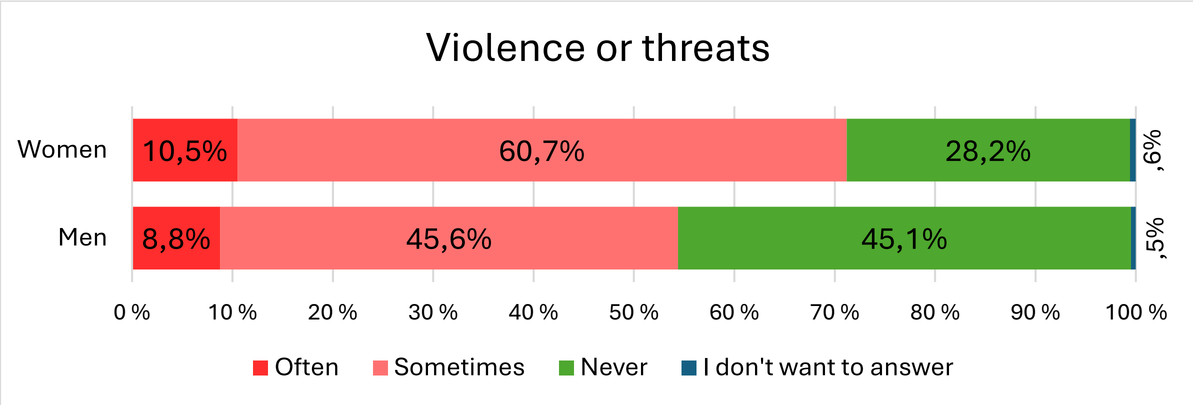

Figure 2.19: Fear of witnessing violence or threats at metro stations among women (n = 631) and men (n = 410).

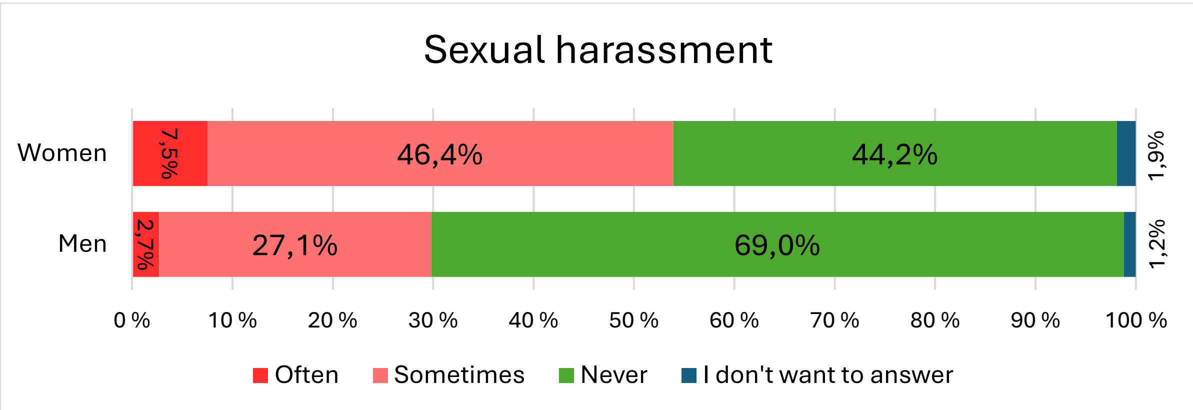

Figure 2.20: Fear of witnessing sexual harassment at metro stations among women (n = 631) and men (n = 413).

Differences in fear of becoming a victim of crime between women and men

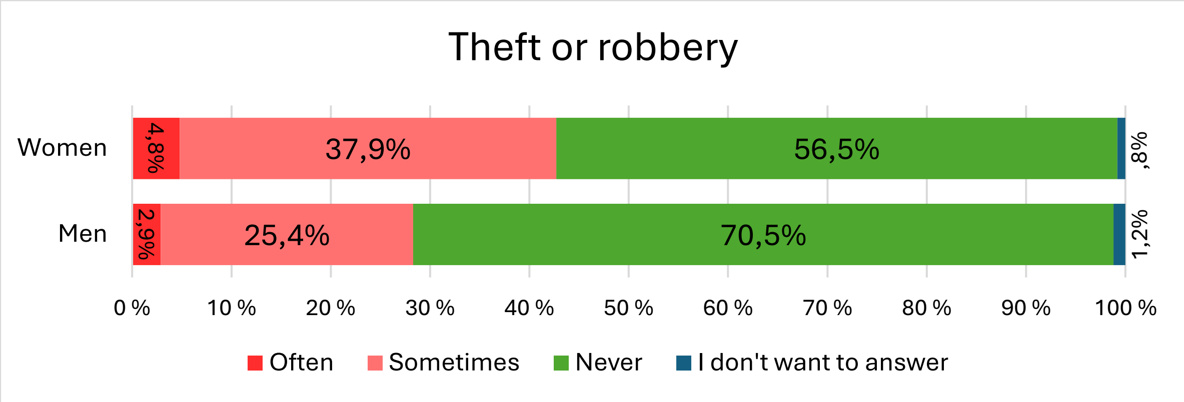

Figure 2.21: Fear of becoming a victim of theft or robbery at metro stations among women (n = 630) and men (n = 413).

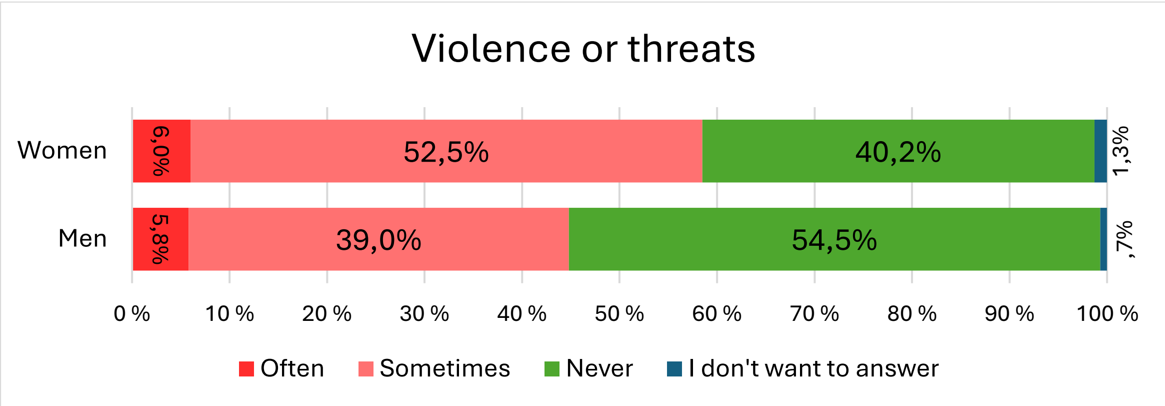

Figure 2.22: Fear of becoming a victim of violence or threats at metro stations among women (n = 631) and men (n = 413).

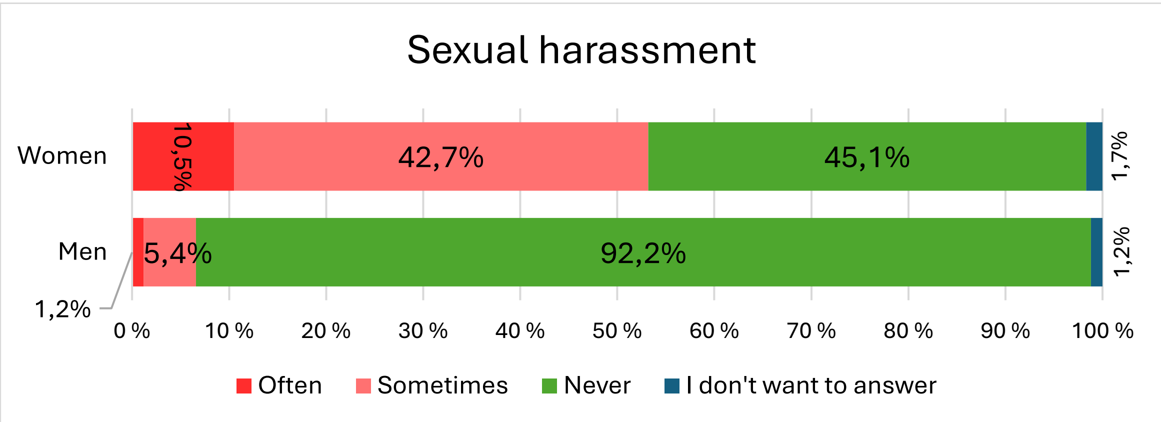

Figure 2.23: Fear of becoming a victim of sexual harassment at metro stations among women (n = 632) and men (n = 412).

Gender differences between women and men on station-specific evaluations

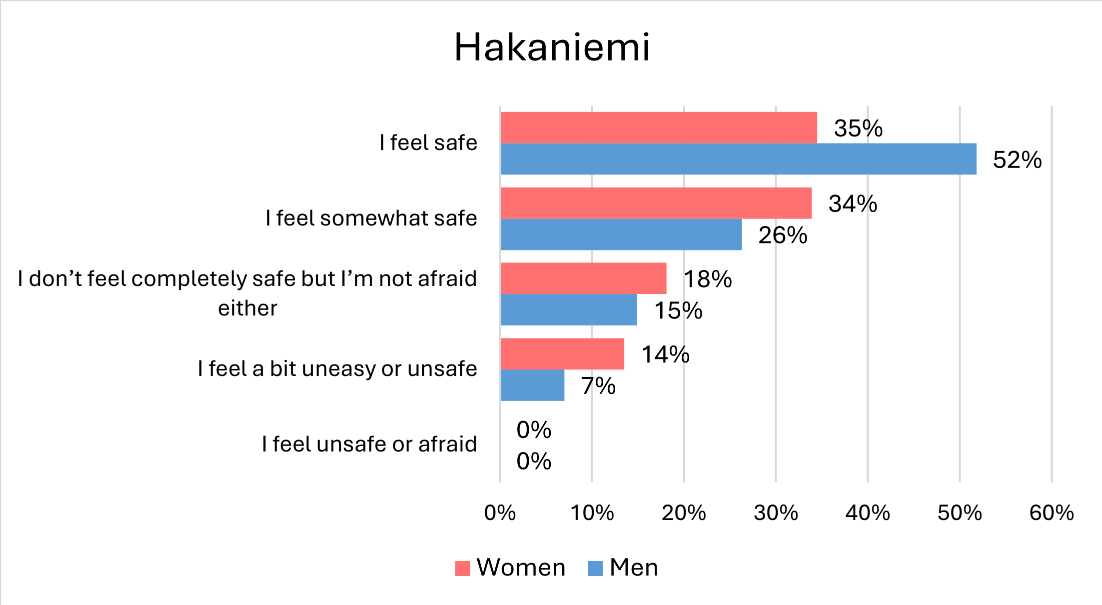

Figure 2.24: Distribution of safety perceptions at Hakaniemi metro station among women (n = 171) and men (n = 114).

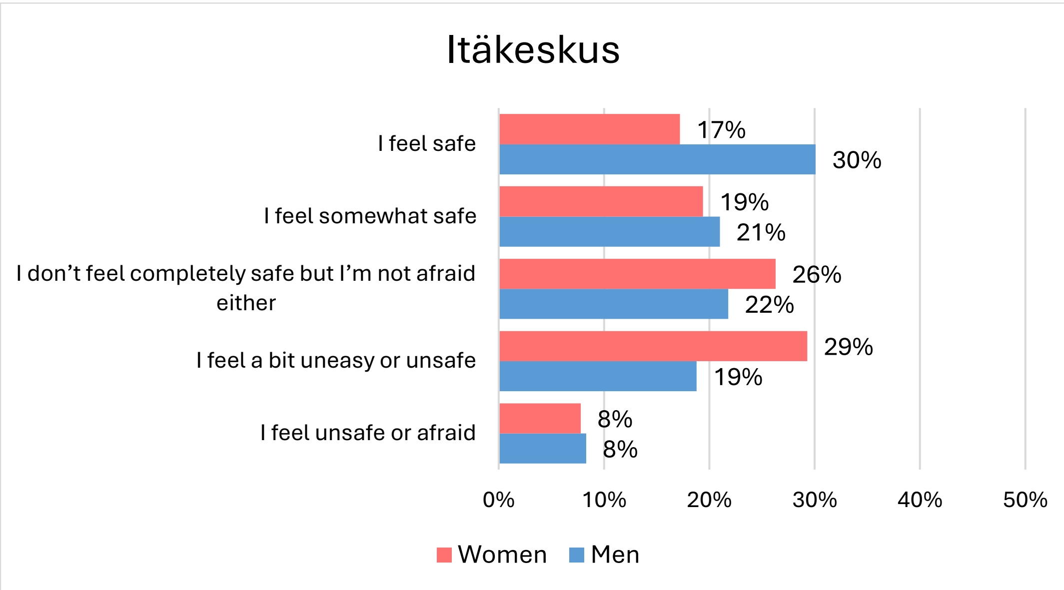

Figure 2.25: Distrubution of safety perceptions at Itäkeskus metro station among women (n = 232) and men (n = 133).

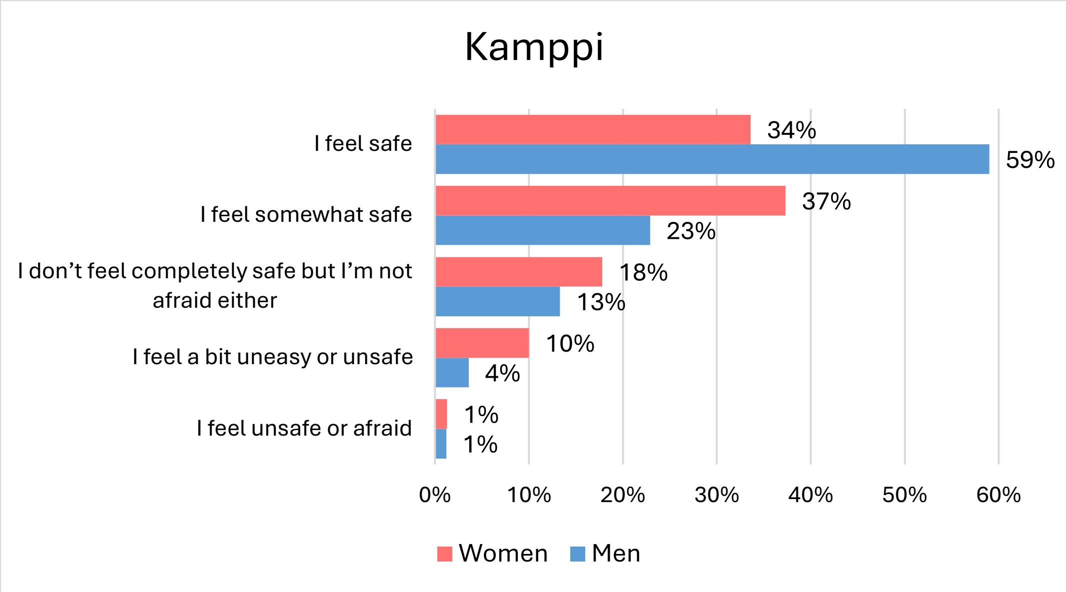

Figure 2.26: Distrubution of safety perceptions at Kamppi metro station among women (n = 381) and men (n = 249).

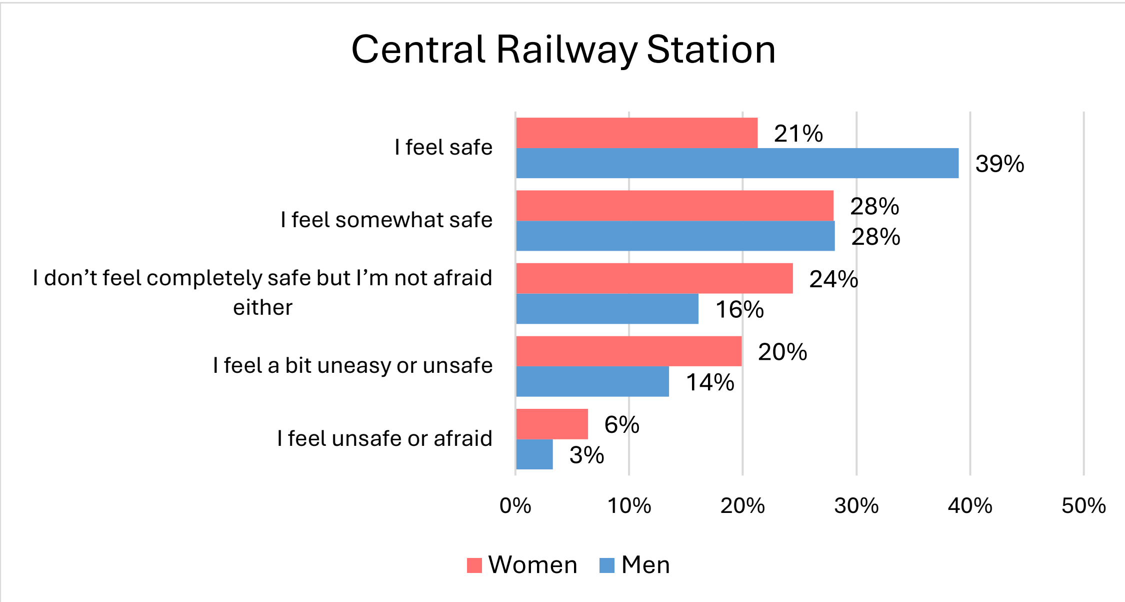

Figure 2.27: Distrubution of safety perceptions at Central Railway Station among women (n = 422) and men (n = 274).

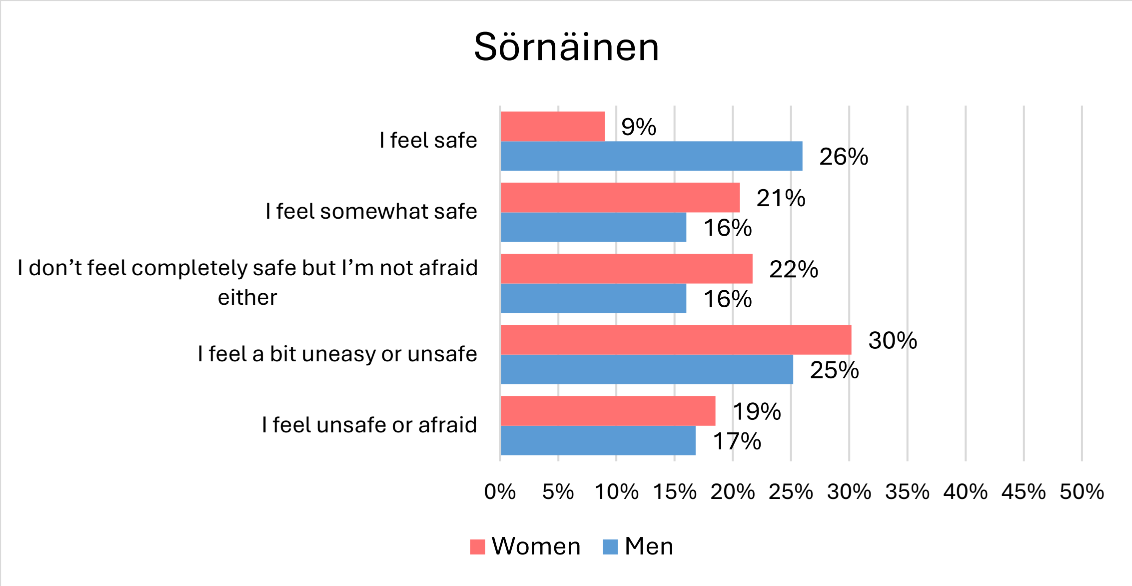

Figure 2.28: Distrubution of safety perceptions at Sörnäinen metro station among women (n = 189) and men (n = 119).

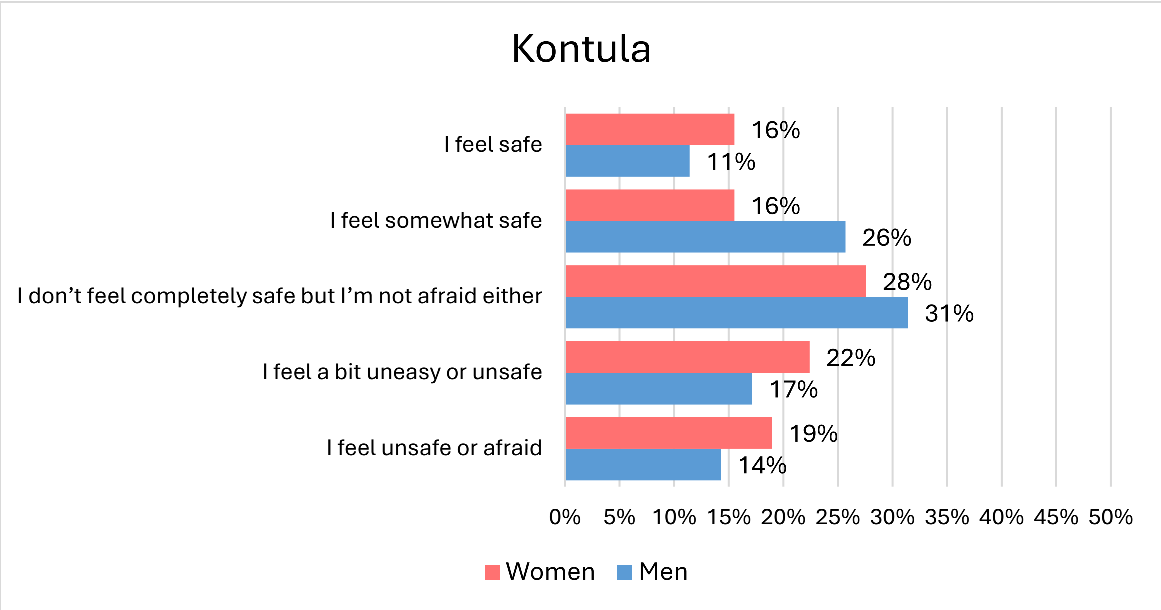

Figure 2.29: Distrubution of safety perceptions at Kontula metro station among women (n = 58) and men (n = 35).

Station-specific evaluations of perceived safety by victimization experience

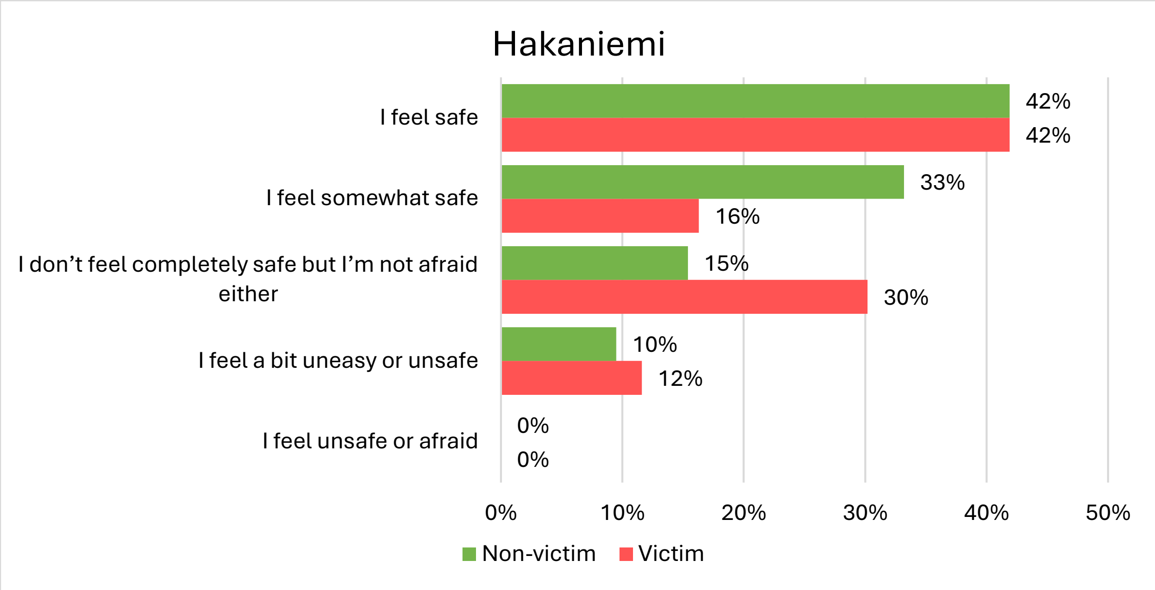

Figure 2.30: Distrubution of safety perceptions at Hakaniemi metro station among victims (n = 43) and others (n = 241).

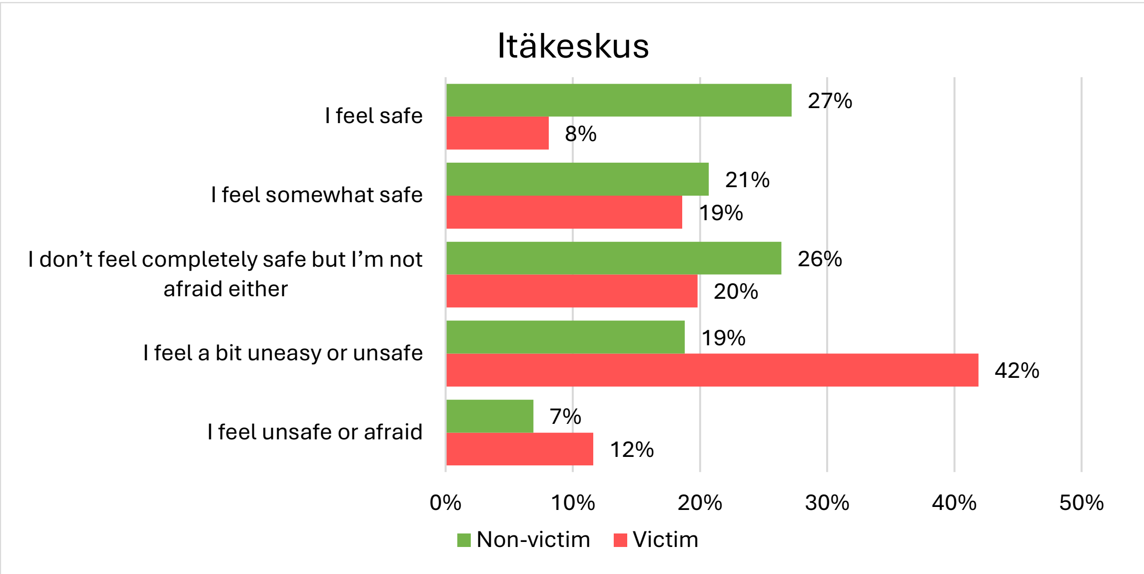

Figure 2.31: Distrubution of safety perceptions at Itäkeskus metro station among victims (n =86) and others (n = 276).

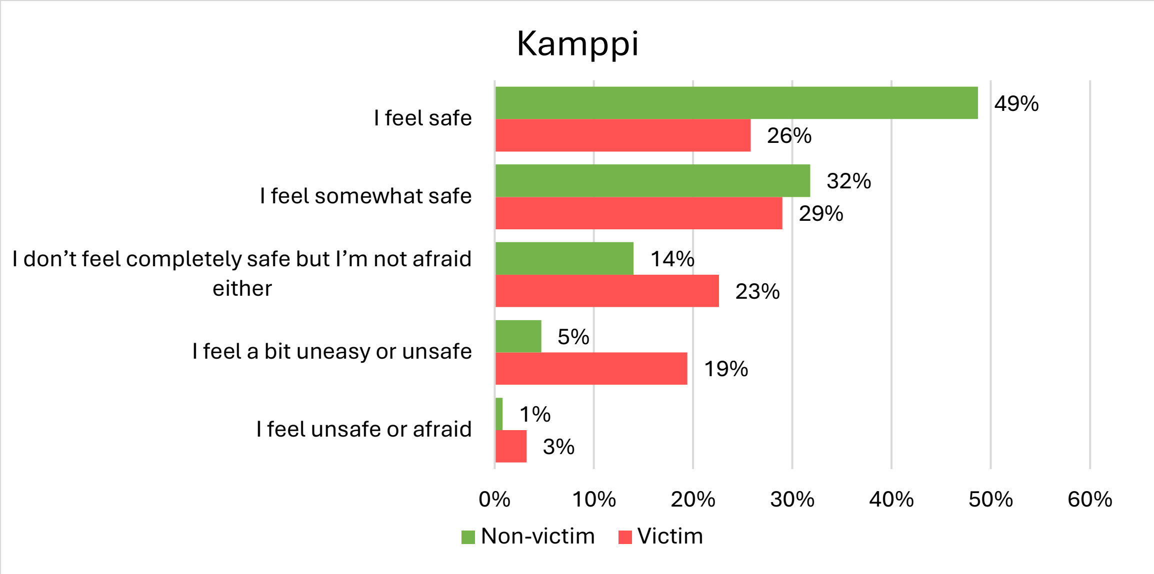

Figure 2.32: Distrubution of safety perceptions at Kamppi metro station among victims (n = 124) and others (n = 513).

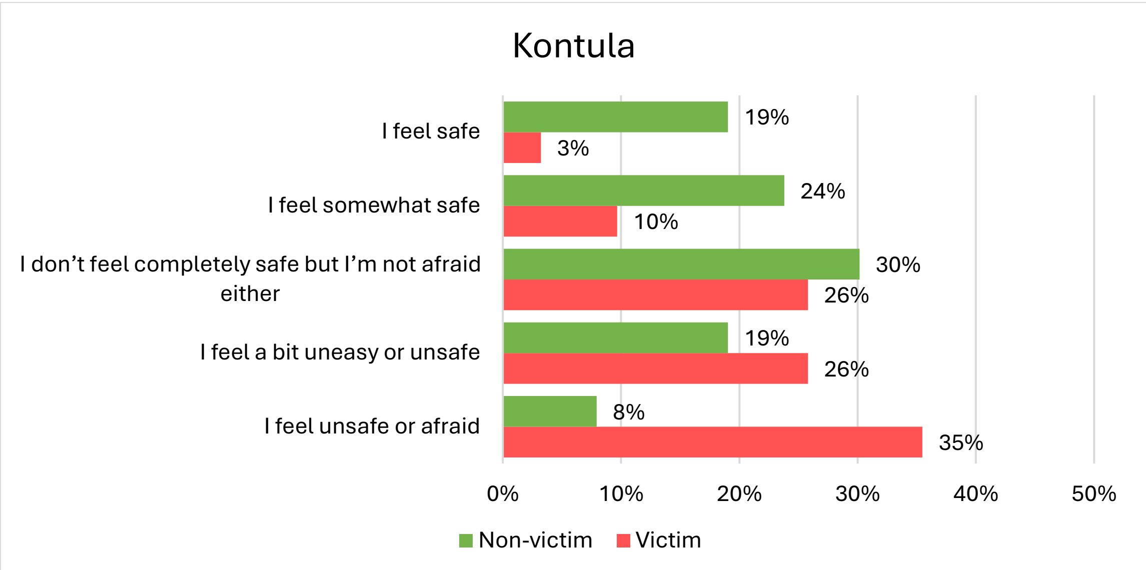

Figure 2.33: Distrubution of safety perceptions at Kontula metro station among victims (n = 31) and others (n = 63).

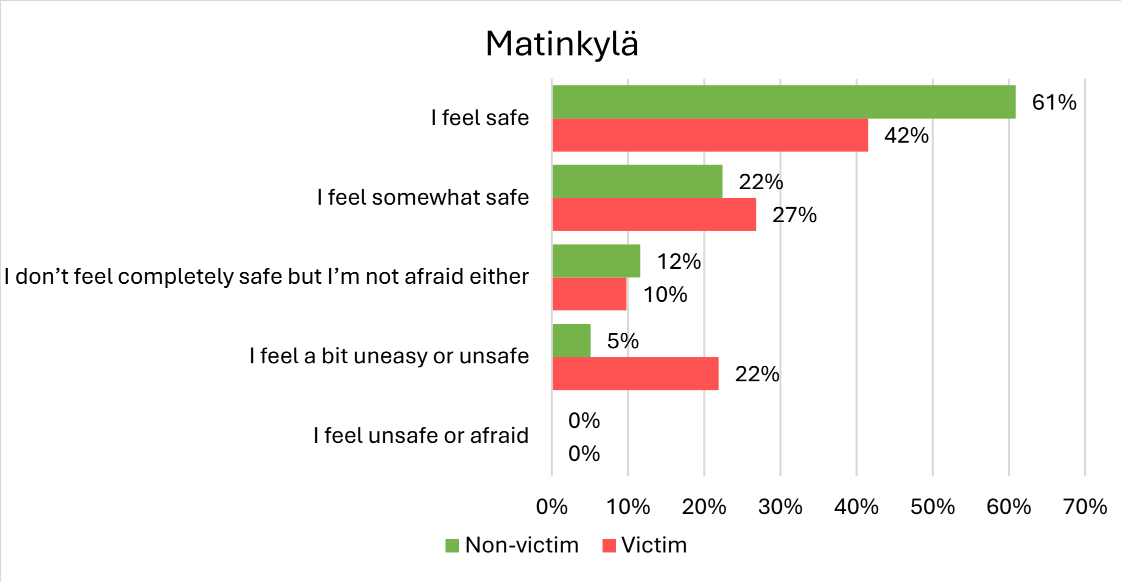

Figure 2.34: Distrubution of safety perceptions at Matinkylä metro station among victims (n = 41) and others (n = 156).

Overall perceived safety at metro stations among respondents with and without mobility limitations

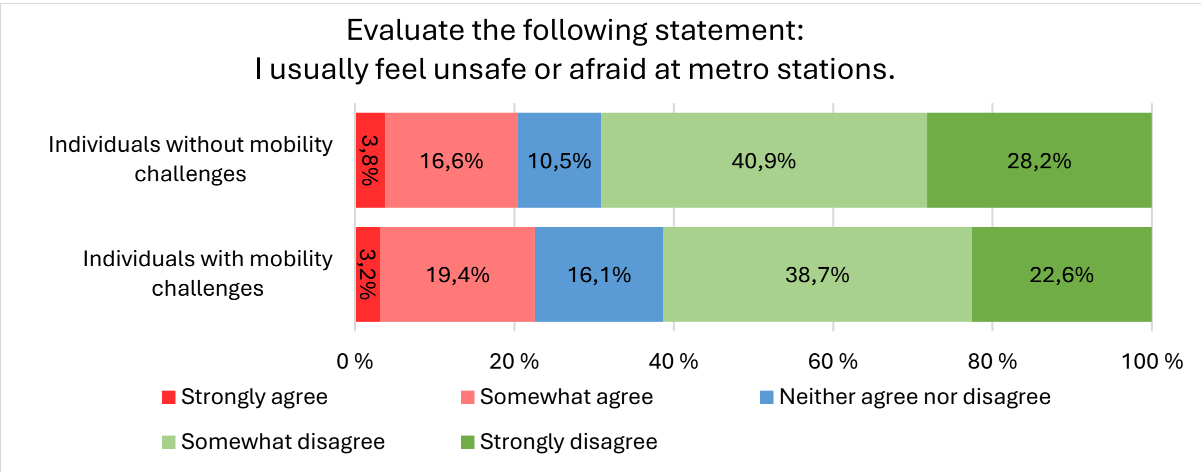

Figure 2.35: Distribution of responses to the statement "I usually feel unsafe or afraid at metro stations" among respondents who use mobility aids or have mobility limitations (n = 31) and others (n = 1036).

Differences in safety perceptions by the combined effect of gender and victimization history

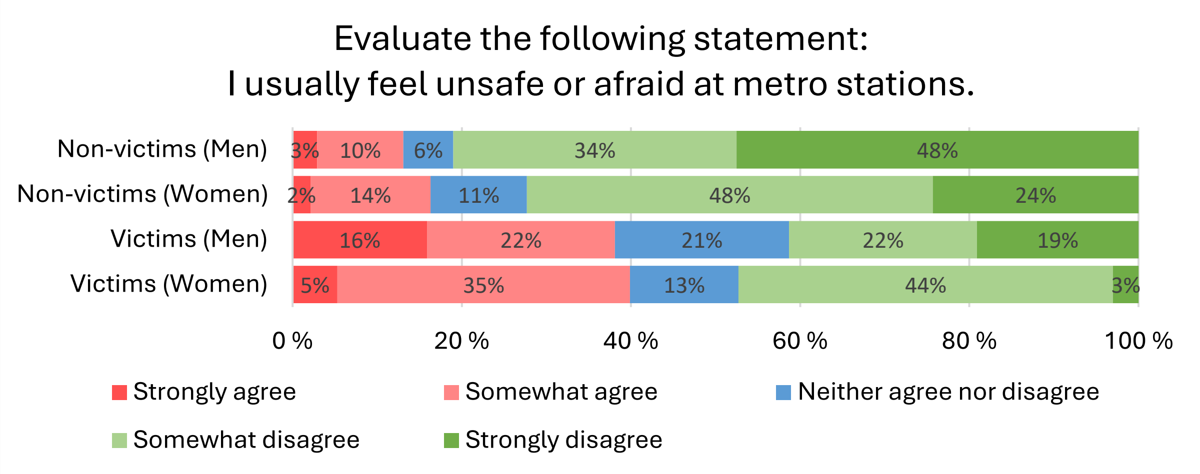

Figure 2.36: Distribution of responses to the statement "I usually feel unsafe or afraid at metro stations," by gender and victimization experience (n = 1020).

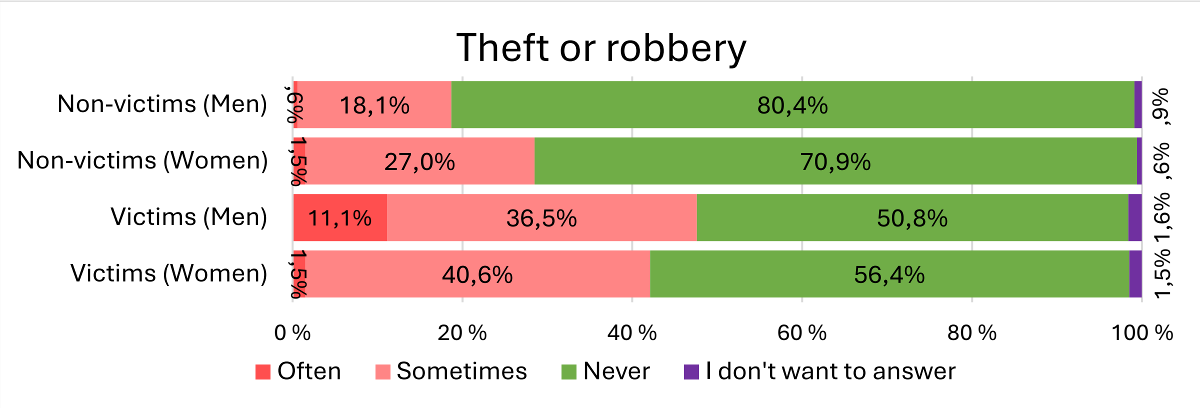

Figure 2.37: Fear of witnessing theft or robbery at metro stations by gender and victimization experience (n = 1,016).

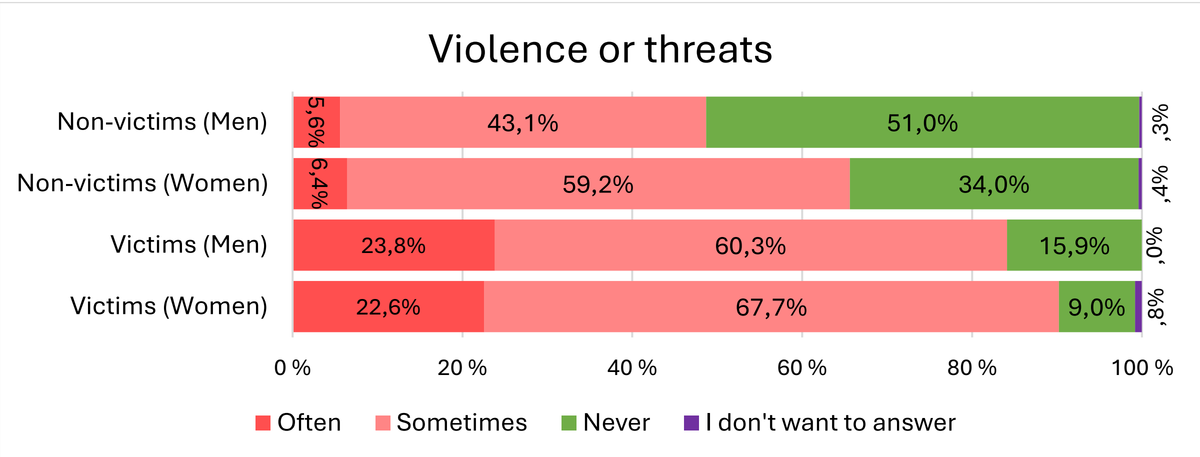

Figure 2.38: Fear of witnessing violence or threats at metro stations by gender and victimization experience (n = 1,017).

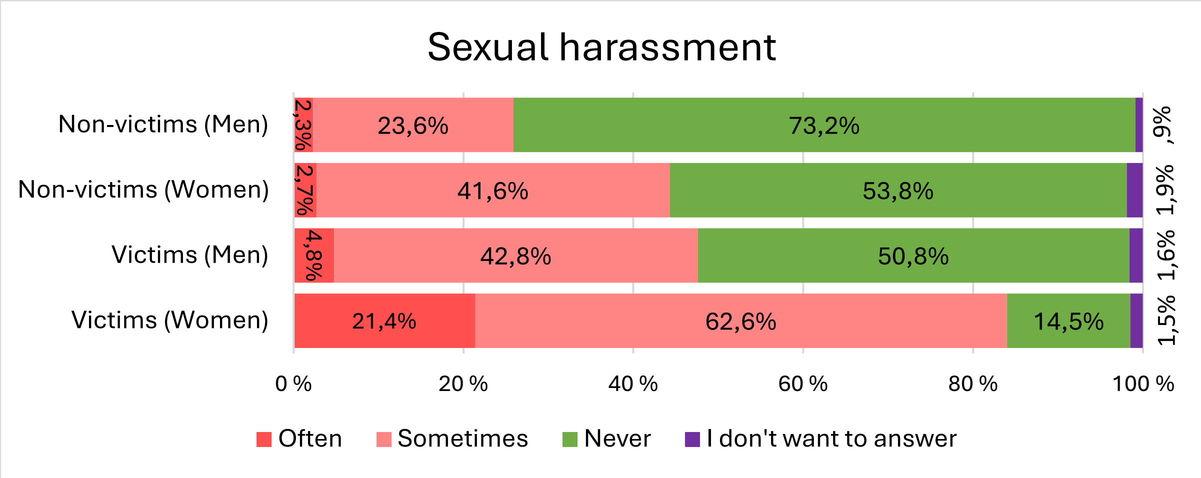

Figure 2.39: Fear of witnessing sexual harassment at metro stations by gender and victimization experience (n = 1,018).

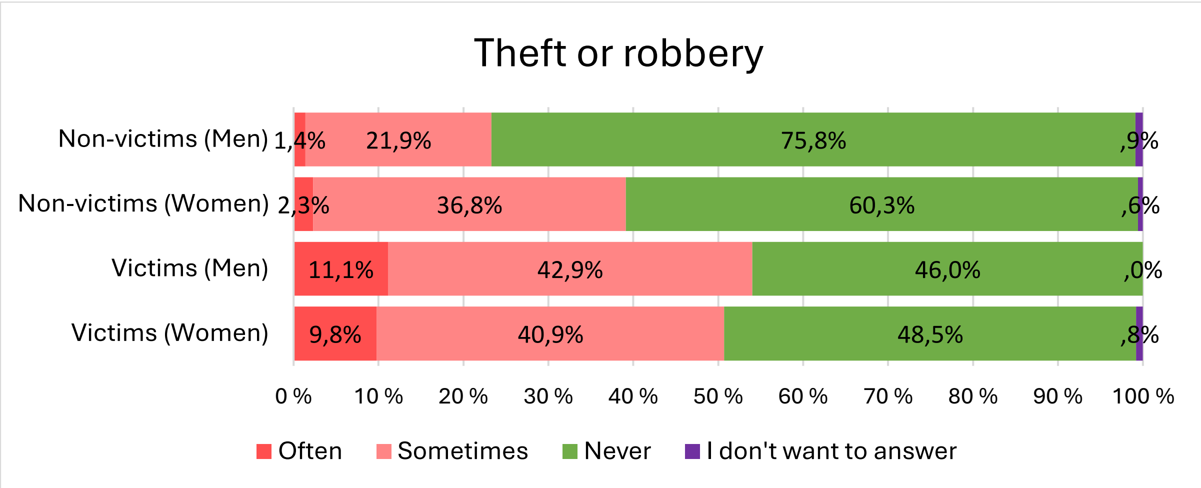

Figure 2.40: Fear of becoming a victim of theft or robbery at metro stations by gender and victimization experience (n = 1,017).

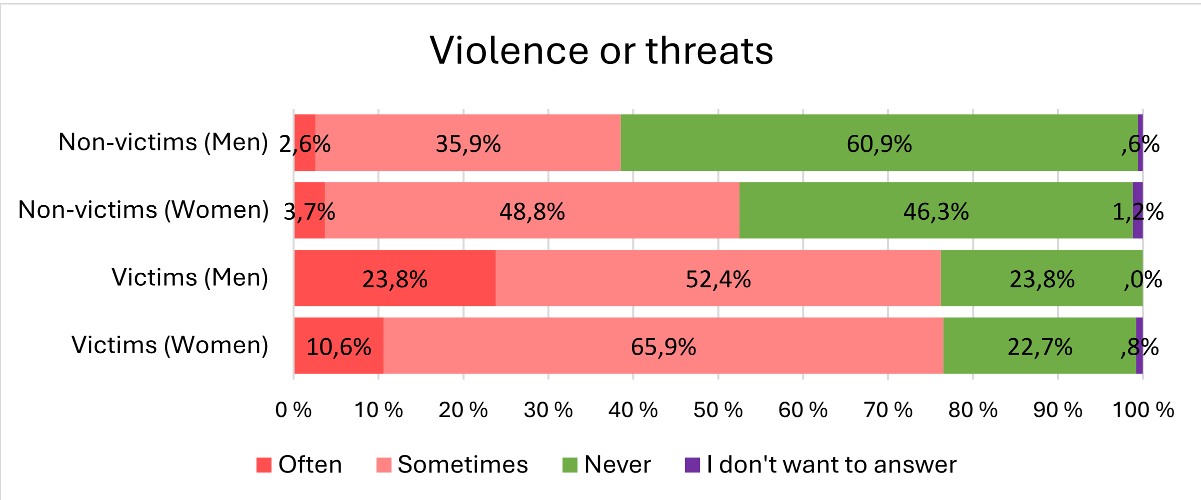

Figure 2.41: Fear of becoming a victim of violence or threats at metro stations by gender and victimization experience (n = 1,018).

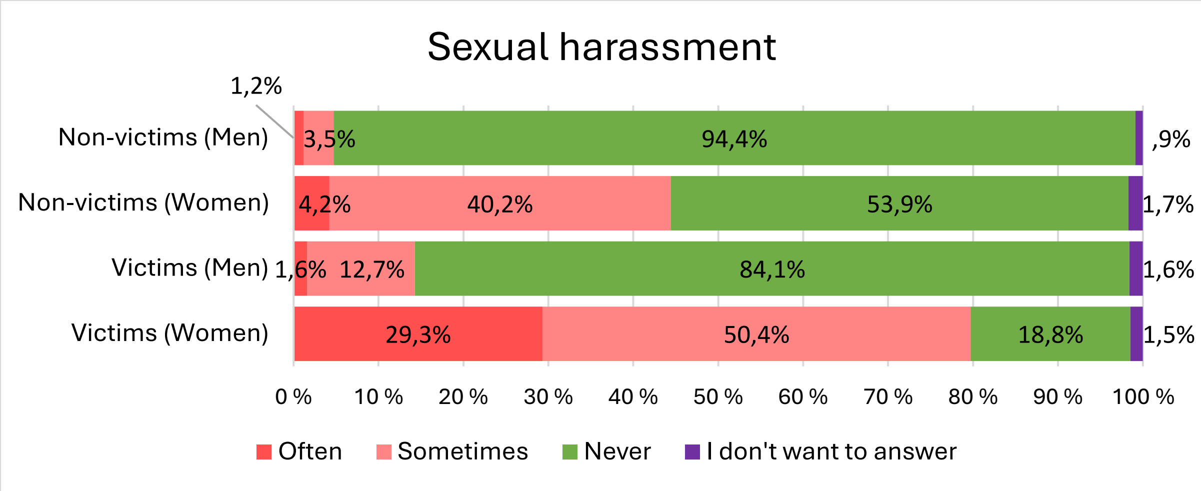

Figure 2.42: Fear of becoming a victim of sexual harassment at metro stations by gender and victimization experience (n = 1,018).

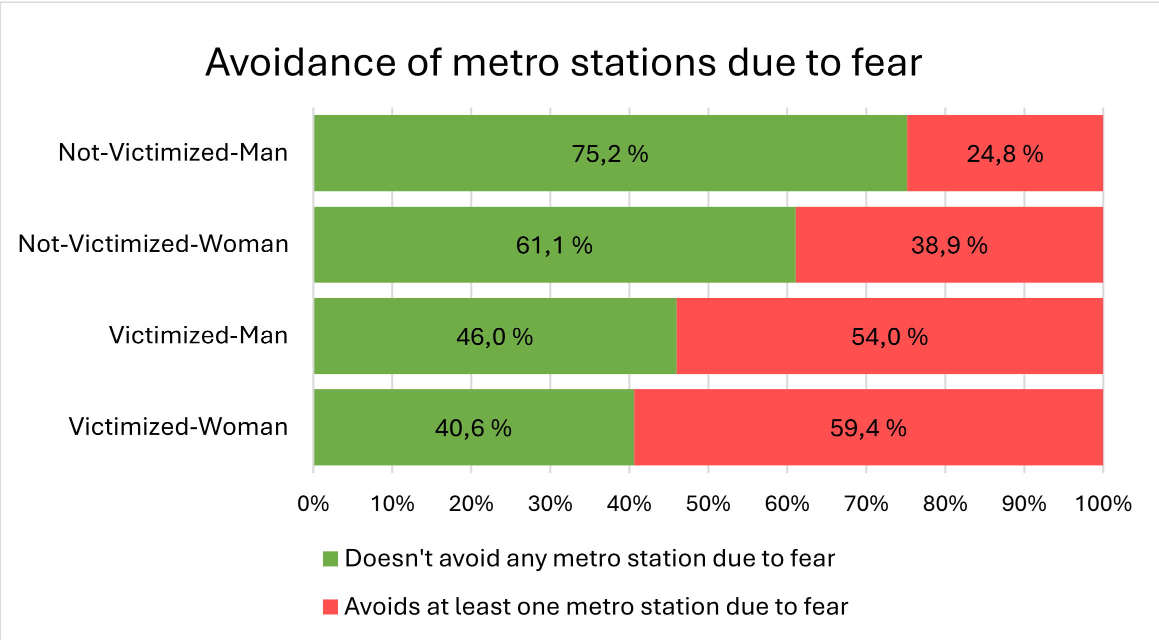

Figure 2.43: Avoidance of metro stations due to safety concerns, by gender and victimization experience (n = 1,020).

Combined Effects of Gender, Victimization, and Place of Residence on Perceived Safety

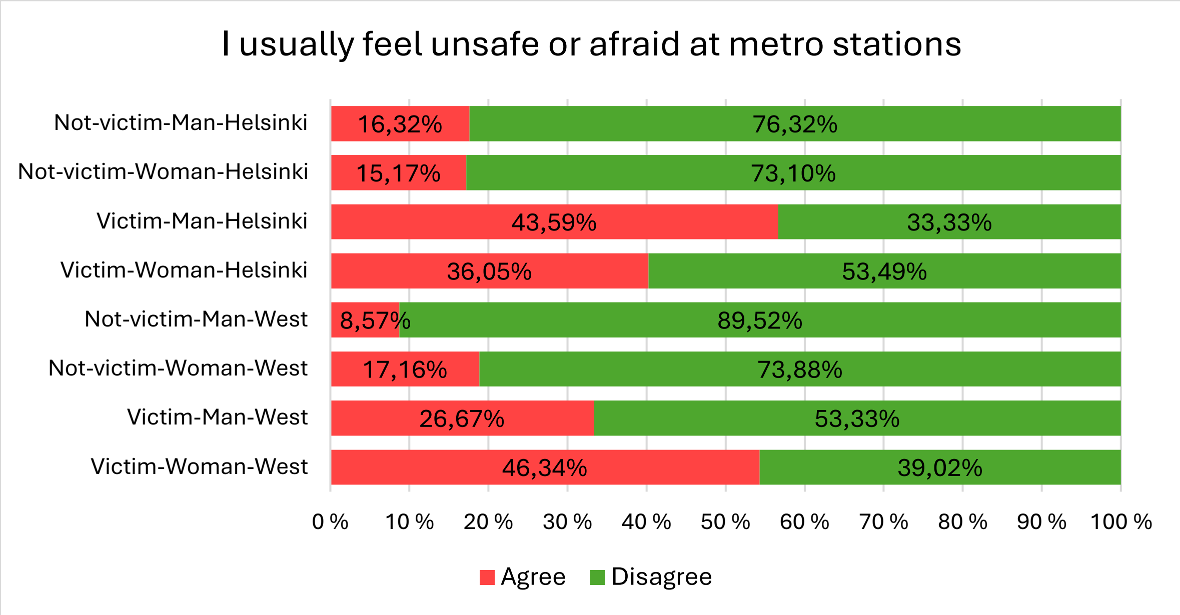

Figure 2.44: Reported feelings of unsafety at metro stations, by gender, victimization history, and place of residence. "Helsinki" refers to respondents who reported living near a metro station located in Helsinki, while "West" refers to those living near a station on the western extension of the metro line (n = 900).

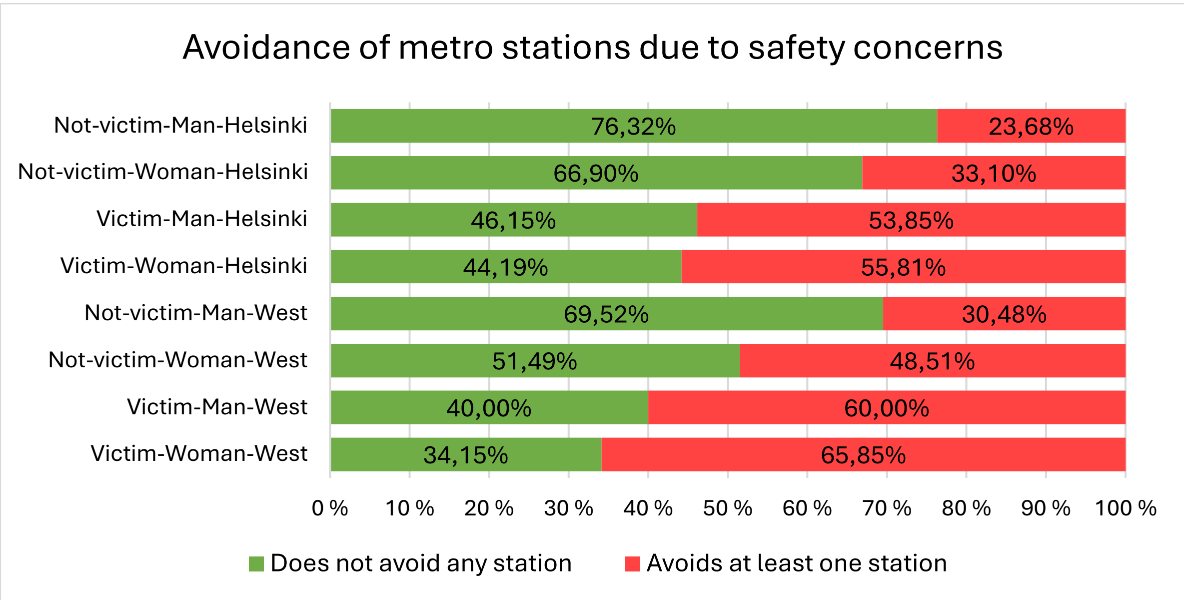

Figure 2.45: Avoidance of metro stations by gender, victimization history, and place of residence. "Helsinki" refers to respondents who reported living near a metro station located in Helsinki, while "West" refers to those living near a station on the western extension of the metro line (n = 900).

Impact of station crowding on perceived safety among victimized and non-victimized respondents

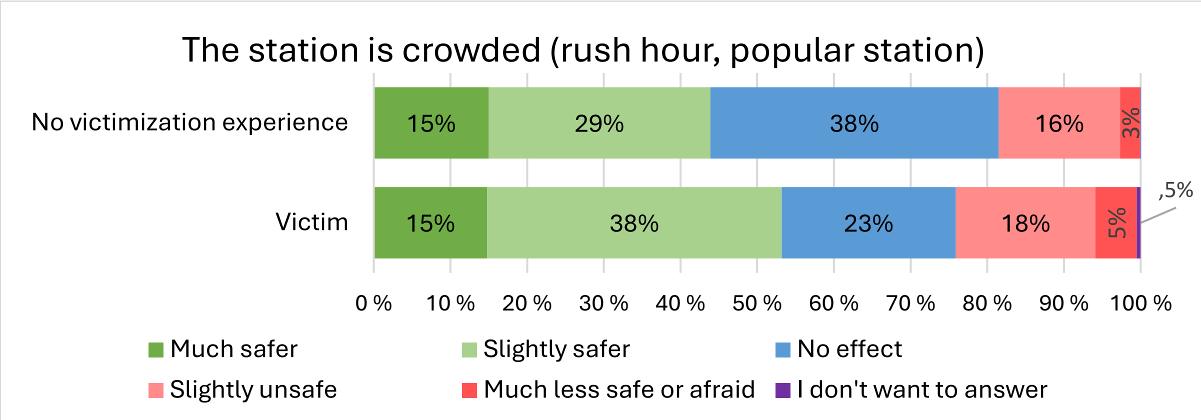

Figure 2.46: Effect of crowding at a metro station on perceived safety among respondents with (n = 203) and without (n = 854) prior victimization experience.

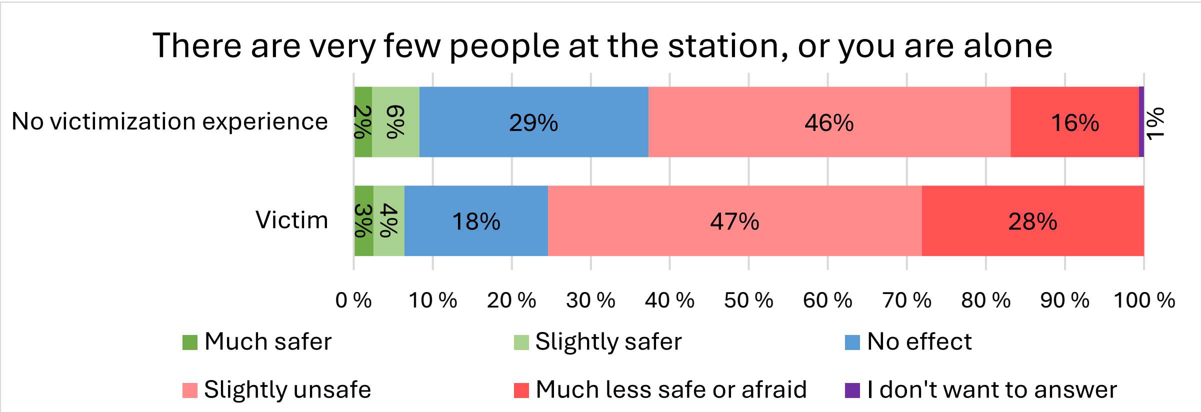

Figure 2.47: Effect of being alone at a metro station on perceived safety among previously victimized (n = 203) and non-victimized (n = 854) respondents.