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Summary

The study compares negative transport outcomes and influencing factors among pedestrians in three African countries (Tanzania, Ghana, Zambia) with three European countries with record of excellence in traffic safety (Norway, Netherlands, Sweden). The study is based on a quantitative survey with about 1900 pedestrian respondents, as well as qualitative interviews and fieldwork. We focus on pedestrians, as vulnerable road users (VRUs) are the largest but most underprivileged road user group in Africa, disproportionately impacted by traffic accidents with fatalities share of 44%. The studied European countries are Safe system pioneers, which involves a pedestrian friendly infrastructure, with a high degree of physical separation between vulnerable road users and cars.

According to a human factors perspective, pedestrian safety is better catered for in a Safe system, as this system aims to tolerate human errors, and prevent exposure to excessive forces (i.e. vehicles). In this study, we examine the consequences of different level of safe system implementation in the studied African and European countries for negative transport outcomes, ranging from accident involvement to life opportunities (e.g. education and work). By negative transport outcomes, we mean involvement in accidents involving vehicles, risk perception, avoidance behaviour and transport poverty (e.g. that limited mobility influences access to life opportunities). Avoidance behaviour means to avoid certain roads and streets, as these are perceived as less traffic safe or less secure. The latter may be due to fear of violence, crime etc.

Results show that there is a significantly higher share of pedestrians in the African countries who answer that "I walk because I have no other choice". There are four times as many who totally agree with the statement in the African sample. The minutes spent walking on a typical day for the African respondents is twice as high as for the Europeans. Additionally, pedestrians in the European countries have twice as large a share of respondents who answer that "I walk for the pleasure of it" (80% of the Europeans agreed).

As expected, African respondents have a less pedestrian friendly infrastructure. We made a sum score index measuring the level of pedestrian friendly infrastructure (e.g. physical separation between pedestrians and cars, separate walkways etc.), and the score of European respondents was significantly higher than that of the African respondents.

A unique contribution of the present study is that we also compare the existence of pedestrian friendly traffic culture. We find that the African respondents have a less pedestrian friendly traffic safety culture. We also find that pedestrians in African countries perceive the traffic volume and vehicle speed to be less pedestrian friendly.

We find that African pedestrians have a higher risk perception and are involved in more collision accidents with vehicles. African respondents had a significantly higher risk perceptions related to the roads where they usually walk: "the roads feel dangerous for walking" (nearly 60% of African respondents agreed) and they fear being hit by vehicles (nearly 80% of African respondents agreed).

If someone is transport poor, it means that a person lacks mobility recourses to access work, education, health, and social networks, e.g. because existing transport opportunities are too expensive, unsafe or inaccessible. There is a significantly higher share of pedestrians in the African countries who answer that "I walk because I have no other choice". In our data, we have seen that this particularly is related to the fact that the prevailing travel conditions are considered dangerous by the African respondents.

We also asked about the consequences of transport poverty, for respondents who agreed that they walk because other alternatives are too expensive, dangerous, or non-existent. The results showed

that over five times more of the African respondents agreed that their education opportunities have been impeded by transport poverty, compared with the European respondents. Additionally, the shares agreeing that too expensive, dangerous or non-existent transport alternatives had reduced their access to job opportunities was over twice as high in the African sample.

Perceived safety also limits the roads where the African pedestrians walk. We refer to this as avoidance behaviour. Our results show that over half of the respondents in the African sample agreed that they avoid walking on many roads/streets in their city, because the traffic do not feel safe. The corresponding share among the European respondents was 13%. This indicates that lower perceived traffic safety confines the mobility of the African respondents to a much higher degree than for the European respondents (about five times more).

Finally, discussing transport poverty and pedestrian safety from a social justice perspective, it is important to note that avoidance behaviour also is an aspect of transport poverty, the same is accident involvement and risk perception. Thus, pedestrian safety is not only important from an environmental and public health perspective, but also from a social justice perspective.

It was hypothesized that a negative transport outcomes experienced by the African pedestrians are related to three important system-related factors: a) a less pedestrian friendly infrastructure, b) a less pedestrian friendly traffic situation (vehicle speed, number of vehicles), and c) a less pedestrian friendly traffic culture. Results from our multivariate regression analyses by and large support this hypothesis. This indicates the importance of the system level factors when comparing the situation of pedestrians across European and African countries. It should also be mentioned that previous research has highlighted other more fundamental system-level factors like insufficient urban planning, less developed public transport system and poorer economy in African countries. This was also indicated in our interviews. Our study indicates that the above mentioned system level factors are related to a lower acknowledgment of walking as a separate mode of transport in the studied African countries. This is also related to the sociocultural position of pedestrians in the studied African and European countries. The survey included the statement: “People who drive a car to their job is respected more than people who walk to their job” The proportion agreeing with this statement was seven times higher among the African respondents than the European respondents (70% vs. 8%). This shows a clearly different social status for pedestrians in the European sample than in the African sample.

We discuss ways to reduce road users’ negative transport outcomes, by focusing on the identified influencing factors. Improving the infrastructure, making it more pedestrian friendly, is likely to reduce negative transport outcomes for pedestrians. Creating a pedestrian friendly traffic might require renewed efforts in land use and urban planning, including the implementation of an organized public transport system (in addition to infrastructure measures). Creating a pedestrian friendly traffic safety culture can be done through improved enforcement in the African countries, combined with information and education to car drivers, to teach them about the situation and needs of pedestrians, aiming to make the car drivers drive more careful and slower around pedestrians, stop for them etc. Improving the Walking is to a greater extent acknowledged as a separate mode of transport in the European countries, both by citizens and stakeholders, along with car driving. This has implications for the construction of pedestrian friendly infrastructure, how car drivers interact with pedestrians, the sociocultural status of walking etc. Relevant measures to improve the sociocultural position of pedestrians in society would be to provide information and education to both stakeholders (politicians, city planners etc.) and citizens stressing that walking is a separate mode of transport, with benefits for health, environment and safety. However, as we have seen, such measures should be combined with infrastructure measures and measures to improve pedestrian safety in the African countries.

1 Introduction

1.1 Background

According to WHO estimates, 1.19 million deaths occur in traffic each year (WHO, 2023). The low- and middle-income countries are the main location of traffic safety problems globally, standing for 93% of traffic fatalities, a share which is completely out of proportion if accounted for their populations and vehicle fleets (Academic Expert Group, 2020). Traffic fatality rate (per population) in Africa is the worst among all world regions. Compared with the EU it is 3 times as much as in Europe and compared with EU-countries 4 times as much. There has been a constant growth in African traffic fatalities and the number is expected to increase by another 68% over the next decade if nothing is done.

To be able to improve the road safety situation in African countries, it is important to analyse the factors related to road users' accident involvement, indicating the most important areas of improvement. The present deliverable therefore provides a case comparison of negative transport outcomes and influencing factors in three African countries (Tanzania, Ghana, Zambia) with three EU countries with record of excellence in traffic safety and practicing Safe Systems principles (Norway, Netherlands, Sweden).

Road users' negative transport outcomes refer to e.g. accident involvement, involvement in near misses, risk perception. Human factors mean several different things. On the one hand, it refers to a perspective for researchers and practitioners, focusing on the utilization of the knowledge about human capabilities and needs in design, implementation, deployment, operation and maintenance of products, systems in order to optimize system functionality as well as human performance (Larson and Tingvall 2013). On the other hand, it also refers to the analysis of human performance, e.g. in the road system, focusing on the factors influencing this performance. Analysing this, Petridou and Moustaki (2000) discern the differences between human factors in the following way:

- 1) Factors that reduce capability on a long-term basis (inexperience, aging, disease and disability, alcoholism, drug abuse),
- 2) Factors that reduce capability on a short-term basis (drowsiness, fatigue, acute alcohol intoxication, short term drug effects, binge eating, acute psychological stress, temporary distraction),
- 3) Factors that promote risk taking behaviour with long-term impact (overestimation of capabilities, macho attitude, habitual speeding, habitual disregard of traffic regulations, indecent driving behaviour, non-use of seat belt or helmet, inappropriate sitting while driving, accident proneness) and
- 4) Factors that promote risk taking behaviour with short-term impact (moderate ethanol intake, psychotropic drugs, motor vehicle crime, suicidal behaviour, compulsive acts).

It is evident that these factors focus on the individual level, and as noted above, the main focus in the human factors approach is that human performance occurs within systems, and that these systems must be designed to compensate for human limitations, in order to maximize system performance. Reason (2000) refers to these two positions as the person approach and system approach to accident causation and prevention.

The person approach has been the prevalent view on accident causation and prevention in the road sector for a very long time (Larsson and Tingvall 2013). This approach attributes road accidents to unsafe behaviours, and focuses on education, information and enforcement, to foster safe behaviours. The system approach on the other hand, gives rise to prevention strategies focusing on building "error tolerant" systems.

In Norway, Sweden and the Netherlands, the system approach was introduced in the road systems around 2000, when Vision Zero and Sustainable safety were introduced. These are examples of the Safe system approach, which means to establish road safety management systems aiming to reduce road fatalities and serious injuries through a road system design that accommodates human errors and injury tolerances.

We compare negative transport outcomes and influencing factors among pedestrians in the six countries. We focus on pedestrians, as vulnerable road users (VRUs) are the largest but most underprivileged road user group in Africa, disproportionately impacted by traffic accidents with fatalities share of 44% (WHO, 2018). The different levels of Safe system implementation in the studied European and African countries are likely to influence the negative transport outcomes of the pedestrians in the African countries. The studied European countries are Safe system pioneers, which involves a pedestrian friendly infrastructure, with a high degree of physical separation between vulnerable road users and cars. Previous studies indicate that high traffic volumes, insufficient pedestrian road infrastructure and lacking respect shown by drivers to pedestrians contribute to high risk perception among pedestrians in LMIC (Aceves-Gonzalez et al 2020).

According to a human factors perspective, pedestrian safety is better catered for in a Safe system, as this system aims to tolerate human errors, and prevent exposure to excessive forces (i.e. vehicles). In this study, we examine the consequences of different level of safe system implementation in the studied African and European countries for negative transport outcomes, ranging from accident involvement to life opportunities (e.g. education and work).

1.2 Aims

The aims of the present study are to:

- 1) Compare respondents in the African and European countries' reliance on walking as a mode of transport, including why they walk.
- 2) Compare respondents in the African and European countries' perceptions of their walking infrastructure, traffic and traffic safety culture.
- 3) Compare negative transport outcomes (accident involvement, risk perception, avoidance behaviour, transport poverty) among pedestrians in the African and European countries.
- 4) Examine factors influencing negative transport outcomes, focusing on person-related and system-related factors.
- 5) Discuss ways to reduce road users' negative transport outcomes, by focusing on the identified influencing factors.

By negative transport outcomes, we mean involvement in accidents involving vehicles, risk perception, avoidance behaviour, transport poverty. Avoidance behaviour means to avoid certain roads and streets, as these are perceived as less traffic safe or less secure. The latter may be due to fear of violence, crime etc. We assume that the negative transport outcomes are different among respondents in the two continents, given different levels of Safe system implementation. Based on this, we also study how this fear of accidents (including reduced mobility options) has had negative impacts for respondents' lives in different ways, e.g. by limiting opportunities for jobs, education and food. The latter is referred to as transport poverty (Lucas et al 2016).

By comparing these six countries, we can discuss the importance of influencing factors that are similar in the African and the European contexts, e.g. related to different levels of Safe System implementation (e.g. education, infrastructure and enforcement).

1.3 The AfroSAFE project

The present study is part of the EU-funded AfroSAFE project (Grant agreement ID: 101069500). The primary objective of the AfroSAFE project is to make a significant progress in propagation of the

Safe System modus operandi within the road safety work context in African countries. This is reached by exposing the local practitioners and decision makers to the state-of-the-art knowledge and practices within road safety management based on Safe System principles, as well as supporting them by sharing necessary knowledge, tools and methods for road safety improvement—adjusted to the African conditions and in tight cooperation with the local actors. The present deliverable is part of Work Package (WP5) in the AfroSAFE project, and the objectives of WP5 are to:

- Review current procedures, practices and methodologies of national road safety work concerning road users in the African participating countries and compare to EU countries, which have applied a Safe System approach to road safety.
- Map Road Safety Culture (RSC) in the African participating countries and benchmark it against selected European countries (e.g., Sweden, Norway) which have applied the Safe System approach.
- Carry out relevant pilot studies to introduce the mind-set of the Safe System approach, focusing on vulnerable road users, enforcement, transport companies and driver education

2 Theoretical approach previous research

2.1 Conceptual background

2.1.1 System approach versus person approach

There is a long-standing debate between safety researchers who point to risky behaviours to explain accidents, and researchers who hold that risky behaviours to a great extent are influenced by contextual factors. Reason (2000) refers to these two diverging positions as the person approach and the system approach, stating that each has its model of error causation and that each model gives rise to quite different philosophies of error management.

According to the person approach, unsafe acts are primarily the result of inadequate mental processes such as forgetfulness, inattention, poor motivation, carelessness, negligence, and recklessness (Reason, 2000). Accordingly, the counter measures that this view gives rise to aim to reduce unwanted variability in human behaviour. Such measures could be poster campaigns with information, procedures governing behaviour, disciplining measures and so forth. According to Reason (2000), this approach tends to view human error as a moral issue.

The systems approach on the other hand, is based on the premise that it is human to err and that human errors are expected. The system approach views errors as consequences, rather than causes, and human errors are explained in light of systemic causes rather than a fallible human nature. As a consequence, the systems approach gives rise to prevention strategies focusing on building “error tolerant” systems. This is done by introducing system defences involving barriers at many different levels, e.g. technological, organisational, cultural. Larsson and Tingvall (2013) note that the person view has been the prevalent view on accident causation and prevention in the road sector for a very long time.. The person view has, however, gained competition in recent years, with the introduction of Vision Zero and the Safe Systems approach. The safe system approach involves a recognition that prevention strategies must be based on human factors principles and system theories.

It is important to note that the person approach versus the system approach provides a simplification of the situation in the real world. Safe system countries accommodates both approaches. Strategies focusing on the person approach (education, information, enforcement) are included under the Safe system pillar “Safe road user”, while strategies focusing on the system approach are to a great extent included under the Safe system pillar “Safe infrastructure”. Both strategies are important in the Safe system approach, as well as strategies focusing on Safe vehicles, Safe speeds, Road safety management and post crash care These strategies, as well as Safe road users and Safe infrastructure are the six pillars in the Safe system approach.

2.1.2 The human factors perspective

Larsson and Tingvall (2013) states that, going through the literature it is hard to find a clear, simple and commonly agreed definition of the human factors concept. According to the Swedish Human Factors Network (HFN) human factors is:

“the scientific discipline that investigates and produces knowledge concerning human physical, cognitive and psychological prerequisites in relation to the character of the task, technical requirements with respect to design, complexity, and organizational premises regarding resource allocation, organizational culture, methods, competence and leadership as well as following up and evaluating systems. The utilization of the knowledge about human capabilities and needs in design, implementation, deployment, operation and maintenance of products, systems (of humans, machines and organizations) in order to optimize system functionality as well as human wellbeing, health and safety.” (Larsson and Tingvall 2013: 20).

Larson and Tingvall (2013) write that the aim of a human factors approach is hence to create optimal system conditions for the human being to be able to act as safely as possible in such a system by eradicating or reducing human error. They further write that the following principles can be deduced from this definition. The first is that the human factors discipline acknowledge that the demands of complex sociotechnical systems often are too much to handle for humans physically, cognitively or psychologically. For that reason, there is a need to adapt the properties of sociotechnical systems to human capabilities. The second principle is that human error is no longer seen as the primary cause of accidents, but as a consequence of latent failures in the broader organizational, social or political system (Larson and Tingvall 2013).

The focus of the human factors perspective is the interplay between the individual and the system. For several years the human factors perspective and its principles on accident prevention was restricted to occupational safety. However, in the late 1990s, these principles informed a radically new way of thinking about road safety management in Sweden and the Netherlands. In these countries, Vision Zero and Sustainable safety were developed and implemented. Norway also adopted Vision Zero in 2001, following its conceptualization and implementation in Sweden.

2.1.3 The Safe Systems approach

Since human errors and mistakes cannot fully be eradicated, the infrastructure components and vehicles of the road transport system must be designed to mitigate the consequences of common human errors and mistakes. These insights emerged with the Safe System approach, which was introduced in the 1990s in Sweden and the Netherlands as a response to a slow-down in traffic fatalities and injuries reduction and realisation that ‘doing more of the same’ will not bring the ultimate solution to the road safety problem (Green et al 2022). By now, Safe System has become the state-of-the-art in road safety management, and it is recommended to countries worldwide (WHO & UN 2021; ITF 2022).

The novelty of the Safe System is the ethical standpoint that road fatalities cannot be accepted, i.e. there is no ‘optimisation problem’ to solve and we must improve road safety until no one is killed or severely injured. Hence Vision Zero, which is another name for Safe System adopted in Norway and Sweden (referring to the systematic management approach to fulfil Vision Zero). The goal of Vision Zero may look unrealistic at the first sight, yet Safe System makes it achievable by clearly limiting the scope of the problem. While minor accidents are likely to continue to happen, all efforts and resources must be focused on prevention of the most severe ones with people injured and killed.

In practical terms, Safe System has its grounds in four fundamental principles (ITF, 2016; Green et al 2022):

- 1) It is human to make mistakes; the traffic system must be designed to tolerate (unintended) errors made by the road users
- 2) The traffic system must be designed so that the external forces in accidents do not exceed the human bodies’ tolerance for biomechanical impacts
- 3) The responsibility for traffic safety must be shared by those who design, build, manage, and use roads and vehicles, as well as the providers of the post-crash care and emergency response
- 4) All system components must be strengthened to multiply the protection effect; if one component fails, road users should still be protected.

The Safe System approach involves a cultural change (“paradigm shift”) in the sense that the “blame the victim” culture is superseded by “blaming the traffic system”, which throws the spotlight on authorities’ accountability (Green 2022). The Safe System approach is generally summed up in six pillars, describing how road safety work should be organized (WHO & UN, 2021; ITF 2022):

- i) Road safety management:* Multi-sectoral partnerships and lead agencies to develop and lead national road safety strategies, plans and targets; research-based monitoring of implementation and effectiveness.
- ii) Safe infrastructure:* Inherently safe and protective road networks, especially for the most vulnerable (e.g. pedestrians, bicyclists and motorcyclists) road users.
- iii) Safe vehicles:* Standards, consumer information and incentives to accelerate the uptake of active and passive vehicle safety technologies.
- iv) Safe speed:* Speeds within the boundaries of biomechanical tolerance.
- v) Safe road users:* Enforcement and supplementary measures (e.g. public awareness/education) targeting high-risk behaviours.
- vi) Post-crash response:* Appropriate emergency response, treatment and rehabilitation for crash victims.

The UN General Assembly has proclaimed the period 2021–2030 as the (second) Decade of Action for Road Safety and established a target of reducing the number of road traffic deaths and injuries by at least 50% by 2030. The Safe System approach forms the basis for UN’s new Global Plan for the Decade of Action on Road Safety 2021–2030. The Safe System approach has become the state-of-the-art in road safety management, and it is recommended to countries worldwide (ITF, 2022).

2.2 Previous research

2.2.1 Road user accident involvement across national contexts

In the present study, we study road safety in three European countries (Norway, Sweden, Netherlands) which have had the best safety records in the world for several years, with three African countries (Ghana, Tanzania, Zambia), with poorer road safety records. Comparing numbers of road fatalities per million capita in 2021, as estimated by the WHO (2024) the numbers in Norway, Sweden and the Netherlands were 15, 21 and 34 killed per million inhabitants, while the numbers in Ghana, Zambia and Tanzania are 259, 171 and 158 killed per million inhabitants.¹ Thus, the fatal road accident rate per capita is on average 8.4 times higher in the three African countries than in the three European countries. Africa has the poorest road safety records among the continents in the world even if it has the lowest level of motorization.

WHO (2016) report that most of the countries providing road accident statistics were unable to provide detailed data on road deaths broken down by road user type. For example, this means that the number of motorcycle deaths is underreported. However, The United Nations Economic Commission for Africa (UNECA) (2023) writes that 38% of all African road traffic fatalities occur among pedestrians while 43% occur among car occupants. UNECA also underlines that these average figures mask the wide variation among countries on the continent with many of them recording a higher share of pedestrian deaths as a percentage of total deaths, and that a significant proportion of road fatalities on the continent occur in urban areas.

2.2.2 Factors influencing road users’ accident involvement

2.2.2.1 Person-level factors

Pedestrian behaviour. There are several studies of pedestrian behaviour across countries using pedestrian behaviour (PBQ) scales (e.g. McIlroy et al 2020). McIlroy et al (2020) aim to validate the

¹ The numbers are based on estimates from WHO (2024). The estimates from WHO are different from the official numbers of fatal accidents reported by national authorities, especially in the African countries. In Tanzania, the WHO estimated number of road fatalities is seven times higher than the official number reported by national authorities.

short version of a Pedestrian Behaviour Questionnaire across six culturally and economically distinct countries; Bangladesh, China, Kenya, Thailand, the UK, and Vietnam. The questionnaire comprised 20 items that asked respondents to rate the extent to which they perform certain types of pedestrian behaviours, with each behaviour belonging to one of five categories identified in previous literature; violations, errors, lapses, aggressive behaviours, and positive behaviours. The sample consisted of 3423 respondents across the six countries. After analyses, only the violations, lapses, and aggressions sub-scales were retained (those with acceptable reliability and factor loadings). Analyses suggest that a three-factor model with 12 items showed the best fit to the data.

McIlroy et al (2020) examined the relationship between pedestrian behaviours and pedestrian accident involvement and found that pedestrians that had never been involved in an accident scored significantly lower on ‘Aggressions’ than those that had been involved in one ($p < .001$) or more than one ($p < .001$). It was also found that those that had never been involved in an accident scored significantly lower on ‘Lapses’ than those that had been involved in one accident ($p = .008$). The items measuring aggressive behaviours in the PBQ were: “I get angry with another road user (pedestrian, driver, cyclist, etc.), and I yell at them”, “I cross very slowly to annoy a driver”, “I get angry with another road user (pedestrian, driver, cyclist, etc.), and I make a hand gesture”, “I have gotten angry with a driver and hit their vehicle”. Comparing results for aggressions, respondents in both Vietnam and Thailand scored significantly lower than all other countries, and respondents in the UK, China, Kenya, and Bangladesh also did not differ significantly from each other. Useche and Llamazares (2022) underline that pedestrian aggression occur within an interaction process with other road users (e.g. car drivers), and that pedestrians’ violations may influence the behaviours of other road users in negative ways. This might lead to mutual aggressive interaction.

Demographic factors. Sex. Males are overrepresented in pedestrian fatalities. Zhu et al (2013) examine the factors that contribute to this male-female discrepancy: walking exposure (kilometres walked per person-year), vehicle-pedestrian, collision risk (number of collisions per kilometres walked), and vehicle-pedestrian collision case fatality rate (number of deaths per collision). They find that the pedestrian death rate per person-year for males was 2.3 times that for females. This ratio of male to female rates can be expressed as the product of three component ratios: 0.995 for walking exposure, 1.191 for collision risk, and 1.976 for case fatality rate. The relative contributions of these components were 1%, 20% and 79%, respectively.

Age. Chakravarthy et al (2007) state that children and older adults are most vulnerable to being struck by a motor vehicle. Moreover, compared to younger patients, older adults experience longer hospitalization, more complications and higher mortality rates (Chakravarthy et al 2007).

Socio economic status. Pedestrian injuries affect all people, but they have a greater negative impact on those of lower socioeconomic standing (Chakravarthy et al (2007). Commonly used proxies for low socioeconomic status are e.g. being economically disadvantaged, having limited education and low social support.

2.2.2.2 System-level factors

There are several system-level factors that might explain a higher level of pedestrian fatalities in the studied African countries than in the studied European countries. The first is related to **transport mode**: there is a high reliance on walking as a primary means of mobility in African countries (Bantjes et al 2024). Tulu et al (2013) Damsere-Derry, et al. (2010: 1087) write that in some places, where unemployment rates are high, people may spend most of their time near the road environment, including standing on roads to seek a temporary job, or just spending their time by walking along the roads. These factors increase pedestrians’ exposure to vehicle traffic and subsequently road accidents.

The second factor is related to a **lack of pedestrian friendly road infrastructure**. Tulu et al (2013) mention that the International Road Assessment Programme (iRAP) pointed out that 84% of roads with pedestrians in developing countries lack sidewalks (WHO 2013: 33). Therefore, pedestrians often tend to walk along roads, due to the absence of footpaths or shoulders. Tulu et al (2013) asserts that, due to financial constraints, most developing countries’ road networks in built-up areas are

constructed without the provision of sidewalks. An important road infrastructure challenge in LMIC countries is the lack of physical separation between vulnerable road users and motorised traffic. This direct exposure to high-speed vehicle traffic in developing countries leads to a considerably larger accident risk for pedestrians compared with pedestrians in Western European countries, which often have separated facilities for vehicles and pedestrians (Tulu et al 2013).

Pedestrians are vulnerable to mortality and morbidity because they are directly exposed to traffic with little to protect them in the event of a collision. The World Health Organization (WHO) estimates that, globally, 88% of pedestrians traverse unsafe roads, which contributes directly to pedestrian injury and death. Tulu et al (2013) cite an in-depth study in a developed country, which shows that non-existing sidewalks, high volumes of motorised traffic, higher speeds, and unsealed shoulders can increase the probability of pedestrian crashes when walking along roads (McMahon, et al. 2001). Tulu et al (2013), also states that lack of sidewalks can increase the risk of crashes twofold compared to roads that have footpaths.

Damsere-Derry, et al. (2010: 1087) asserts that even when sidewalks are present, they may be occupied by roadside vendors and hawkers, or pedestrian facilities may be constructed without adequately accommodating the volume of pedestrians, or the surface is uneven or of poor quality, in ways that discourage walking. These factors may lead to pedestrians walking along the road. In poor residential neighbourhoods, areas with high unemployment, and near markets, pedestrian volumes may be extremely high, driving pedestrians to walk along the roadways.

The third factor is related to **national road safety culture**. Several studies of vehicle pedestrian collisions find that the risk of pedestrian accidents increase with increasing car driver violations, as well as pedestrian violations. For example, Chakravarthy et al (2007) note that in 18% of fatal pedestrian collisions, the car drivers had consumed alcohol. Additionally, drivers' non-compliance with speed limits is another risk factor. Operationalizing national RSC partly as descriptive norms, Nævestad et al (2024) measure RSC as the level of road safety violations (e.g. aggressive violations, drink driving, lacking seat belt use) that road users expect from other drivers in their country. Descriptive norms may influence behaviour by providing information about what is normal behaviour in traffic in our country, thereby creating a "mild social pressure" to do as the others do (Cialdini et al 1990; Nævestad et al 2019). However, the expected level of driver's road safety violations may also indicate the level of car driver violations in a country, influencing the risk of pedestrian accidents. Moreover, pedestrians' road safety violations are also likely to exist in a relationship to car driver violations. This applies e.g. to the aggressive violations of car drivers and pedestrians. These are likely to influence each other, the same is other types of behaviour, e.g. pedestrians' dangerous crossing behaviour, car drivers' speeding or lacking respect for pedestrians who wants to cross the road (e.g. not stopping at zebra crossings) (cf. Useche and Llamazares 2022).

2.3 Pedestrian risk awareness

Pedestrian risk awareness is also an important study topic. Kummeneje and Rundmo (2019) study the association between pedestrians' risk perception and worry, and how worry influence pedestrians' behaviour, based on a questionnaire survey carried out among a representative sample (n = 2000) of the Norwegian population. Structural equation modelling (SEM) revealed that risk perception was a significant predictor variable for worry during both night-time and daytime. Additionally, worry was found to influence pedestrian behaviour, i.e. worry was moderately associated with walking frequency during night-time, and how often individuals walked alone outdoors during night-time. Previous studies indicate that high traffic volumes, insufficient pedestrian road infrastructure and lacking respect shown by drivers to pedestrians contribute to high risk perception among pedestrians in LMIC (Aceves-Gonzalez et al 2020). Thus, we might expect that the different levels of Safe system implementation (what we have referred to above as system-level factors) influence the risk perception of vulnerable road users in northern European countries and in African countries. The studied

European countries are Safe system pioneers, which involves a pedestrian friendly infrastructure, with a high degree of physical separation between vulnerable road users and cars.

2.4 Pedestrian safety in a social justice perspective

Beside from being a significant public health issue, improving the safety of pedestrians is also a social justice issue (Bantjes et al 2024). As noted by Chakravarthy et al (2007), pedestrian injuries affect all people, but they have a greater negative impact on those of lower socio-economic standing. Moreover, promoting pedestrian safety is also essential from an environmental perspective, as campaigns to slowing climate change by encouraging walking will be feasible only if the road infrastructure is pedestrian friendly.

We might also understand pedestrian safety in a social justice perspective through the concept of transport poverty. Lucas et al (2016) that the poorest groups in any given country tend to be less mobile, suffering from a lack of both private and public transport services. Therefore, they need to rely on walking and cycling, often over long distances and in unsafe conditions. For these reasons, they are more exposed to road accidents and pollution, which has negative consequences for their health and well-being. This situation is often worse in developing countries, as the road systems in these countries offer fewer opportunities for the low-income, non-car-owning citizens of the population who need to rely on walking as a mode of transport. On the other hand, the road systems in these countries are generally car friendly, catering for the preferences of middle- and higher-class populations (Lucas et al 2016).

Lucas et al (2016) states that neither the academic nor policy literatures have defined what precisely constitutes transport poverty. However, according to Lucas et al (2016) an individual is transport poor if, in order to satisfy their daily basic activity needs, at least one of the following conditions apply:

- 1) There is no transport option available that is suited to the individual's physical condition and capabilities,
- 2) The existing transport options do not reach destinations where the individual can fulfil his/her daily activity needs, in order to maintain a reasonable quality of life.,
- 3) The necessary weekly amount spent on transport leaves the household with a residual income below the official poverty line.,
- 4) The individual needs to spend an excessive amount of time travelling, leading to time poverty or social isolation.
- 5) The prevailing travel conditions are dangerous, unsafe or unhealthy for the individual.

2.5 Hypotheses

A higher level of negative transport outcomes in the African countries is expected, which can be related to lower levels of Safe system implementation, less developed public transport system, poorer economy and lower levels of urban planning. Comparing the situation of pedestrians in European versus African countries, we have the following hypotheses:

- 1) That pedestrians in the African countries are more reliant on walking as a mode of transport, i.e. that they more often walk because "they have to", compared with pedestrians in the European countries.
- 2) That pedestrians in African countries perceive their road infrastructure to be less pedestrian friendly, compared with pedestrians in the European countries.
- 3) That pedestrians in African countries perceive the traffic and the culture to be less pedestrian friendly, compared with pedestrians in the European countries.

- 4) That pedestrians in African countries are more afraid of being involved in traffic accidents with vehicles compared with the European countries.
- 5) That respondents in the African countries are involved in a higher level of pedestrian accidents involving a vehicle.
- 6) That the hypothesized more negative transport outcomes experienced by the African respondents are related to a) a less pedestrian friendly infrastructure, b) a less pedestrian friendly traffic situation (vehicle speed, number of vehicles), and c) a less pedestrian friendly traffic culture.

3 Methods

Several methods and approaches were used. **First**, European researchers have conducted field works in the African countries, while African researchers have conducted field works in the European countries. **Second**, individual interviews and focus group interviews have been conducted with road users and stakeholders in the African countries. **Third**, literature has been reviewed, describing the road safety behaviours, attitudes, beliefs etc. in African countries, in addition to literature about road safety and road safety policies in African countries in general. **Fourth**, this served as a backdrop for developing a large-scale survey.

3.1 Fieldwork

The main author visited Zambia in 2022, and Tanzania in 2023 and 2024 and Ghana in 2023. He stayed for 6-7 days each time and spent a lot of time in traffic as passenger in cars and as pedestrian. Provisional field work notes were made (as well as photographs and videos), focusing on e.g. the: 1) composition of road users, 2) interaction between road users (e.g. the level of cooperation or conflict), 3) the quality of road and road infrastructure, 4) facilitation of the road system for vulnerable road users and 5) car drivers respect for and consideration of vulnerable road users and motorcyclists, 6) general risk taking behaviours (e.g. speeding, seat belt use, helmet use) and 7) the situation of children in traffic. The focus on the field notes were on comparing the situation in the African countries with the situation in the European countries (i.e. Norway, Sweden, Netherlands). A second Norwegian researcher has also been to Ghana and Tanzania to observe and discuss results from the fieldwork. The purpose of the fieldwork was that the Norwegian authors should experience traffic in Ghana, to get a deeper understanding of the background of the data in the survey. . In addition, African researchers have been to Norway and Sweden, using the same field work note scheme as the Norwegian researchers used in the African countries.

3.2 Interviews and focus groups

Individual interviews and focus group interviews with 46 stakeholders were conducted in three African countries: Ghana, Tanzania and Zambia. The main purpose of the interviews and focus groups was to get information about and discuss the relevance of items measuring road safety violations and items measuring road safety culture, including to get insights into the most relevant road safety challenges and behaviours, beliefs and norms that might be important in these contexts. Other issues that were discussed were factors influencing road safety culture, e.g. road user interaction, enforcement, the composition of road users (e.g. vulnerable road users, motorcyclist), economy, urban planning. We had a relatively open interview guide, which includes questions about the most important types of accidents, typical scenarios involved in these accidents (e.g. who, where and when), typical risky road user behaviours in different settings, relevant road safety measures to address the most prevalent accident types and road safety challenges. In addition to asking about this, we also showed lists of relevant items that we planned to use to measure road safety violations and national RSC to compare this across European and African countries. We asked about the relevance of the items, and whether interviewees had suggestions to more items to be added, based on their views on risky road user behaviours that are prevalent in their (African) country.

The focus group interviews were conducted as part of focus group interviews about road safety management in the three African countries. Interviews were conducted digitally via Microsoft Teams between November 2022 and April 2023, with interview durations ranging from 40 minutes to 2,5 hours (for group interviews). We employed a strategic sampling method, where the interviewees were selected based on criteria relevant to the research questions. We focused on assembling a sample that represented various roles in traffic safety work, including e.g. people working in authorities, NGOs and people working as researchers. We conducted thematic analyses of the interviews, systematically recurring themes in the interviewees' descriptions of specific topics. (Braun & Clarke, 2006).

3.3 Quantitative survey

3.3.1 Recruitment of respondents

The survey data was mainly collected during the first half of 2024. The aim of the survey was to include a representative sample of pedestrians in the capitals/largest cities of the participating countries. Capitals were chosen in all the participating countries, except Tanzania, where we choose the largest city (Dar es Salaam), which was the capital until 1996. The survey data in the three African countries was collected through personal interviews in Lusaka, Accra and Dar es Salaam. Accessing respondents through web surveys was not feasible in these countries, as only a few people have e-mails and internet access, presumably people in favourable economic positions and/or high levels of education. To obtain representative samples of pedestrians, teams of interviewers therefore went out in traffic to recruit respondents to participate in personal survey interviews. In some cases, respondents who were in a hurry were given the link to the survey, so they could answer the survey in their home. To maintain representativity, interviewers ensured to recruit respondents in different areas of the cities and at different times. We assumed that this would avoid recruiting only particular segments of road users. The Norwegian respondents were recruited from a representative sample of respondents from the Oslo, who have agreed to participate in surveys from the Institute of Transport Economics. The Swedish and Dutch respondents were recruited from representative samples of respondents from Stockholm and Amsterdam, using representative panels of respondents from the company Norstat. Norstat is a leading European data collector for market research, which offer access to over 4 million respondents across 19 countries. Surveys were collected using the official languages in all countries, e.g. English in Ghana and Zambia, Swahili in Tanzania, Dutch, Swedish and Norwegian. Professional translators were used, and translations were tested and validated by native speakers, who are traffic researchers. In an attempt to increase response rates, Norwegian respondents were informed that they could, if they wanted, participate in a draw for a present card of 3000 NOK (260 Euro). The Norstat respondents in Sweden and Netherlands are part of a panel which means that they get points for participating in surveys.

Respondents in the survey were filtered in two steps. First, the present study only includes results for respondents who are of the same nationality as their country. The reason is that we focus on questions related to national road safety culture. Previous studies have indicated that respondents who are immigrants in their country might rate different factors higher than domestic respondents, e.g. due to deference to authority and their immigrant status (Guldenmund et al 2013). Results for the immigrant respondents will be presented in other publications, also including these. Second, we have filtered out 353 respondents who answered the survey in a shorter time than 2,5 minutes. The speed of respondents' survey response time is an established measure of survey response quality (Huang et al 2012; Zhang and Conrad 2014). There are no established threshold limits for excluding too fast respondents, but one criterion is that speeding involves answering the survey faster than it is possible to read the questions (e.g. 300 milliseconds per word) (Zhang and Conrad 2014). We assess that reading all the 50 questions in the survey fast takes about three minutes. Thus, our threshold value is somewhat below that. The reason is that survey speeding does not apply to all sections in surveys. It should ideally be measured for several sections within surveys. We have not had the possibility to do that. With a threshold time criterion of 2,5 minutes for survey responses, we acknowledge that speeding does not necessarily apply to all questions in the survey.

3.3.2 Survey Themes

Sum score indexes: Several sum score indexes, based on the questions in the surveys were constructed. When making these sum score indexes, we considered the following: First, we assessed the importance and relationship between questions based on previous research, indicating that the questions measure the same underlying phenomenon. Second, we conducted exploratory factor

analyses based on the data from all the countries taken together, examining whether questions load on the same factor, or different factors. Third, we conducted analyses of internal consistency, including Cronbach Alpha estimate with: “scale if item deleted” analyses, to identify questions that seem less important, and if removed would increase the internal consistence of the sum score index.

Demographic variables. All respondents were asked questions about age, gender, nationality and education.

How often, where and why the pedestrians walk. We asked pedestrians how often they walk to reach destinations, e.g. from home to work, from home to the shop, from home to the bus etc., using walking as a means of transport. Answer alternatives were: 1) Several times each day, 2) Every day, 3) 5-6 days a week, 4) 3-4 days a week, 5) 1-2 days a week, 6) A few days each month, 7) Less frequently than a few days each month, 8) I never walk to any destinations. Respondents who answered the latter were filtered out of the survey. We also asked What is the total duration of your walks on a typical day where you walk to reach destinations (e.g. work, shop, bus)? (minutes approximately for the whole day). We also asked the type of roads where they usually walk. Additionally, respondents were also asked to answer the following questions:

- Walking is one of my main means of transportation
- I walk because I have no other choice
- I walk for the pleasure of it
- Public transport is one of my main means of transportation
- Private car is one of my main means of transportation

Answers ranged from 1 (totally disagree) to 5 (totally agree).

Pedestrian road violations. The survey includes four questions about aggressive pedestrian behaviours: “For every ten trips you walk on streets/roads, approximately how often do you behave like this?:

- I get angry with another road user (pedestrian, driver etc.), and I yell at them
- I get angry with another road user (pedestrian, driver etc.), and I make a hand gesture
- I get angry with a driver and hit their vehicle
- I cross very slowly to annoy a driver

The four questions were combined into a sum score index (Cronbach’s Alpha: .720). PBQ items are based on McIlroy et al (2020).

The answer alternatives on the pedestrian road violations are absolute alternatives (e.g. Question: “For every ten trips, how often do you ...?”, Alternative answers: 1) “Never”, 2) “Once or twice”, 3) “Three or four times”, 4) “Five or six times”, 5) “Seven or eight times”, 6) “More than eight times but not always”, 7) “Always”). Answer alternatives were changed from the relative answer alternatives e.g. in the DBQ, as previous research indicates that different demographic groups tend to interpret questions and formulations differently (i.e. what does “often” mean?) (Bjørnskau and Sagberg 2005). Given that e.g. “often” and “very often” may have different meanings among respondents across countries and parts of the world, we use absolute answer alternatives on these questions.

National RSC measured as descriptive norms. We measure national RSC as descriptive norms (Cialdini et al 1990), reflecting drivers’ perceptions of what other drivers in our country do. The survey includes 5 questions on expectations to other car drivers in your country. The questions were introduced like this: “When walking on roads in my country, I expect the following behaviour from car drivers:”

- That they become angered by a certain type of driver and indicate their hostility by whatever means they can
- That they sound their horn to indicate their annoyance to another road user

- That they overtake a slow driver on the inappropriate side
- That they drive when they suspect they might be over the legal blood alcohol limit
- That they drive without using a seatbelt

Questions were combined into a sum score index (Cronbach's Alpha: .798). Five answer alternatives ranged between 1 (none-very few) and 5 (almost all/all).

Perception of pedestrian friendly infrastructure. The survey includes five questions measuring the degree of pedestrian friendly infrastructure:

Please answer with regard to the streets/roads that you usually walk. These streets/roads:

- ...have sidewalks dedicated for pedestrians
- ...have walkways that are well separated from vehicles and motorcycles
- ...have crosswalks where I can safely cross the road
- ...have streetlights that sufficiently light up the road/street when it is dark
-are very challenging to use as a pedestrian because of obstacles in the road side

The first four questions were combined into a sum score index (Cronbach's Alpha: .838).

The survey includes two questions measuring the perception of traffic volume and speed on the roads where the pedestrians in the study usually walk:

- The speed of vehicles/motorbikes is too high
- The speed and amount of traffic creates a sense of danger for pedestrians¹

Questions were combined into a sum score index (Cronbach's Alpha: .778).

Sociocultural position of pedestrians. The survey includes two questions measuring the sociocultural position of pedestrians:

- People who drive a car to their job is respected more than people who walk to their job
- The road system in my country is made for cars and not for pedestrians

Pedestrian risk perception. The survey includes three questions measuring pedestrians' perception of risk related to walking:

- The streets/roads that I normally use feel dangerous for walking
- I generally fear being hit by a vehicle while walking on the streets/roads that I normally use
- I generally fear being hit by a bicycle, or other two-wheelers while walking on the streets/roads that I normally use

The two first questions measuring pedestrian risk perception were combined into a sum score index (Cronbach's Alpha: .816).

The survey includes two questions about avoidance behaviour among pedestrians:

- I avoid walking on many roads/streets in my city, because the traffic does not feel safe
- I avoid walking on many roads/streets in my city, because I fear crime/violence there

Accident involvement. We report results for two question on pedestrians' accident involvement while walking in the last two years: "During the last two years, have you been involved in an accident involving a vehicle (e.g. car, motorcycle) while walking on streets/roads?" Answer alternatives were: 1) No, 2) Yes, but I was not physically injured, 3) Yes, I was physically injured, but I did not seek

¹ This question relates to risk perception, but it is not a question about risk perception, as it does not focus on the individual level, i.e. the risk perception of the respondent who is answering. Rather, the statement refers to the risk perception of the pedestrians using the streets in general.

medical help, 4) Yes, I was physically injured and visited doctor/hospital. Alternatives were combined into two categories: 1) No, 2) Yes.

Questions measuring transport poverty and consequences of it. In the survey, we had a filter following up respondents who agreed that: “they walk because they have no other choice”: “You agreed that you walk because you have no other choice. Please explain why:”

Four answer alternatives were provided:

- I walk because other means of transportation are too expensive
- I walk because I find that other means of transport are too dangerous
- I walk because there are no other means of transportation in my area
- I walk because of other reason

“The fact that you walk because other alternatives are too expensive, dangerous or non-existent:”

- ...has reduced my access to education opportunities
- ...has reduced my access to job opportunities
- ...has reduced my access to food markets

The three questions were combined into a sum score index (Cronbach’s Alpha: .862).

3.3.3 Multivariate analyses

We have conducted four multivariate regression analyses. Examining the factors influencing whether respondents have been involved in a traffic accident with a vehicle, while walking in the last two years, we employ binary logistic regression analyses. Independent variables are included in successive steps, with the most basic ones added first, followed by the other independent variables. We use logistic regression analysis, as the dependent variable is dichotomous (accident: yes/no). In the other analyses, we use linear regression analysis, as the dependent variables are continuous. The dependent variables in these analyses are: pedestrians’ risk perception, pedestrians’ avoidance behaviour and pedestrians transport poverty consequences.

4 Results

4.1 Description of the respondents

4.1.1 Sex, age and education

A total of 1862 of the respondents participated in the study (cf. Table 4.1).

Table 4.1 Car drivers and respondents in the study

	Male	Female	Total
Pedestrian Europe	48%	52%	1109
Pedestrian Africa	61%	39%	753
Total	53%	47%	1862

Table 4.2 shows the distribution of pedestrians in each country.

Table 4.2 Distribution of pedestrians within each country

Group	Male	Female	Total
Pedestrian Norway	49%	51%	544
Pedestrian Sweden	44%	56%	285
Pedestrian Netherlands	51%	49%	280
Pedestrian Ghana	62%	38%	258
Pedestrian Tanzania	70%	30%	250
Pedestrian Zambia	52%	48%	245
Total	53%	47%	1862

Table 4.3 shows the distribution of the respondents in different age groups.

Table 4.3 The distribution of the respondents in different age groups.

Group	<26 yrs	26-35 yrs	36-45 yrs	46-55 yrs	>55 yrs	Total
Pedestrian Africa	31%	38%	19%	9%	3%	753
Pedestrian Europe	8%	21%	18%	22%	32%	1109
Total	17%	14%	18%	16%	10%	1862

Table 4.3 shows that the European respondents are generally older than the African respondents. There are ten times more respondents in the age group over 55 years old in the European sample, and nearly three times more respondents under 26 years old in the African sample.

Table 4.4 shows the highest level education of the respondents in the different groups. Respondents were asked: “What is your highest education?”¹

Table 4.4 The highest level education of the respondents in the different groups.

	Primary school	High school	University 3-4 yrs	University 5 yrs	Total
Pedestrian Africa	12%	36%	19%	32%	753
Pedestrian Europe	2%	23%	36%	39%	1109
Total	6%	28%	30%	36%	1862

¹ The answer alternatives were slightly different in the European and the African samples for education, due to a perceived need for national adaptation. Answer alternative 3 in the African sample was “Professional school / Technological university”. The fourth alternative in the African sample was “University (tertiary)”. Thus, the category university is not fully comparable across national contexts.

Table 4.4 show relatively similar levels of education among the different groups, although there are higher shares of respondents in the lowest education level among the African pedestrians. Moreover, the education level among the pedestrians in Europe is higher than for the African pedestrians.

4.1.2 How often, where and why the pedestrians walk

The focus of this section is the first aim of the study, which is to compare respondents in the African and European countries’ reliance on walking as a mode of transport, including why they walk.

We asked pedestrians how often they walk to reach destinations, e.g. from home to work, from home to the shop, from home to the bus etc., using walking as a means of transport. Answers are shown in table 4.5.

Table 4.5 Frequency of walking as a means of transport among African and European pedestrians

	Several times a day	Every day	5-6 days a week	3-4 days a week	1-2 days a week	A few days a month	Less frequently	Total
European	24%	39%	11%	13%	10%	3%	1%	753
African	40%	26%	9%	11%	7%	5%	2%	1109
Total	627	578	190	218	149	75	25	1862

Table 4.5 shows that among both African and European respondents, about 65% use walking as a means of transport to reach destinations each day. European respondents have a higher share who report that they walk several times a day. However, we also asked respondents how long they usually walk on a typical day where they walk to reach destinations. The African respondents walk twice as many minutes on average on a typical day where they walk (96 minutes versus 45 minutes). It should be noted that the African respondents were recruited when they walked on the street, while the European were recruited through e-mails. Thus, there might be a self-selection bias for the European respondents, which could indicate that they to a greater extent perceive themselves as pedestrians (and often use walking as a means of transport). Results for the different countries are summed up in Figure 4.1.

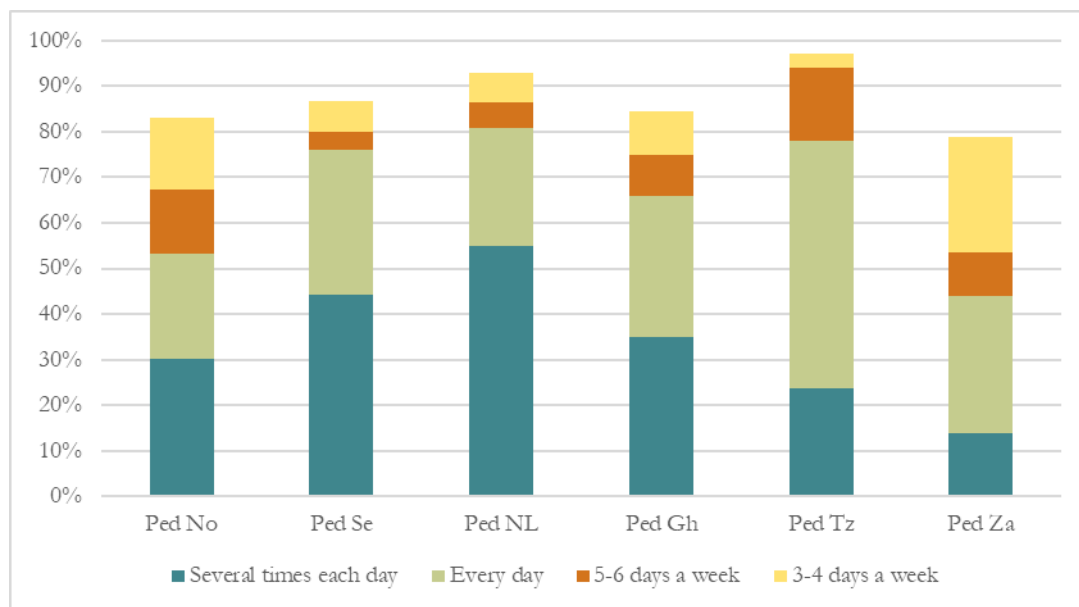


Figure 4.1 Frequency of walking as a means of transport among African and European pedestrians in different countries.

Figure 4.1 shows that especially the Netherlands have a high share of respondents who walk several times each day.

Figure 4.2 shows where respondents usually walk.

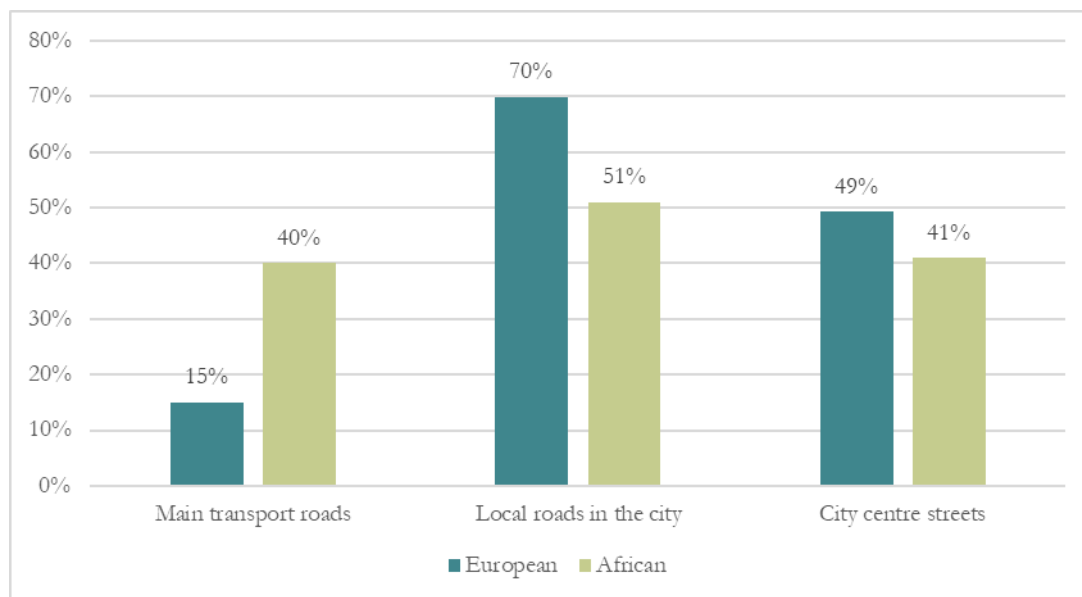


Figure 4.2 Where pedestrians from European (n=1109) and African countries (n=753) usually walk.

Figure 4.2 shows that African respondents walk more on the main transport roads (indicating that they use walking as the main means of transport for longer trips), while the European walk more on local roads. This difference is also reflected in the length of the walking trips for the African respondents.

We ask respondents questions about why they walk.

- Walking is one of my main means of transportation
- I walk because I have no other choice
- I walk for the pleasure of it
- Public transport is one of my main means of transportation
- Private car is one of my main means of transportation

Proportions who agree are shown in Figure 4.3 below.

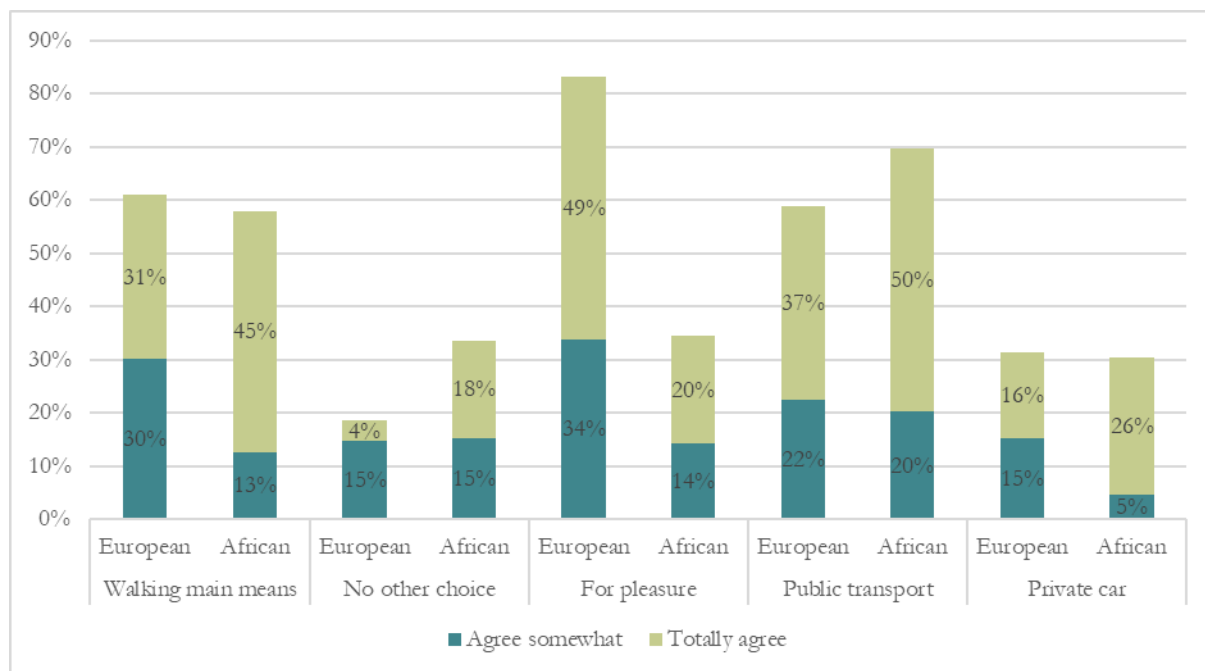


Figure 4.3 Questions about why the pedestrians in the European (n=1109) and African countries (n=753) walk.

Figure 4.3 shows that the share who has walking as their main mode of transport is approximately the same in the two groups. There is, however, a higher share of pedestrians in the African countries who answer that "I walk because I have no other choice". There are over four times as many who totally agree with the statement in the African sample. The pedestrians in the European countries have twice as large a share of respondents who answer that "I walk for the pleasure of it". There is a slightly higher share of respondents who has public transport as their main means of transportation in the African sample, and about the same shares who have private car as their main means of transportation in the two groups.

4.2 Results based on fieldwork

Fieldwork data indicate a more chaotic, hectic and unregulated traffic picture in the African countries than in the European countries. There is a high level of congestion at rush hours, and a high number of motorcyclists which navigate between cars. There is also a high number of (mini) buses, which seem to push their way through in the traffic congestion. The minibuses are full of passengers (15-20 people) and seem to offer a low level of physical protection. Additionally, there is also a high number of hawkers, selling their products in the middle of the road, also in road stretches with relatively high speed limits, although congestions stops the cars and "creates a market". There is also a high level of pedestrians along the roads but no wheelchair users and very few bicyclists.

Spaces between the vehicles are narrow compared to the situation in European countries. The cooperation between road users seem to some extent to be based on the "right of the strong"; you have to push your way through in congestion and bigger vehicles often "win". Larger vehicles and offensive drivers tend to "win" in this situation, while vulnerable road users (MC, pedestrians, cyclists) "lose" and must give way for cars.

Especially in Tanzania (Dar es Salaam), the situation on the main roads resembles a "race to get ahead", with everyone trying to get ahead as fast as possible. This creates a lot of overtaking and manoeuvrings in traffic, and a relatively chaotic traffic environment. Taking two-way traffic into account, and road users trying to get onto the road from the side roads, this leads to a high level of near misses and conflicts, which was observed on every trip that the researchers made. There seemed to be a considerable number of near "head-on collisions" and "near side-collisions". The situation was

especially unclear and chaotic because of all the motorcycles, which merged with the vehicles from different sides, and generated a lot of conflicts and near misses, often with considerable differences in speed. Additionally, there was also high numbers of pedestrians walking along the road, trying to cross the road and running to escape oncoming vehicles.

The respect for vulnerable road users in the African countries is lower than in the European setting, especially in Norway and Sweden, where motorists usually give way to vulnerable road users. The roads and road infrastructure in the African countries are also to a lesser extent than in the European countries, adapted to vulnerable road users. There is seldom physical separation between cars and pedestrians, neither on high-speed roads, which may go through village areas with children in and around the roads. Additionally, pedestrians have to walk along roads with high-speed vehicles.

Fieldwork data also indicate relatively low use of protective equipment (helmet, seat belt), and a seemingly high tolerance for risk. We often saw families on motorbikes, including small children, often without helmets. Such observations are never made in a European setting. The main author remarked in a conference presentation in Winneba, Ghana 2023, that if such a thing had happened in Norway, it would have reached the national news. This actually happened in Norway, three days after the conference presentation: a seven-year-old was delivered at school sitting in front of the rider; on the tank of the motorbike (Bil24 2023). The fact that this reached a national news website dedicated to cars and transport, indicates that this is seen as a very rare and condemnable action (“newsworthy”), indicating that it breaches with the national norms related to road safety, the national RSC. Thus, the main differences between the national RSC in the African countries compared with the European countries, based on the fieldwork, is that the former is more risk tolerant, that the traffic environment is more chaotic and unregulated, that there is a high level of conflicts and near misses, and that the road system is less in line with Safe system principles. Vulnerable road users in European countries are less exposed to high-speed cars.

4.3 Perceptions of infrastructure and traffic

The focus of this section is the second aim of the study, which is to compare respondents in the African and European countries’ perceptions of their walking infrastructure, traffic and traffic safety culture.

4.3.1 Pedestrian friendly infrastructure

The survey includes five questions measuring the degree of pedestrian friendly infrastructure:

Please answer with regard to the streets/roads that you usually walk. These streets/roads:

- ...have sidewalks dedicated for pedestrians
- ...have walkways that are well separated from vehicles and motorcycles
- ...have crosswalks where I can safely cross the road
- ...are very challenging to use as a pedestrian because of obstacles in the road side
- ...have streetlights that sufficiently light up the road/street when it is dark

Figure 4.4 shows proportions agreeing with five statements about pedestrian friendly infrastructure, among pedestrians in the European and the African countries.

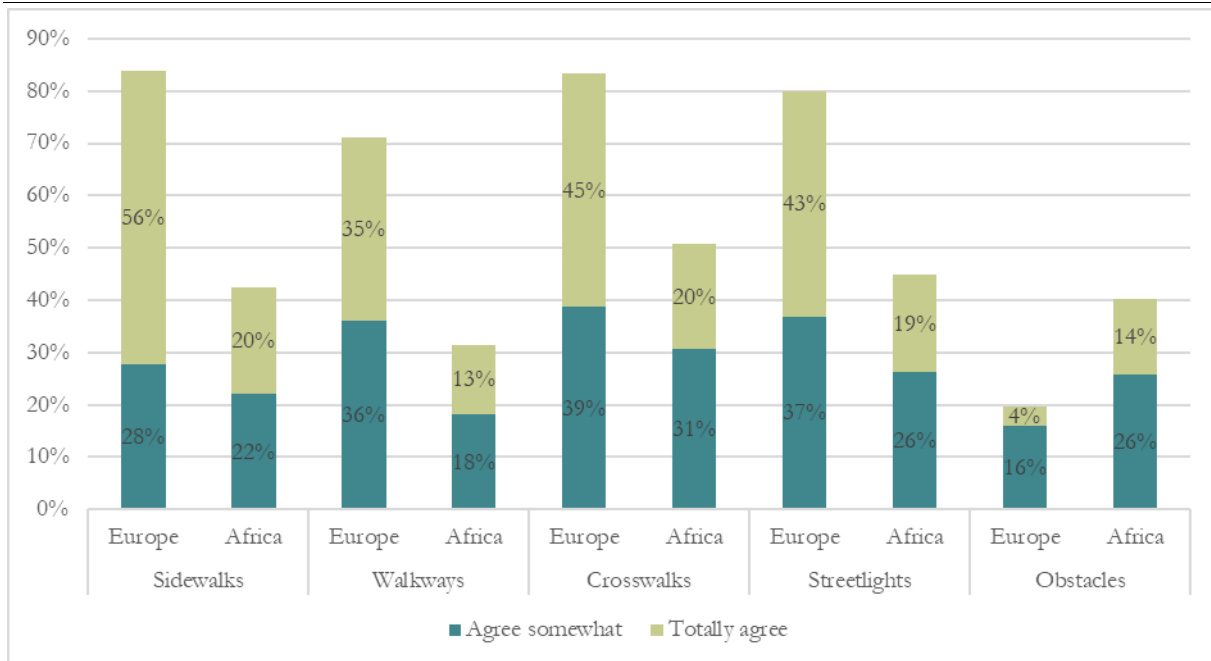


Figure 4.4 Proportions agreeing with five statements about pedestrian friendly infrastructure, among pedestrians in the European and the African countries.

The figure shows that the European respondents generally agree more with the positive statements about pedestrian friendly infrastructure. The percentage points agreeing in the European pedestrian sample is generally around forty or thirty percentage points higher than in African pedestrian sample. This indicates more pedestrian friendly infrastructure for the European pedestrian respondents. We made a sum score index of the first four questions, and the score of European respondents was 16.4 points, while the score of African respondents was 10.9 points. The difference was statistically significant ($p < .001$).

4.3.2 Traffic volume and vehicle speed

The survey includes two questions measuring the perception of traffic volume and speed on the roads where the pedestrians in the study usually walk:

- The speed of vehicles/motorbikes is too high
- The speed and amount of traffic creates a sense of danger for pedestrians¹

Figure 4.5 shows proportions of respondents agreeing with two statements about their perception of traffic volume and speed on the roads where the pedestrians in the study usually walk.

¹ This question relates to risk perception, but it is not a question about risk perception, as it does not focus on the individual level, i.e. the risk perception of the respondent who is answering. Rather, the statement refers to the risk perception of the pedestrians using the streets in general.

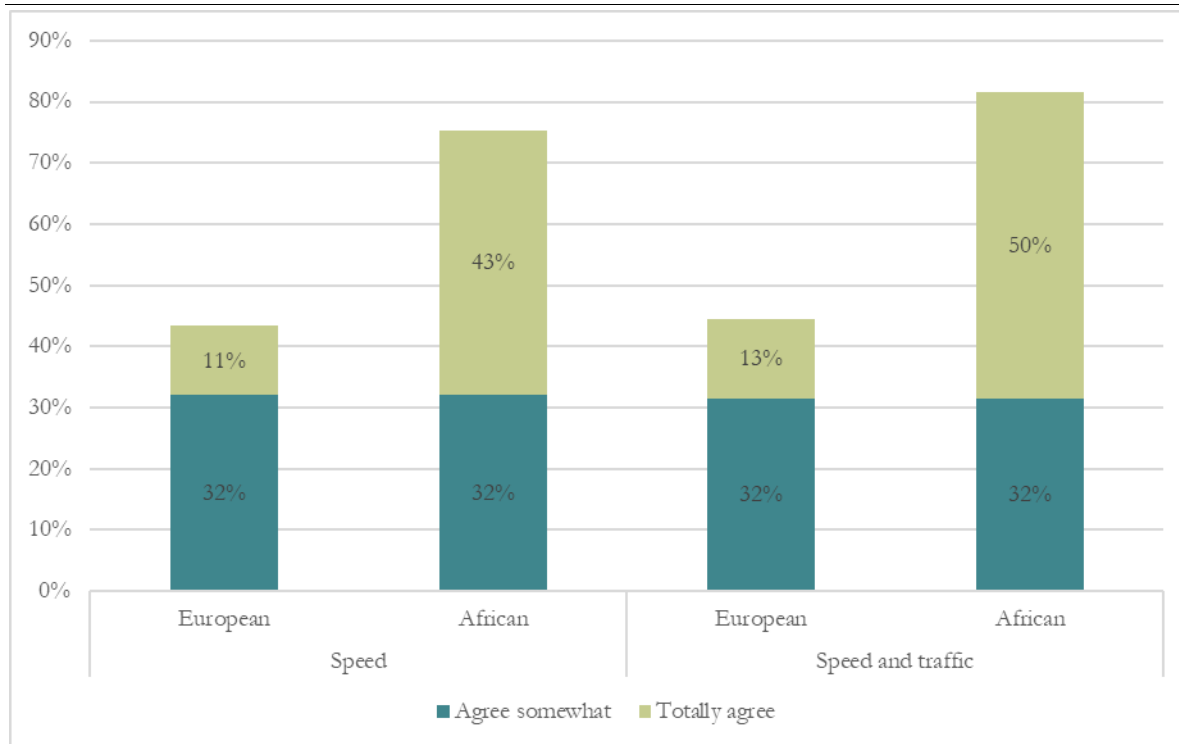


Figure 4.5 Proportions agreeing with two statements about perception of traffic volume and speed on the roads where the pedestrians in the European and the African countries usually walk.

The figure shows that the African respondents generally agree more with the statements about vehicle speed and traffic volume. The percentage of pedestrians who totally agree in African is almost twice as much as pedestrians in Europe. This indicates a more pedestrian friendly traffic environment in Europe.

4.3.3 Traffic safety culture

Items measuring descriptive norms were used to measure traffic safety culture. The pedestrian survey includes the following questions, that we hypothesize to be different among the European and African countries. The questions were introduced like this: “When walking on roads in my country, I expect the following behaviour from other drivers:”

- That they become angered by a certain type of driver and indicate their hostility by whatever means they can
- That they sound their horn to indicate their annoyance to another road user
- That they overtake a slow driver on the inappropriate side
- That they drive when they suspect they might be over the legal blood alcohol limit
- That they drive without using a seatbelt

Figure 4.6 shows mean scores on the index measuring descriptive norms in the different countries. The higher the scores on the index, the more violations road users expect from car drivers in their country. In addition to pedestrians the figure also includes scores for car drivers and bus drivers.

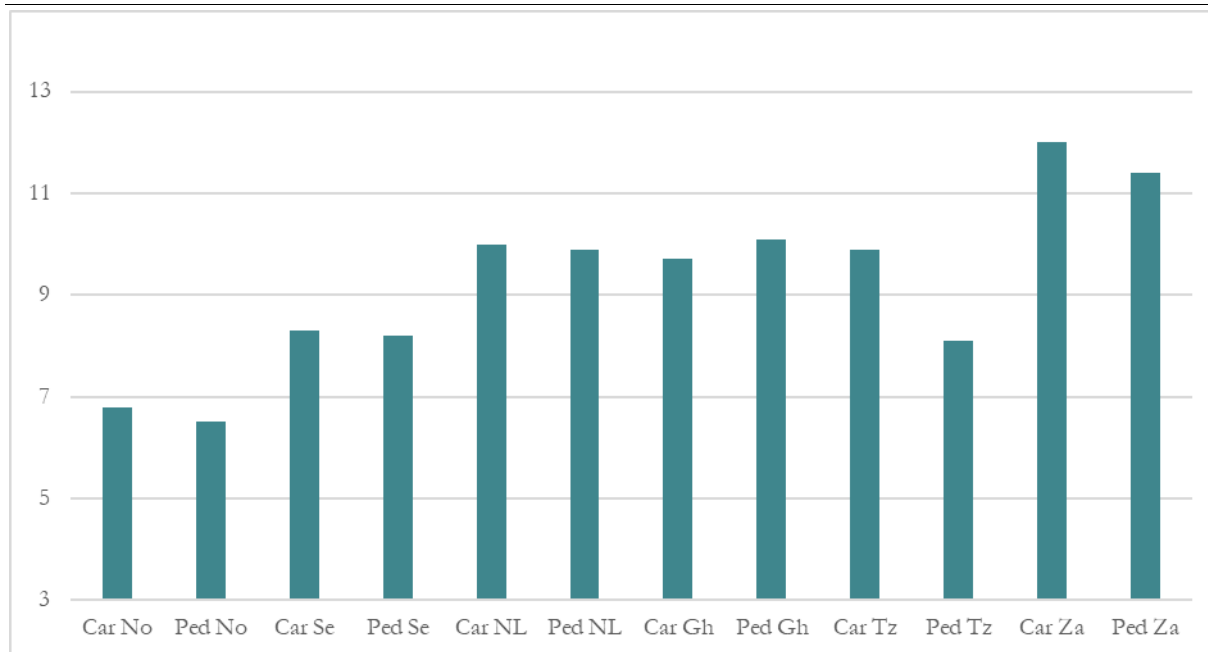


Figure 4.6 Mean scores on the index measuring descriptive norms in the different countries (min: 5, Max: 25).

Figure 4.6 shows that Norway and Sweden have the lowest scores on the index and expect the lowest level of road violations from car drivers in their country. Road users in Zambia have the highest score on the index and expect the highest level of violations from car drivers in their country. Although, we see that there are considerable national differences within the countries on each continent, there is a general tendency. The general score among the European pedestrians is 7.9 points, while it is 10.8 among the African pedestrians ($p < .001$). It is also important to note that the mean scores are relatively similar between car drivers and pedestrians within countries, indicating shared RSC measured as descriptive norms. The exception is Tanzania.

Table 4.6 shows the detailed scores in each country, with standard deviations.

Table 4.6 Mean scores on the index measuring descriptive norms in the different countries.

Groups	Mean	N	Std. D.
Car No	6,8	544	2,2
Ped No	6,5	545	2
Car Se	8,3	293	2,9
Ped Se	8,2	285	3,7
Car NL	10	284	3,5
Ped NL	9,9	279	3,8
Car Gh	9,7	282	4,3
Ped Gh	10,1	258	4,8
Car Tz	9,9	216	3,9
Ped Tz	8,1	250	3
Car Za	12	291	5
Ped Za	11,4	245	5,3
Total	8,9	3772	4

4.3.4 The sociocultural position of pedestrians

The survey includes two questions measuring the sociocultural position of pedestrians:

- People who drive a car to their job is respected more than people who walk to their job

- The road system in my country is made for cars and not for pedestrians

Figure 4.7 shows proportions agreeing with the two statements about the sociocultural position of pedestrians among pedestrians in the European and the African countries.

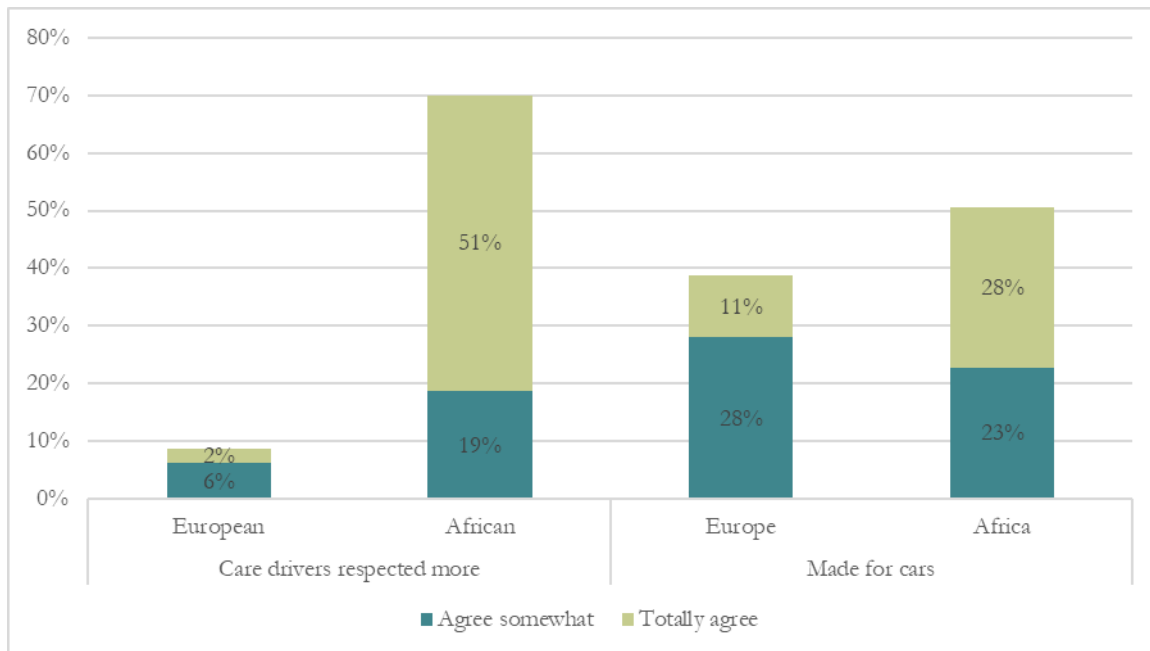


Figure 4.7 Proportions agreeing with two statements about the sociocultural position of pedestrians, among pedestrians in the European and the African countries.

Figure 4.7 shows a clearly different social status for pedestrians in the European sample than in the African sample: the share agreeing with the first statement is seven times higher in the European sample. We do not see the same striking difference on the question of whether the road system is made for cars.

4.4 Negative transport outcomes

The focus of this section is the third aim of the study, which is to compare negative transport outcomes (accident involvement, risk perception, avoidance behaviour, transport poverty) among pedestrians in the African and European countries.

4.4.1 Accident involvement

Respondents were asked: “During the last two years, have you been involved in an accident involving a vehicle (e.g. car, motorcycle) while walking on streets/roads?” and “During the last two years, have you been involved in an accident not involving any vehicle (e.g. tripping, falling) while walking on streets/roads?” Answer alternatives were: 1) No, 2) Yes, but I was not physically injured, 3) Yes, I was physically injured, but I did not seek medical help, 4) Yes, I was physically injured and visited doctor/hospital. Figure 4.5 shows accident involvement for pedestrians in the European and African countries, in the last two years among the car drivers in each country, with and without vehicles involved.

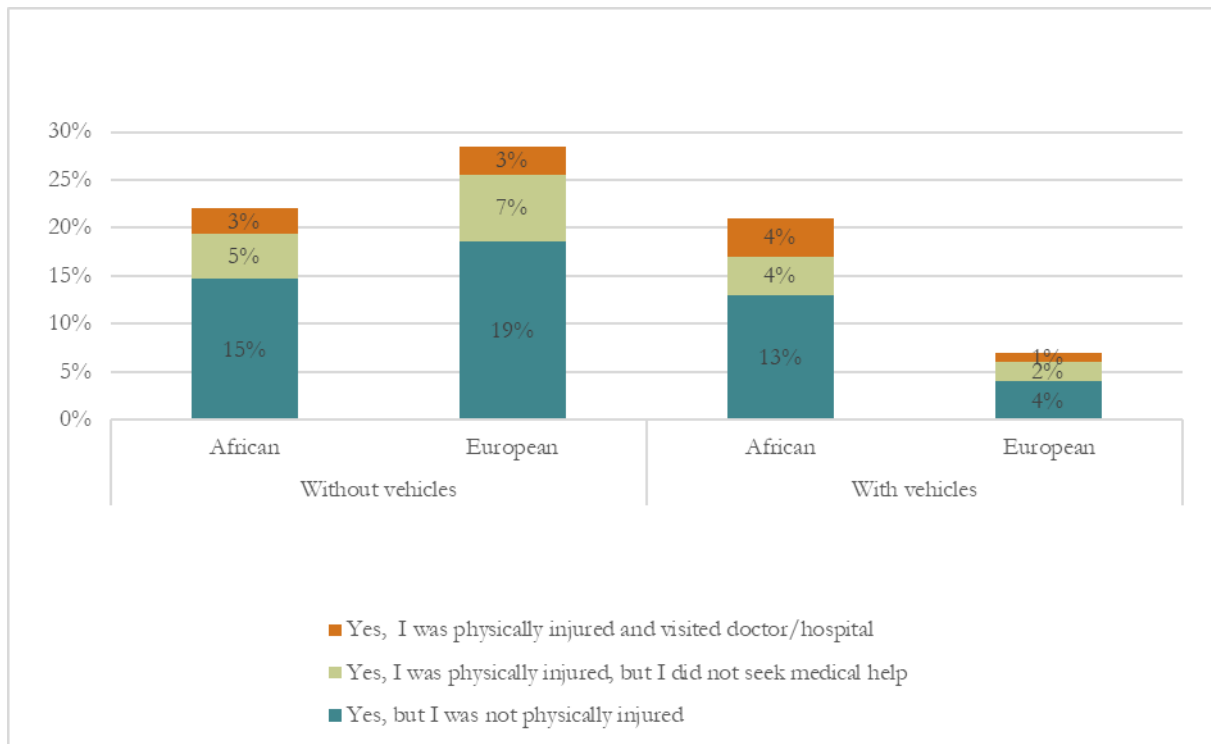


Figure 4.8 Accident involvement for pedestrians in the European (n=1125) and African (n=898) countries, in the last two years, with and without vehicles involved.

Figure 4.8 shows a higher share of accidents among European pedestrians without vehicles involved, especially without physical injuries. The situation is different when it comes to accidents which involves vehicles; here the share is higher among the African pedestrians. The share of respondents who was physically injured, but did not seek medical help is three times higher in the African sample.

4.4.2 Pedestrians’ risk perception

The survey includes three questions measuring pedestrians’ perception of risk related to walking:

- The streets/roads that I normally use feel dangerous for walking
- I generally fear being hit by a vehicle while walking on the streets/roads that I normally use
- I generally fear being hit by a bicycle, or other two-wheelers while walking on the streets/roads that I normally use

Figure 4.9 shows proportions agreeing with the different statements about risk perception, among pedestrians in the European and the African countries.

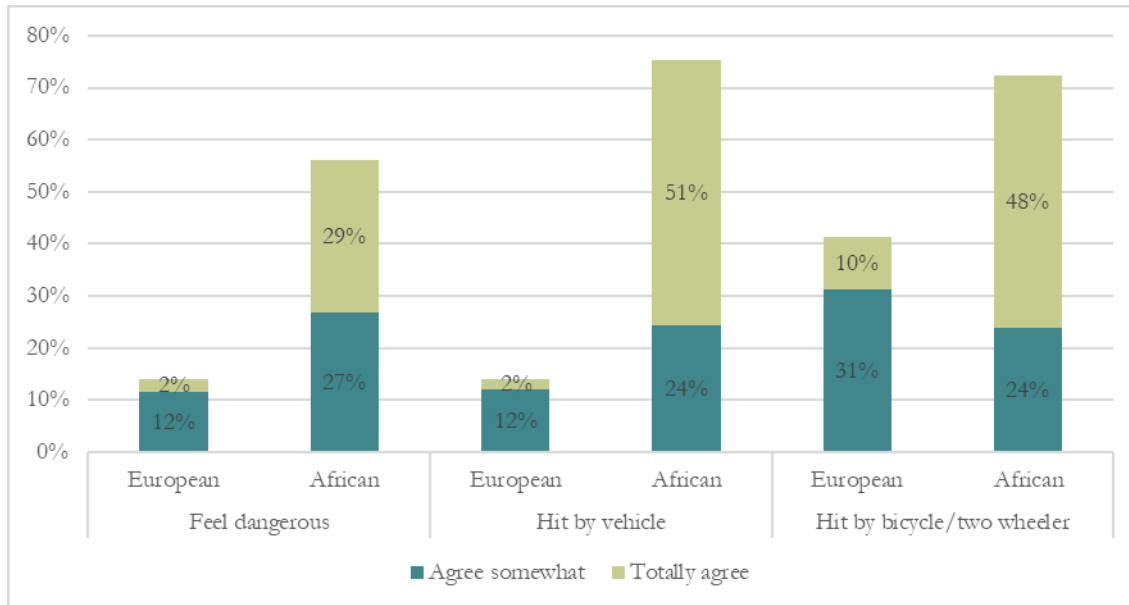


Figure 4.9 Proportions agreeing with three statements about risk perception, among pedestrians in the European and the African countries.

The figure shows that the African pedestrians generally have a far higher risk perception than the European pedestrians. The shares agreeing in the African sample is between two times and 5.4 times higher than in the European sample. We made a sum score index of the first two questions, and the score of European respondents was 4 points, while the score of African respondents was 7.3 points. The difference was statistically significant ($p < .001$).

The results shows that European pedestrians have a fear of being hit by bicycles and two-wheelers. There are nearly three times more European pedestrians agree with this statement, compared with the statement about being hit by a vehicle. African respondents had a far higher fear of being hit by a vehicle. These differences are related to different levels of Safe system implementation in the two groups: European respondents do not fear being hit by vehicles to the same extent, as the road infrastructure protects them more from vehicles, than the road infrastructure protects the African respondents from vehicles. However, European pedestrians to a great extent share the pedestrian infrastructure with bicycles.

4.4.3 Avoidance behaviour

The survey includes two questions about avoidance behaviour among pedestrians:

- I avoid walking on many roads/streets in my city, because the traffic does not feel safe
- I avoid walking on many roads/streets in my city, because I fear crime/violence there

Figure 4.10 shows proportions agreeing with the two questions about avoidance behaviour, among pedestrians in the European and the African countries.

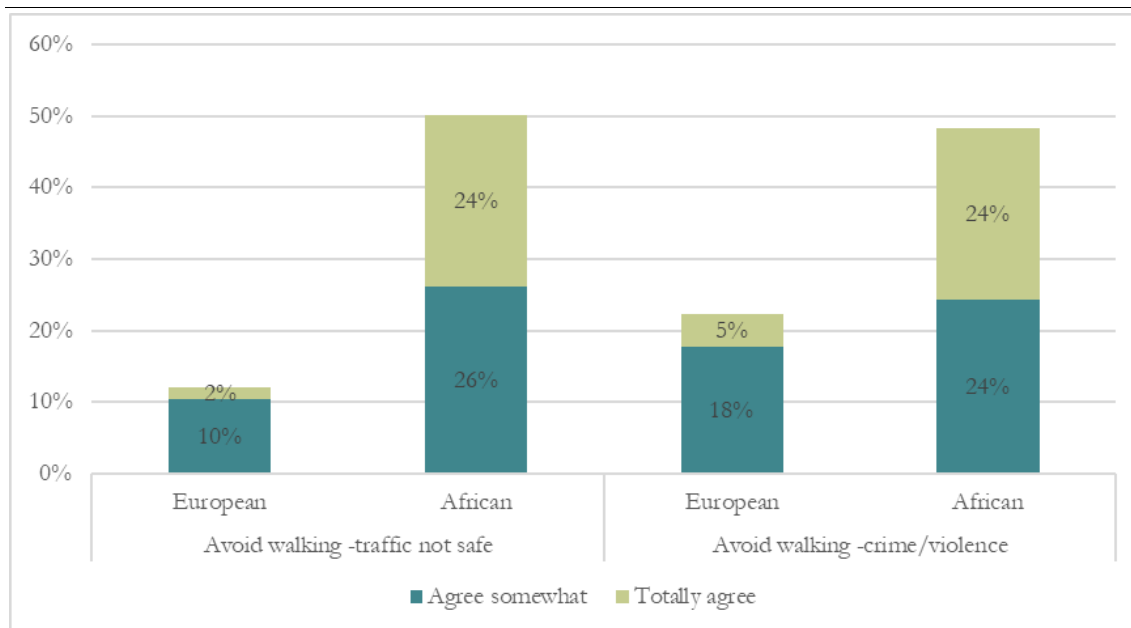


Figure 4.10 Proportions agreeing with two statements about avoidance behaviour, among pedestrians in the European and the African countries.

Figure 4.10 shows that half of the respondents in the African sample agree that they avoid walking on many roads/streets in their city, because the traffic does not feel safe. The corresponding share among the European respondents is 12%. This indicates that perceived traffic safety confines the mobility of the African respondents to a much higher degree than for the European respondents (about five times more). The difference is smaller when we look at crime and violence as a transport confining mechanism. However, the share agreeing in the African sample is still twice as large as the share in the European sample.

4.4.4 Transport poverty and transport poverty impacts

We saw above that there is a higher share of pedestrians in the African countries who answer that "I walk because I have no other choice" (33% vs. 19% agree). There are four times as many who totally agree with the statement in the African sample. On the other hand, the pedestrians in the European countries have twice as large a share of respondents who answer that "I walk for the pleasure of it" (83% vs. 34% who agree).

In the survey, we had a filter following up respondents who agreed that: "they walk because they have no other choice": "You agreed that you walk because you have no other choice. Please explain why:"

Four answer alternatives were provided:

- I walk because other means of transportation are too expensive
- I walk because I find that other means of transport are too dangerous
- I walk because there are no other means of transportation in my area
- I walk because of other reason

The proportion of respondents who agree with the statements about transport poverty are shown in Figure 4.11.

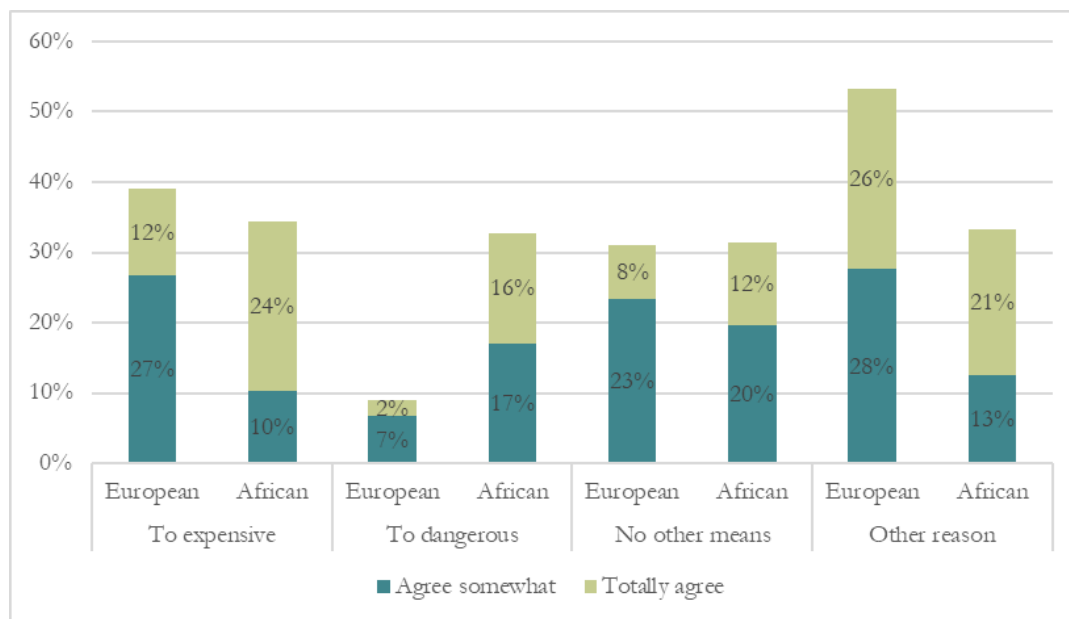


Figure 4.11 The proportion of respondents who agree with the statements about transport poverty, among the European and the African respondents.

Figure 4.11 shows relatively equal proportions in the African and the European sample, for the statements about too expensive and no other means of transport. The shares agreeing with the statement that they walk because they have to, as other means of transport are too dangerous is nearly four times higher in the African sample. The share that says “other reason” 20 percentage point higher in the European sample, compared with the African sample.

Respondents who agreed with the statements about transport poverty, were filtered to answer questions about consequences of transport poverty: “The fact that you walk because other alternatives are too expensive, dangerous or non-existent:”

- ...has reduced my access to education opportunities
- ...has reduced my access to job opportunities
- ...has reduced my access to food markets

The proportion of respondents who agree with the statements about consequences of transport poverty are shown in Figure 4.12.

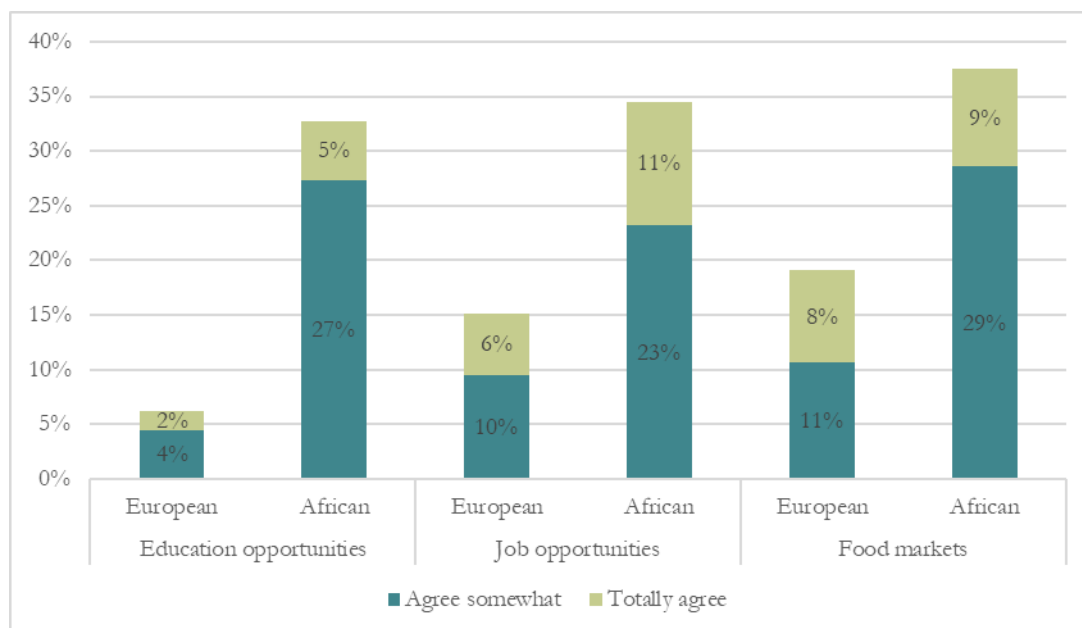


Figure 4.12 The proportion of respondents who agree with the statements about the consequences of transport poverty, among the European and the African respondents.

Figure 4.12 shows considerable differences related to transport poverty among the European and the African respondents. Among the African respondents, between 32% and 38% agree with the statements, while 6%, 16% and 19% agree among the European respondents. Thus, over five times more of the African respondents agree that their education opportunities have been impeded by transport poverty, and as noted the biggest difference is related to perceived safety, i.e. that respondents walk because they have to, as other modes are perceived to be too dangerous. This indicates the importance of perceived safety as an aspect of transport poverty.

4.5 Factors influencing negative transport outcomes

The focus of this section is the fourth aim of the study, which is examine factors influencing negative transport outcomes, focusing on person-related and system-related factors.

4.5.1 Factors influencing accident involvement

The share of pedestrians in the African sample who had been involved in an accident involving a vehicle in the last two years, was 21%, while it was 7% in the European sample. In Table 4.7, we examine factors influencing pedestrians’ accident involvement in the las two years.

Table 4.7 Logistic regression. Dependent variable: pedestrians’ accident involvement as in the last two years. Odds Ratios (statistically significant coefficients in bold). (Accident: 1=yes, 0=no)

Variable	Mod. 1	Mod. 2	Mod. 3	Mod. 4	Mod.5	Mod. 6	Mod. 7	Mod. 8	Mod. 9
Walking frequency	.892*	.902*	.905*	.909*	.859***	.874***	.873***	.882**	.884**
Age (>56=1, <56=0)		.410***	.398***	.424***	.486***	.671	.675	.677	.681
Education (University=1, Else=0)			.635***	.657**	.709*	.732*	.733*	.727*	.719*
Aggressive road safety violations				1.085***	1.072***	1.060**	1.061**	1.053**	1.049**
Pedestrian infrastructure					.944***	.989	.989	.987	.987
European vs, Afrian (=0 vs. 1)						2.468***	2.294***	2.283***	2.298***
Fatalistic beliefs index							1.008	1.003	1.001
Descriptive norms index								1.030	1.028
Individual freedom index									1.030
Nagelkerke R2	.006	.024	.032	.046	.060	.083	.083	.086	.087

The results shows that walking frequency contributes significantly to pedestrians’ accident involvement. The less pedestrians walk, the higher value they get on the frequency variable. The contribution is lower than 1, indicating that less walking is related to decreased probability of being involved in a pedestrian accident.

Second, age contributes significantly in Model 1-5. The odds are lower than 1, indicating that being older than 56 years, is related to decreased probability of pedestrian accident involvement.

Third, university education contributes significantly. The odds are lower than 1, indicating that university education, is related to decreased probability of pedestrian accident involvement, compared with those with a lower level of education.

Fourth, the aggressive road safety behaviour index contributes significantly, and the odds are higher than 1, indicating that a higher level of aggressive pedestrian violations is related to increased probability of pedestrian accident involvement.

Fifth, the pedestrian infrastructure index contributes significantly, and the odds are lower than 1, indicating that a higher level of pedestrian infrastructure is related to decreased probability of pedestrian accident involvement. The pedestrian infrastructure index ceases to contribute significantly in Model 6, when European vs. African countries variable is included. This is because there is a strong relationship between pedestrian infrastructure and African vs. European: the latter scores higher on the index.

Sixth, the European vs, African countries variable contributes significantly, and the odds are higher than 1, indicating that African nationality is related to increased probability of pedestrian accident involvement, compared with the European sample.

Finally, the Nagelkerke R2 value in Model 9 is .087, which indicates that the variables in Model 9 explains 9% of the pedestrians’ accident involvement.

4.5.2 Factors influencing risk perception

In Table 4.8 factors influencing pedestrians’ risk perception are presented. This was based on an index comprised of two questions: “The streets/roads that I normally use feel dangerous for walking” and “I generally fear being hit by a vehicle while walking on the streets/roads that I normally use”.

Table 4.8 Linear regression. Dependent variable: pedestrians’ risk perception index. Standardized beta values.

Variable	Mod. 1	Mod. 2	Mod. 3	Mod. 4	Mod.5	Mod. 6	Mod. 7
Gender (Male=1, Female=2)	-.056*	-.053**	-.049**	-.017	-.014	-.017	.017
Age (<56=1, >56=2)		-.186***	-.190***	-.102***	-.099***	-.089***	.005
Education (University=1, Other=0)			-.082***	-.026	-.035*	-.029	-.017
Infrastructure index				-.467***	-.419***	-.412***	-.228***
Vehicles too high speed					.252***	.235***	.170***
Traffic culture (violations)						.096***	.048**
European vs. African							.396***
Adjusted R2	.003	.037	.043	.250	.310	.319	.406

First, we see that age contributes significantly and negatively to pedestrians’ risk perception, until European vs. African is included in Model 7. The significant contribution means that being over 56 years old is related to lower risk perception, controlled for the other variables in the model. The age variable ceases to contribute statistically significantly when European vs. African is introduced in Model 7. This indicates a relationship between Age and continent: there are more respondents over 56 years in the European sample, and they have a lower risk perception.

Second, the infrastructure index contributes significantly and negatively to pedestrians’ risk perception. This means that the less pedestrian friendly respondents rate their road infrastructure, the higher is their risk perception, controlled for the other variables in the model.

Third, we also see that the variable: “The speed of vehicles/motorbikes is too high” (on the roads where I usually walk) contributes significantly and positively to risk perception. This means that the more you agree with this statement, the higher score you get on the risk perception index.

Fourth, the descriptive norms index contributes significantly and positively to risk perception. This means that pedestrians who ascribe a high level of aggressive violations and other road violations to car drivers in their own country also report high levels of risk perception. In other word: a traffic culture with higher number of violations among drivers creates a higher fear of road accidents among pedestrians.

Fifth, the variable European vs. African contributes significantly and positively to pedestrians’ risk perception. This indicates higher levels of risk perception among African pedestrians, controlled for the other variables in the model.

Finally, the adjusted R2 value in Model 7 is .406, indicating that the model explains about 41% of the risk perception of the pedestrians.

4.5.3 Factors influencing avoidance behaviour

In Table 4.9, we examine factors influencing pedestrians’ avoidance behaviour. This is measured with the question: “I avoid walking on many roads/streets in my city, because the traffic does not feel safe”.

Table 4.9 Linear regression. Dependent variable: pedestrians’ avoidance behaviours. Standardized beta values.

Variable	Mod. 1	Mod. 2	Mod. 3	Mod. 4	Mod.5	Mod. 6	Mod. 7	Mod. 8
Gender (Male=1, Female=2)	-.042*	-.040*	-.039*	-.017	-.014	-.006	-.009	-.007
Age (<56=1, >56=2)		-.092***	-.093***	-.031	-.028	.029	.036*	.042**
Education (University=2, Other=1)			-.024	.016	.008	.028	.032*	.033*
Infrastructure index				-.330***	-.287***	-.046**	-.045**	-.035
Vehicles too high speed					.227***	.082***	.071***	.068***
Risk perception						.573***	.562***	.553***
Traffic culture (violations)							.084***	.081***
European vs. African								.029
Adjusted R2	.001	.009	.009	.112	.161	.388	.394	.394

First, we see that age contributes significantly and positively to pedestrians’ avoidance behaviour, which means that being over 56 years old is related to somewhat more avoidance behaviour, controlled for the other variables in the model.

Second, we see that university education contributes significantly and positively to pedestrians’ avoidance behaviour, which means that having university education is related to somewhat more avoidance behaviour, controlled for the other variables in the model.

Third, the infrastructure index contributes significantly and negatively to pedestrians’ avoidance behaviour. This means that the less pedestrian friendly respondents rate their road infrastructure, the more avoidance behaviour the pedestrians report, controlled for the other variables in the model. This variable cease to contribute statistically significantly when European vs. African is introduced in Model 8. This indicates a relationship between infrastructure and continent: African respondents report a less pedestrian friendly infrastructure.

Fourth, we also see that the variable: “The speed of vehicles/motorbikes is too high” (on the roads where I usually walk) contributes significantly and positively to avoidance behaviour. This means that the more you agree with this statement, the more avoidance behaviour you report.

Fifth, the descriptive norms index contributes significantly and positively to avoidance behaviour. This means that pedestrians who ascribe a high level of aggressive violations and other road violations to car drivers in their own country also report high levels of avoidance behaviour. In other word: a traffic culture with higher number of violations among drivers creates more avoidance behaviour among the pedestrians.

Finally, the adjusted R2 value in Model 8 is .394, indicating that the model explains about 39% of the avoidance behaviour of the pedestrians.

4.5.4 Factors influencing transport poverty consequences

In Table 4.10, factors influencing pedestrians’ transport poverty consequences are presented. This is a sum score index comprised of three questions. “The fact that you walk because other alternatives are too expensive, dangerous or non-existent:” “...has reduced my access to education opportunities, ...has reduced my access to job opportunities, ...has reduced my access to food markets.” Answer alternatives ranged from 1 (totally disagree) to 5 (totally agree). Thus, the scores on the index ranges between 3 (1*3) and 15 (5*3).

Table 4.10 Linear regression. Dependent variable: pedestrians’ transport poverty consequences. Standardized beta values.

Variable	Mod. 1	Mod. 2	Mod. 3	Mod. 4	Mod.5	Mod. 6	Mod. 7	Mod. 8
Gender (Male=1, Female=2)	-.081	-.077	-.066	-.066	-.058	-.037	-.036	-.038
Age (>26=1, <26=2)		.163***	.132**	.133**	.143***	.100*	.103**	.109**
Infrastructure index			-.194***	-.192***	-.141**	-.043	-.039	-.049
Vehicles too high speed				.019	.000	-.043	-.037	-.036
I walk, as other means are too dang.					.206***	.122**	.134**	.139**
Risk perception						.295***	.301***	.309***
Traffic culture (violations)							-.036	-.033
European vs. African								-.027
Adjusted R2	.004	.027	.061	.059	.096	.153	.151	.149

Variable	Mod. 1	Mod. 2	Mod. 3	Mod. 4	Mod.5	Mod. 6	Mod. 7	Mod. 8
Gender (Male=1, Female=2)	-.081	-.076	-.062	-.061	-.056	-.033	-.033	-.035
Age (>26=1, <26=2)		.158***	.127**	.127**	.141***	.097*	.099*	.106*
Infrastructure index			-.205***	-.200***	-.147***	-.045	-.042	-.054
Vehicles too high speed				.036	.015	-.025	-.021	-.020
I walk, as other means are too dang.					.211***	.125**	.132**	.138**
Risk perception						.303***	.306***	.315***
Traffic culture (violations)							-.021	-.017
European vs. African								-.032
Adjusted R2	.004	.026	.064	.062	.101	.161	.159	.156

First, we see that age contributes significantly and positively to pedestrians’ transport poverty consequences, which means that being under 26 years old is related to more negative transport poverty impacts, controlled for the other variables in the model.

Second, the infrastructure index contributes significantly and negatively to pedestrians’ transport poverty consequences. This means that the less pedestrian friendly respondents rate their road infrastructure, the more severe transport poverty consequences they report, controlled for the other variables in the model. This variable cease to contribute statistically significantly when the variable “I walk because I find that other means of transport are too dangerous” is introduced in Model 5. This indicates a relationship between the two variables, i.e. that respondents’ assessment of “unsafe infrastructure” and “unsafe means of transport” are related.

Third, the variable “I walk because I find that other means of transport are too dangerous” contributes significantly and positively to pedestrians’ transport poverty consequences, which means the level of agreement with this statement is related to more negative transport poverty impacts, controlled for the other variables in the model.

Fourth, pedestrians’ risk perception index contributes significantly and positively to pedestrians’ transport poverty consequences, which means the higher the risk perception related to the transport system is, the more negative transport poverty impacts respondents report, controlled for the other variables in the model.

Finally, the adjusted R2 value in Model 7 is .156, indicating that the model explains about 16% of the transport poverty consequences of the pedestrians.

4.6 Interview results on factors influencing negative outcomes

In the following, we will provide interview results on the factors that may shed light on the traffic environment and the road safety culture; factors which also have a strong impact on the situation of pedestrians in the African countries. These data may shed light on the situation of pedestrians in the African countries.

As with the fieldwork data, the interview data indicate a more congested chaotic, hectic and unregulated traffic picture in the African countries than in the European countries. This results in numerous conflicts, near-misses, and actual accidents. The interaction between road users appears to

be somewhat based on the "right of the strong," with less respect for pedestrians than in Europe and a generally higher tolerance for risk.

Road infrastructure. As with the fieldwork data, the interview data indicates less developed safe system solutions in the road infrastructure in the African countries. Lack of roundabouts, less red-light regulation and lack of road markings was mentioned during the focus groups. In addition, also undivided roads, poor lighting and single carriageways was mentioned when discussion contributing factors to road accidents.

Even though new roads are being constructed, the "safety is lacking." For example, potholes and uncovered drainage systems constitutes major safety hazards. One of the respondents from a focus group in Zambia stated that:

"the construction is a waste of money, if they [the government] do not pay attention to safety hazards. Do they want to build sustainable solutions, or quick fixes? Safety needs to be a top priority, which it is not today."

During the focus groups the need to build infrastructure converting two lane rural roads into four lane divided roads and build separate dual carriageways was emphasized. This was discussed as measures to prevent head on collisions.

During the focus groups the lack of infrastructure for vulnerable road users was emphasized and discussed. There is a lack of sidewalks, crosswalks, pedestrian crossings and bike lanes. There is often no protective barriers or railings to protect pedestrian and cyclist from vehicular traffic. Encroachment in the sides of the road, including obstacles (cars, shops etc.) were mentioned as a problem for pedestrians, giving less space for footpaths. Roads are typically not being built with ramps or curb cuts for wheelchair users at crossings or along sidewalks, and there are typically no auditory signals at pedestrian crossings or tactile paving for visually impaired individuals. Parking for disabled road users is not prioritized. This is in accordance with our results from the survey data, where African pedestrians score significantly lower on the index measuring pedestrian friendly infrastructure.

Due to the high number of vulnerable road users involved in traffic accidents, initiatives to build road designs that to a larger degree consider pedestrians and cyclist were emphasized during the focus groups. In Ghana several participants emphasized that the National Road Safety Authority have had intervention activities trying to target pedestrian safety and to target speeding. In Zambia the UN Road Safety Funds (RSF) project Safe Roads Zambia was mentioned. "The objective of the Safe Roads Zambia - Creating Cities for Non-motorized Transportation Users project is to create safe, inclusive, and sustainable road conditions for pedestrians, through encouraging multisectoral partnerships, private sector involvement, advocacy and fundraising towards safe sidewalks, bike lanes and pedestrian crossings" (RSF, 2020).¹ In Tanzania the "Ten Step Project" funded by The United Nations Road Safety Fund (UNRSF) was mentioned (iRap, 2021).² A part of the Ten Step Project is the iRAP pilot project, "TanRAP", which evaluates road safety levels and suggests infrastructural measures to reduce accidents and fatalities. Participants from Tanzania discussed its potential in assessing road safety and identifying high-risk areas. iRAP projects typically aim to assess roads using their own developed Star Rating system, which evaluates safety levels and suggests measures to reduce accidents and fatalities. The goal of the TanRAP pilot project in Tanzania is that 70 % of roads corresponds to the iRap Three Star Rating.

Urban planning, road capacity and congestion. Urban planning was not explicitly discussed as part of the interview guide in the focus groups. Heavy congestion and poor road capacity was

¹ Safe roads Zambia - creating cities for non-motorized transportation users | United Nations Road Safety Fund UNRSF

² The Ten Step Plan for Safer Road Infrastructure kicks off in Tanzania - iRAP

nevertheless mentioned as obstacles for traffic. Interviewees mentioned the challenge of increasing car ownership in the population, which has not been followed by increased road capacity:

“a lot of people with access to money have decided to invest in their own vehicles... now we in Zambia have unregulated overpopulation or subscription of low-capacity vehicles competing for limited road space to drive on because our roads in the country are not expanding.”

Encroachment was mentioned as a factor contribution to congestion. Also, heavy vehicles broken down along the road was mentioned as a contributing factor to accidents. These vehicles are left along the road, taking up space, and other vehicles hit these abandoned vehicles. Whether or not congestion give rise to aggressive interaction patterns between road users was not explicitly discussed during the focus groups, though it was emphasized that motorized road users typically have a sense of urgency and a need to “rush ahead”, that creates dangerous situations with wrongful overtaking and speeding. Especially motorcyclist where describes as “impatient” due to time pressure:

“There is a surge in motorcyclist because of the whole delivery business. So, you will find that most of them [motorcyclist], on the road are impatient so they will not follow their proper road rules. They will be swerving around in traffic.”

Lack of a viable organized public transport system. Public transport systems were not explicitly discussed as part of the interview guide in the focus groups. It was mentioned, however, that poor public transport systems weaken the mobility of vulnerable road users, and that a lack of a viable organized public transport system contributes to more car driving and more congestion on the roads. There is potential of working with public transport systems to “promote safe and active mobility and safe space for all those that want to use the road”.

Several participants described that a lot of people have lost their trust in public transport and that they, if possible, prefer to buy their own vehicles. For some, driving their own car is viewed as safer than traveling by public transport. Each year, several buses are involved in deadly crashes. Also, some of the buses that are used for public transport is often modified, and do not consider the safety and comfort of passengers. Bus drivers can also suffer from fatigue, driving long hours at the expense of passenger’s safety.

In Zambia the management of the public transport system was described as “chaotic”. A participant from Zambia explained that the public transport system is inaccessible to people in vulnerable situations, “like people living with disabilities, pregnant women, the elderly, people with children, people of faith.” The vehicles that are imported are not meant for public transport. They are modified locally and do not consider the safety and comfort of passengers. The participant proposed two measures to improve public transport: 1) To go from fixed routing, causing double commuting, to a ring routing system, creating direct connectivity that cuts down on travel time and travel cost and 2) To make isolated or dedicated lanes for public transport.

In Tanzania they have developed a Bus Rapid Transit System (BRT), which is up and on one road stretch, and which will expand in the next year (it is still under construction) It was mentioned that this system has the potential to reduce congestion and improve the traffic environment.

The lack of the public transport systems increases the attractiveness of motorcycles:

“It's very difficult to avoid them. There are so many and many of them operate also on the last mile or First mile. Often used to travel when one wants to go for a major bus station ... that's normally the easiest means of transport to get”.

The composition of road users. Demographic characteristics of the African countries was not discussed explicitly as part of the interview guide in the focus groups. It was confirmed, however, like we see in the result from the field studies, that the African countries have a high share of motorcyclists, which makes the traffic picture more chaotic, with more conflicts between road users.

The survey indicates less road safety violations among car drivers and pedestrians with increasing age. During the focus groups it was emphasized by some participants that the motorcycle drivers are young and with little former experience of driving motorized vehicles.

Drivers that do not respect the right to give way or consider other road users, as well as reckless driving from motorcyclist were mentioned as contributing to conflict between road users. Also, like previously stated, time pressure and the need to “get ahead” was mentioned as reasons for speeding and wrongful overtaking also contributing to conflicts between road users.

The level of enforcement. An important factor potentially influencing national RSC, that was underlined by the interviewees and also in previous research, is the level of enforcement (Özkan et al., 2006). There is a close relationship between the level of enforcement in countries and road user behaviors (Elvik et al., 2009).

During the focus groups several examples of behavior that violates traffic rules were mentioned: speeding, running red lights, driving without seat belt or helmet, wrongful overtaking, overloading, using the phone while driving, driving in the dark without lights on, failure to comply with the duty to give way and abuse of alcohol.

In addition to the aforementioned behaviors, a typical behavior described by several participants was a lack of respect for other motorists often attributed to being in a rush and having a need to catch up with time. It was mentioned that this often may lead to dangerous overtaking and risk taking in traffic. Also, some participants did mention that governmental cars will for example run red light because “they think of themselves as above the law”.

In general, the enforcement of the traffic police was viewed as insufficient:

“We need to put more effort in terms of legislation as well as enforcement to ensure that the behavior of the drivers is safe enough to prevent accidents.”

Lack of licensing and training for motorcyclist was mentioned as an issue that is not sufficiently supervised and enforced. The motorcyclist is a big challenge. In one of the African countries, it was mentioned that:

“The enforcement of traffic rules is very weak. Traffic police are not interested in enforcing traffic rules. As far as two wheelers are concerned, they just leave them to do whatever they like.”

“Enforcement of the traffic rules is important. On the part of the police ... they need to regard the behavior of the motorcycles. It is very important.”

“Simply, they [the traffic police] cannot control them.”

Interviewees attributed lacking enforcement to partly to lack of resources in the police. Additionally, corruption was mentioned as a hindrance for effective enforcement of traffic rules. Examples of traffic police abusing enforcement measures, like police check points, to raise money for themselves, or examples with police being bought off to drop cases.

Measures. Several enforcement measures were mentioned during the focus groups. Here are some examples mentioned during the focus groups: In Zambia they have been implementing speed cameras at dedicated road sections to fine speeding. Also, it was mentioned that in Tanzania they have put speed limiters on passenger transport. In Ghana there is a use of police check points, and traffic police are placed in several places along the road to inspect traffic.

All focus group participants emphasized that there is a need for more manpower and funding to effectively implement measures and increase the use of police enforcement. In general, there was some uncertainty as to whether the efficiency of the measures was evaluated over time.

Discussing road safety violations with the focus group participants, they emphasized a combination of both enforcement and education to change road user behaviour:

Are we doing enough enforcement? Are we doing enough education? I think in our country, behavior change...it is quite...for someone's behavior to change you need to do a lot. We need to keep talking about the same thing over and over again. Sometimes you have to punish people, sometimes you just need to educate them.

In the following, we will discuss workshop participants' views on road user education.

Formal driver training. The study presupposes that national RSC, defined partly as our expectations of other road users, to some extent can be "normalized" in formal driver training. Based on the focus group discussion it seems that there is great belief in driver training as means to change behavior.

Work shop participants stated that there is lack of knowledge of traffic rules by all road users, also vulnerable road users. It is also an issue that road users do not consider the traffic rules as adhering to them. Especially, lack of licensing and formal training of motorcyclist is regarded as an issue:

"They [motorcyclist] don't know traffic rules or think it does not adhere to them".

Several participants emphasized the need for the combination of increased enforcement, training and licensing to change behavior.

"Lack of formal training combined with weak enforcement of traffic rules contributes to traffic where can "do whatever they like".

Several of the participants discussed the level of driver education and whether the curriculum had sufficient focus on traffic safety.

"The road safety issues as far as I know, for instance, the driver, the driving schools now are only teaching how to drive cars. They don't have Road safety issues in the models, so most of the drivers are being given license without even knowing."Anything about road safety They just know how to ride the motorcycles. So, this is the area which we'll need to focus on."

Economy and socioeconomic factors. Several interviewees mentioned that working as motorcycle taxi riders have provided a way to avoid crime among young people. An increase in the demand for delivery services as well as passenger transport attracts especially younger drivers that want to make a living as a courier and/or motorcycle taxi. It provides employment to the youth and functions as an alternative to crime. Some of the interviewees viewed the motorcycles as an important contribution to transportation, as it provides first mile and last mile delivery. At the same time, it causes challenges for traffic safety.

"It has put many young people into jobs that otherwise would be causing havoc in our residences and so on, earning an income robbing people and so on ... So, it has created a lot of employment".

"The motorcycles are providing employment to the youth, which is beneficial to the country, but I think we need to put a limit on the number of motorcycles operating in specific areas."

5 Discussion

5.1 There are more African pedestrians who walk “because they have to”

The first aim of the study was to compare respondents in the African and European countries’ reliance on walking as a mode of transport, including why respondents walk, as a means of transport. We hypothesized that pedestrians in the African countries are more reliant on walking as a mode of transport, i.e. that they more often walk because “they have to”, compared with pedestrians in the European countries (*Hypothesis 1*). Results support this hypothesis: there is a significantly higher share of pedestrians in the African countries who answer that "I walk because I have no other choice". There are four times as many who totally agree with the statement in the African sample. The minutes spent walking on a typical day for the African respondents is twice as high as for the Europeans. Additionally, pedestrians in the European countries have twice as large a share of respondents who answer that "I walk for the pleasure of it".

On the other hand, the shares having walking as one of their main modes of transport is relatively similar among European and African respondents. This is not according to previous research. Previous studies show a higher reliance on walking as a mode of transport in the African countries (cf. Tulu et al 2013; Torfs et al 2021; Bantjes et al 2024). However, the similar share of walking as a main mode of transport among European and African respondents can be explained by the fact that this is a survey targeting pedestrians, not a study examining the most widely used modes of transport among representative populations. Thus, the respondents in the European sample were included (through self-selection) as they are pedestrians. European pedestrian respondents in the study were recruited through a survey of representative people in the capitals of the participating countries. People who never walk as a mean of transport, were filtered out. African pedestrian respondents in the study were recruited when they were walking on the street. Thus, we might expect that respondents in both African and European countries have walking as one of their main modes of transport. However, the main difference is, as expected, related to the higher share of pedestrians in the African country who “walk because they have no other choice” as mentioned above.

5.2 African respondents have a less pedestrian friendly infrastructure

The second aim of the study was to compare respondents in the African and European countries’ perceptions of their walking infrastructure, traffic and traffic safety culture. We hypothesized that pedestrians in African countries perceive their road infrastructure to be less pedestrian friendly, compared with pedestrians in the European countries (*Hypothesis 2*). Our results support this hypothesis. We made a sum score index measuring the level of pedestrian friendly infrastructure, and the score of European respondents was 16.3 points, while the score of African respondents was 11.1 points. The difference was statistically significant ($p < .001$). This result is in line with previous research. Tulu et al (2013) mention that the International Road Assessment Programme (iRAP) pointed out that 84% of roads with pedestrians in developing countries lack sidewalks (WHO 2013: 33). Another important road infrastructure challenge in LMIC countries is the lack of physical separation between vulnerable road users and motorised traffic. The World Health Organization (WHO) estimates that, globally, 88% of pedestrians traverse unsafe roads, which contributes directly to pedestrian injury and death.

5.3 African respondents have a less pedestrian friendly traffic safety culture

We hypothesized that pedestrians in African countries perceive the traffic and the traffic safety culture to be less pedestrian friendly, compared with pedestrians in the European countries (*Hypothesis 3*). Our results support this hypothesis.

A unique contribution of the present study is that we also compare the existence of pedestrian friendly traffic culture. Several studies of vehicle pedestrian collisions find that the risk of pedestrian accidents increase with increasing car driver violations, as well as pedestrian violations. Relevant car driver violations increasing the risk of pedestrian vehicle collisions are driving under the influence and over speeding (Chakravarthy et al 2007). We measure pedestrians' expected car driver violations in their country as descriptive norms, i.e. the level of violations (e.g. aggressive violations, drink driving, lacking seat belt use) that road users expect from other drivers in their country. Descriptive norms may influence behaviour by providing information about what is normal behaviour in traffic in their own country, thereby creating a "mild social pressure" to do as the others do (Cialdini et al 1990; Nævestad et al 2019). The general score among the European pedestrians was 7.9 points, while it is 10.8 among the African pedestrians ($p < .001$). This indicates a less pedestrian friendly traffic culture in the African countries, with a higher level of violations, although differences between all countries were substantial.

Moreover, pedestrians' road safety violations are likely to exist in a relationship to car driver violations (cf. Useche and Llamazares 2022), e.g. if there is a high level of aggressive violations among car drivers, this might lead to more aggressive violations among pedestrians, and vice versa, as these road users interact. The results from this study support this since it is a higher expected level of aggressive violations from car drivers in the African countries, and a significantly ($p < .001$) higher level of aggressive violations among the pedestrians in the African countries than in the European countries (6.4 vs. 5.2 points).

We also find, in accordance with *Hypothesis 3*, that pedestrians in African countries perceive the traffic environment (traffic volume and speed) to be less pedestrian friendly. The survey included questions about the speed of vehicles and the traffic volume, on the roads where pedestrians "usually walk", e.g. "The speed of vehicles/motorbikes is too high" and "The speed and amount of traffic creates a sense of danger for pedestrians". The percentage points agreeing in the African pedestrian sample is nearly the double of the score in the European pedestrian sample. This indicates more pedestrian friendly traffic for the European pedestrian respondents.

5.4 African pedestrians have a higher risk perception and are involved in more collision accidents with vehicles

The third aim of the study was to compare negative transport outcomes (accident involvement, risk perception, avoidance behaviour, transport poverty) among pedestrians in the African and European countries. It was hypothesized that pedestrians in African countries are more afraid of being involved in traffic accidents with vehicles compared with the European countries (*Hypothesis 4*). Our results support this hypothesis. African respondents had a significantly higher risk perceptions related to the roads where they usually walk: "the roads feel dangerous for walking" (nearly 60% of African respondents agreed) and they fear being hit by vehicles (nearly 80% of African respondents agreed). This is in accordance with previous studies (cf. Aceves-Gonzalez et al 2020).

It was also hypothesized that respondents in the African countries are involved in a higher level of pedestrian accidents involving a vehicle (*Hypothesis 5*). Our results support this hypothesis when it comes to accidents involving vehicles. Among European pedestrians, 7% had been involved in such an accident compared to 19% among the African respondents. The share of accidents without vehicles was higher among the African respondents, but not if we exclude "non-vehicle accidents" without

personal injury. Although the United Nations Economic Commission for Africa (UNECA) (2023) report that 38% of all African road traffic fatalities occur among pedestrians, we do not know the accident risk for African pedestrians. Comparing numbers of road fatalities per million capita in 2021, data from WHO (2024) indicate that the fatal road accident rate per capita is in average 8,4 times higher in the three African countries than in the three European countries. We do not see this pattern in our data. On the other hand, we do not examine fatal pedestrian accidents.

5.5 Transport poverty and its consequences

If someone is transport poor, it means that a person lacks mobility recourses to access work, education, health, and social networks.¹ Thus, transport poverty means that individuals' access to work, education, health etc. are limited because existing transport opportunities are too expensive, unsafe or inaccessible (Lucas et al 2016). There is a significantly higher share of pedestrians in the African countries who answer that "I walk because I have no other choice". In our data, we have seen that this particularly is related to the fact that the prevailing travel conditions are considered dangerous by the African respondents (cf. Lucas et al 2016). There were more African respondents who agreed that "I walk because I find that other means of transport are too dangerous" Thus, roads that are considered unsafe seems to be a cause of transport poverty among the African respondents.

We also asked about the consequences of transport poverty, for respondents who agreed that they walk because other alternatives are too expensive, dangerous, or non-existent. The results showed that over five times more of the African respondents agreed that their education opportunities have been impeded by transport poverty, compared with the European respondents. Additionally. The shares agreeing that too expensive, dangerous or non-existent transport alternatives had reduced their access to job opportunities was over twice as high in the African sample.

As noted, the largest difference between the African and European respondents' transport poverty, was related to perceived safety, i.e. that more African respondents walk because they have to, as other modes are perceived to be too dangerous. This indicates the importance of perceived safety as an aspect of transport poverty.

Perceived safety also limits the roads where the African pedestrians can walk. We refer to this as avoidance behaviour. Our results show that over half of the respondents in the African sample agreed that they avoid walking on many roads/streets in their city, because the traffic do not feel safe. The corresponding share among the European respondents was 13%. This indicates that perceived traffic safety confines the mobility of the African respondents to a much higher degree than for the European respondents (about five times more).

Finally, discussing transport poverty and pedestrian safety from a social justice perspective, it is important to note that avoidance behaviour also is an aspect of transport poverty, the same is accident involvement and risk perception. Thus, pedestrian safety is not only important from an environmental and public health perspective, but also from a social justice perspective (Chakravarthy et al 2007; Bantjes et al 2024).

5.6 Person-related versus system-related factors

The fourth aim of the study was to examine factors influencing negative transport outcomes, focusing on person-related and system-related factors. Several negative transport outcomes were examined in the study, e.g. accident involvement, risk perception, avoidance behaviour and transport poverty. It was hypothesized that a negative transport outcomes experienced by the African pedestrians are related to three important system-related factors: a) a less pedestrian friendly infrastructure, b) a less pedestrian friendly traffic situation (vehicle speed, number of vehicles), and c) a less pedestrian friendly traffic culture (*Hypothesis 6*). Results from our multivariate regression analyses by and large

¹ <https://accting.eu/what-does-transport-poverty-mean/>

support this hypothesis. Our index measuring pedestrian friendly infrastructure influenced all the negative transport outcomes, and it was clearly related to the variable European vs. African. This is in line with our result that the European countries score higher on the pedestrian friendly infrastructure index. The variables “vehicles have too high speed” (on the roads where I normally walk) and a traffic culture with a high level of violations also influenced pedestrians’ risk perception and avoidance behaviour. Pedestrians’ risk perception was a key variable influencing avoidance behaviour and transport poverty. This indicates the importance of the system level factors when comparing the situation of pedestrians across European and African countries. This is also a result of our design. We expected that the different levels of Safe system implementation in African and European countries would influence negative transport outcomes. Our research also indicates the importance of person-related factors predicting negative transport outcomes, e.g. sex, age, education. This is in accordance with previous studies (Chakravarthy et al 2007; Zhu et al 2013; McIlroy 2020).

It should also be mentioned that previous research has highlighted other more fundamental system-level factors like insufficient urban planning, less developed public transport system and poorer economy in African countries (Boateng 2021; Hoose 2021). These issues were also highlighted in the focus group interviews. Focus group participants stressed, for instance that poor public transport systems weaken the mobility of vulnerable road users, and that a lack of a viable organized public transport system contributes to more car driving and more congestion on the roads. Moreover, participants were also concerned that an insufficient public transport system, combined with improved family economy, leads to increased car ownership, which might increase the congestion on the roads even more.

5.7 Policy implications

The sixth aim of the study was to discuss ways to reduce road users’ negative transport outcomes, by focusing on the identified influencing factors. As noted, it is important to note that the person approach versus the system approach provides a simplification of the situation in the real world. Safe system countries accommodates both approaches. Strategies focusing on the person approach (education, information, enforcement) are included under the Safe system pillar “Safe road user”, while strategies focusing on the system approach are to a great extent included under the Safe system pillar “Safe infrastructure”. Both strategies are important in the Safe system approach, as well as the strategies subsumed under the six Safe system pillars.

As noted above, our results generally indicate the importance of system-level factors influencing negative transport outcomes in the studied African countries. These system level factors are: 1) Pedestrian friendly infrastructure, 2) Pedestrian friendly traffic, 3) Pedestrian friendly traffic safety culture, 4) The Sociocultural position of pedestrians in the society.

Creating a pedestrian friendly infrastructure. Our survey data indicates less developed safe system solutions in the road infrastructure in the African countries. African pedestrians score significantly lower on the index measuring pedestrian friendly infrastructure. Our fieldwork data indicate that the roads and road infrastructure in the African countries are to a lesser extent than in the European countries, adapted to vulnerable road users. There is seldom physical separation between cars and pedestrians, neither on high-speed roads, which may go through village areas with children in and around the roads. Additionally, pedestrians walk along roads with high-speed vehicles. Improving the infrastructure, making it more pedestrian friendly, is likely to reduce negative transport outcomes for pedestrians, but this is, however, resource demanding.

Creating a pedestrian friendly traffic. Fieldwork data indicate a more congested, chaotic, hectic and unregulated traffic picture in the African countries than in the European countries. There is a high level of congestion at rush hours. Especially in Tanzania (Dar es Salaam), the situation on the main roads resemble a “race to get ahead”, with everyone trying to get ahead as fast as possible. This creates a lot of overtakings and manouverings in traffic, and a relatively chaotic traffic picture, with

aggressive violations, e.g. using the horn to indicate “aggression to other road users”. Both Boateng (2021) and Hoose (2023) relate this to *land use and low level of urban planning*:

“(…)the most important reason for the traffic situation is structural and a result of decades of no, or, at best, insufficient urban planning. Rapid urbanization with almost no governmental regulation and land-use planning has led to a situation where residential areas move further away from workplaces, which are mostly located in the centre of Accra. This results in high amounts of people that must commute a substantial distance to get to work every day.” (Hoose 2021)

Both Boateng and Hoose also emphasize the *lack of a viable organized public transport system*, which leads to a high level of car drivers (Boateng 2021; Hoose 2023). Thus, improvement in land use and urban planning, including the implementation of an organized public transport system, are relevant measures to create a pedestrian friendly traffic (in addition to infrastructure measures).

Creating a pedestrian friendly traffic safety culture. The survey indicates less pedestrian friendly traffic safety culture in the African countries, because of the higher level of car driver violations. This is an issue that could be addressed by more efficient enforcement in the African countries. Another relevant measure is to provide information and education to car drivers, to teach them about the situation and needs of pedestrians, aiming to make the car drivers drive more careful and slower around pedestrians, stop for them etc. This is also likely to reduced pedestrians risk perception, which we have seen is related to avoidance behaviour.

Improving the Sociocultural position of pedestrians in the society. The survey shows a clearly different social status for pedestrians in the European sample than in the African sample. The survey included the statement: “People who drive a car to their job is respected more than people who walk to their job”. In the African countries, 70% agreed, while 10% agreed in the European countries. We can speculate that this is related to the status of cars as a sign of wealth in the African countries, indicating high socioeconomic status. Thus, driving a car resembles what Torstein Veblen refers to as “conspicuous consumption”, i.e. a public display of income and social status. In the European countries, it can be argued that the situation is opposite, driving a car to work is not a practice which gives high social status, but the other way around, as the car is viewed as a source of pollution, and as social status is attributed to physical activity and fitness. In Western countries, the concept of “bodily capital” has been coined to explain the value generated from appearance, attractiveness, and physical ability (Hutson 2013). We may speculate that conspicuous consumption in the studied European countries is more related to investing in bodily capital through e.g. walking. This gives pedestrians a more favourable social position in society in the European than the African countries. In the latter, we may speculate that walking to a greater extent indicates poverty (i.e. not owning a car). This is of course a simplification, as respondents in the African countries also reported that they walk for exercise and for pleasure. However, these factors may shed light on the difference noted above. Additionally, walking is to a greater extent acknowledged as a separate mode of transport in the European countries, both by citizens and stakeholders, along with car driving. This has implications for the construction of pedestrian friendly infrastructure, how car drivers interact with pedestrians, the sociocultural status of walking etc. Relevant measures to improve the Sociocultural position of pedestrians in the society would be to provide information and education to both stakeholders (politicians, city planners etc.) and citizens stressing that walking is a separate mode of transport, with benefits for health, environment and safety. However, as we have seen such measures should be combined with infrastructure measures and measures to improve pedestrian safety in the African countries, as many of these pedestrians have a high risk perception and avoid walking in several areas, as they fear traffic accidents.

5.8 Methodological weaknesses and strengths

1) Comprehensive survey safety data are rarely available. The study contributes with new knowledge. There are few studies linking cultural factors with road safety, and even fewer studies

comparing road safety culture across African and European countries. And there are as far as we know, no studies comparing RSC among both car drivers and pedestrians in both European and African countries. Additionally, comprehensive survey safety data are rarely available from African countries (UNECA, 2015).

2) Positively worded questions are excluded. It must be mentioned that positively worded questions are excluded from our presentation of results in this deliverable. We originally included positively worded questions among the survey questions measuring descriptive norms. These are about what kind of behaviours respondents expect from drivers in their country e.g. “That they always stop for pedestrians who want to cross the road”, “That they always slow down, or drive more carefully, when there are pedestrians at the side of the road”, “That drivers with small children (under 3 years) in the vehicle always have children in a separate child seat, where they are buckled up”, “That they always drive more carefully (e.g. yield, keep a safe distance) around motorcycles”. These questions were based on fieldworks and focus group interviews. There were also positively worded questions about pedestrian safety behaviours.

The challenge with these questions was that they are positively worded, and they follow negatively worded questions in the survey. Thus, several respondents commented that they had not realized the opposite wording before after they had finished the survey, and that they had “answered wrong”, or the opposite of what they intended. They recommended us to discard their answers on these questions. Looking at the results, we saw that the results were contrary to what we expected: drivers in the African countries came out as more pedestrian friendly than drivers in the European countries etc. This is in sharp contrast to our field work experiences: drivers in the African countries were less inclined to stop for pedestrians than European drivers. This tendency is also reflected in the negatively behaviour question about this in the survey. Thus, we do not present results for the positive behaviour questions in the survey.

3) Conceptualization and Specification of the Main Variables. A limitation of the study is that the main variables were measured by means of a relatively small number of questions. This applies, for instance, to the pedestrian safety violations scale and the different measurements of national RSC. We specified national RSC as shared patterns of behaviour and descriptive norms, based on a few key DBQ items that had been found important in previous research, e.g. our pilot study in Ghana (Nævestad et al 2024). The most important reason that we operationalized several of the main variables using a relatively small number of items is that the study in general includes a relatively high number of variables. The relatively low numbers of items to measure the survey constructs is due to the many themes that we wanted to cover in the survey. We therefore limited the number of items measuring each of the main variables, to avoid a too high total number of questions in the questionnaire. Going further to measure some of the issues more in detail is an important issue for future research.

4) Representativeness of the Samples and possible self-selection in Europe. All the national samples have been drawn from representative populations. The European samples have been drawn from representative panels, and the African samples have been recruited from different city areas at different times. African pedestrian respondents in the study were recruited when they were walking on the street. European pedestrian respondents in the study were recruited through a survey of representative people in the capitals of the participating countries. People who never walk as a mean of transport, were filtered out. Given that the survey was addressed to car drivers or pedestrians, we could perhaps assume there to be some self-selection among the European respondents, i.e. that people who walk often were more motivated to answer a survey about walking.

5) Self-Reported Data. The study is based on self-reported data, which could be influenced by respondents’ memory, truthfulness, and social or psychological biases that may influence reporting. As noted by Nævestad et al. (2017), comparing cross-cultural samples is challenging, as different national samples may be influenced by different baselines, and as expectations may vary between

national samples. The levels of experience with surveys and trust in anonymity may vary between national samples. It is difficult to conclude about the importance of this.

6) Survey response quality. We have filtered out 353 respondents who answered the survey in a shorter time than 2,5 minutes, as the speed of respondents' survey response time is an established measure of survey response quality (Huang et al 2012; Zhang and Conrad 2014). The basis for this, was that a response time of less than 2,5 minutes involves a very fast reading of the survey questions, and perhaps inadequate perception of the content of the questions. The survey questions are in several instances complex and probably require some contemplation. There are, however, no clear-cut lines of demarcation when it comes to assessing survey response quality, but research has been done on the issue (Huang et al 2012; Zhang and Conrad 2014). This research generally conclude that it is difficult to establish threshold times for survey speeding (i.e. for answering surveys too fast), especially since respondents are not likely to speed through all sequences of surveys, and as some respondents answer surveys very fast, without there being indications that their responses are of lower quality than others, meaning that they have not read the questions properly. One solution is to look for straightlining, which indicates that respondents have answered the same answer alternatives on all or many questions. Zhang and Conrad 2014) set the speeding threshold as 300 milliseconds (msec) per word, a rough estimate of reading speed, multiplied by the number of words in the question. The idea behind their approach is that when response times are faster than likely reading times, respondents are unlikely to have given the question adequate thought. Respondents generally use 7,5 seconds on average per survey question in surveys. In our survey with about 50 questions this equals about 6 minutes and 20 second on average. As noted, 353 respondents used less than 2,5 minutes to answer the survey. The majority of these were in the African countries. As noted, answering the surveys fast, would generally take approximately three minutes (about four seconds per question). With a threshold of 2.5 minutes, we take into account that some respondents answer very fast, and that although speeding may occur, it does not necessarily occur in all sequences of the survey. Although the decision to set a threshold value of 2,5 minutes was based on a reasonable principle, it did not have any practical implications for the results. We have conducted all the analyses in the study both including and excluding the respondents who used less than 2,5 minutes. Excluding or including these respondents have no implications for the bivariate results and minor implications for the multivariate results. This is also noted by Zhang and Conrad (2014), who perform multiple analyses of survey data including and excluding speeding respondents.

5.9 Issues for future research

5.9.1 There is a need to measure traffic safety culture related to pedestrians

Based on qualitative fieldwork data, we have described types of road safety behaviour and road safety culture which seem to be important in the studied African countries. We describe this as a hectic, chaotic traffic safety culture, with a high number of conflicts and near misses. There were high numbers of pedestrians walking along the road and trying to cross the road several places or running to escape an oncoming vehicle. We also found the same hectic traffic environment in the other African countries we visited. As this type of interaction created a great deal of conflicts and near misses, we also presuppose that it also creates many traffic accidents. Vulnerable road users are particularly at risk in this traffic culture, as they do not have a separate infrastructure and often lack places to safely cross the road. Thus, this hectic and chaotic traffic culture could be part of the explanation for the higher fatality rate in the African countries.

To measure the interaction between car drivers and pedestrians, we included several questions about the cooperation between pedestrians and car drivers, measuring descriptive norms, in the survey. These questions were, however, positively worded, and they followed negatively worded questions to the respondents, and results on these questions had to be discarded. Results were contrary to what

we expected: drivers in the African countries came out as more pedestrian friendly than drivers in the European countries. This is in sharp contrast to our field work experiences. The topic is, however, not less important and future studies should examine this with better tools than we were able to construct.

5.9.2 There is a need to include more types of pedestrian behaviour

Future studies should also examine more types of pedestrian behaviours, e.g. pedestrians' dangerous crossing behaviour, as well as more types of car driver behaviours, e.g. car drivers' speeding or lacking respect for pedestrians who wants to cross the road (e.g. not stopping at zebra crossings). These are important areas for future research.

5.9.3 Other reason among European pedestrian

We asked pedestrians about why they walk, focusing on e.g. "because I have to", "for pleasure", and "I walk because of other reason". Among the respondents who answered "I walk because I have to", we asked why they have to, as a follow up question, focusing on, e.g. "I walk because other means of transportation are too expensive", "I walk because I find that other means of transport are too dangerous", "I walk because there are no other means of transportation in my area", "I walk because of other reason"

The share who answered "other reason" was 20 percentage points higher in the European sample, compared with the African sample. A share of 54% agreed with this in the European sample of pedestrians. Respondents had the opportunity to specify this in a free text field. The three most common categories of answers were related to: 1) exercise, 2) lacking car/license, 3) lacking public transport all the way. Typical answers mentioned by e.g. Norwegian respondents were, e.g. "I don't have a car, or car licence", "distances are very short", "fresh air", "for exercise", "because I like it", "It is fun", "faster", "there is no public transport to my home", "I need it because I sit all day in my work". Many of these answers are not related to transport poverty, but exercise. However, lack of car and licence are related to transport poverty. Examining these issues further in a European context is an interesting topic for future research.

5.9.4 Conflicts between vulnerable road users in Europe

Results showed that among the European pedestrians, there were nearly three times who agreed with this statement that they fear being hit by bicycles and two-wheelers, compared with the statement about being hit by a vehicle. Moreover, African respondents had a far higher fear of being hit by a vehicle when they were walking compared with the European respondents. These differences are related to different levels of Safe system implementation in the two groups: European respondents do not fear being hit by vehicles to the same extent, as the road infrastructure protects them more from vehicles, than the road infrastructure protects the African respondents from vehicles. However, European pedestrians to a great extent share the pedestrian infrastructure with bicycles, and this influences their risk perception. This is an important issue for future research in European countries, and it might also indicate future challenges when more pedestrian friendly infrastructure is developed in African countries.

6 Conclusions

Several negative transport outcomes were examined in this study, e.g. accident involvement, risk perception, avoidance behaviour and transport poverty. We have seen that the African pedestrians are worse off than the European respondents on all these negative transport outcomes. Our results indicate that this is related to a lacking implementation of Safe system implementation in the African countries, more specifically: a) a less pedestrian friendly infrastructure, b) a less pedestrian friendly traffic situation (vehicle speed, number of vehicles), and c) a less pedestrian friendly traffic culture. Previous research has also highlighted other more fundamental system-level factors like insufficient urban planning, less developed public transport system and poorer economy in African countries. This indicates the importance of system level factors when comparing the situation of pedestrians across European and African countries. Our results indicate that Safe system implementation in the studied African countries is likely to negative transport outcomes. Doing this is, however, contingent on resources.

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8 References

Academic Expert Group (2020) 'Saving lives beyond 2020: the next steps'. Recommendations of the Academic Expert Group for the 3rd Global Ministerial Conference on Road Safety.

https://www.roadsafetysweden.com/contentassets/c65bb9192abb44d5b26b633e70e0be2c/200113_final-reports_ingle.pdf

Aceves-González, C. K. Ekambaram, J. R Galindo & L. Rizo-Corona (2020) The role of perceived pedestrian safety on designing safer built environments, *Traffic Injury Prevention*, 21:sup1, S84-S89

Bantjes J, du Plessis S, Jansen A, Slabbert P. Pedestrian safety: Motorists' attitudes to the law and driving practices in South Africa. *S Afr J Sci.* 2024;120(1/2)

Bil24 (2023) <https://bil24.no/kjorte-med-7-aring-pa-tanken>

Bjørnskau, T.; Sagberg, F. What do Novice Drivers Learn during the First Months of Driving? Improved Handling Skills or Improved Road User Interaction? In *Traffic and Transport Psychology Theory and Application*; Underwood, G., Ed.; Elsevier: Amsterdam, The Netherlands, 2005; pp. 129–140

Boateng, F. G. (2021) Why Africa Cannot Prosecute (Or even Educate) Its Way out of Road Accidents: Insights from Ghana (January 14, 2021). *HUMANITIES AND SOCIAL SCIENCES COMMUNICATIONS*

Chakravarthy B, Lotfipour S, Vaca FE. Pedestrian injuries: emergency care considerations. *Cal J Emerg Med.* 2007 Feb;8(1):15-21. PMID: 20440388; PMCID: PMC2859736.

Cialdini, R.B.; Reno, R.R.; Kallgren, C.A. A focus theory of normative conduct: Recycling the concept of norms to reduce littering in public places. *J. Person. Soc. Psychol.* 1990, 58, 1015–1026

Damsere-Derry, J. E. K. Adanu, T. K. Ojo, E. F. Sam (2021) Injury-severity analysis of intercity bus crashes in Ghana: A random parameters multinomial logit with heterogeneity in means and variances approach, *Accident Analysis & Prevention*, Volume 160,

Green, M. C. Muir, J. Oxley, A. Sobhani (2022) Safe System in road safety public policy: A case study from Victoria, Australia *IATSS Res.*, 46 (2022), pp. 171-180

Greszki, R. M. Meyer, H. Schoen, (2015) Exploring the Effects of Removing “Too Fast” Responses and Respondents from Web Surveys, *Public Opinion Quarterly*, Volume 79, Issue 2, Summer 2015, Pages 471–503

Guldenmund, F.; Cleal, B.; Mearns, K. An exploratory study of migrant workers and safety in three European countries. *Saf. Sci.* 2013, 52, 92–99.

Hoose (2021) <https://www.uib.no/en/urbanenclavingfutures/150410/finding-ways-move-through-accra%C2%B4s-traffic>

Hutson, D.J. (2013) “Your body is your business card”: Bodily capital and health authority in the fitness industry, *Social Science & Medicine*, Volume 90, Pages 63-71

ITF (2016) 'Zero Road Deaths and Serious Injuries: Leading a Paradigm Shift to a Safe System'. OECD Publishing, Paris. <http://dx.doi.org/10.1787/9789282108055-en>

ITF (2022) The Safe System Approach in Action, <https://www.itf-oecd.org/sites/default/files/docs/safe-system-in-action.pdf>

Kummeneje, A.M. Torbjørn Rundmo, (2019) Risk perception, worry, and pedestrian behaviour in the Norwegian population, *Accident Analysis & Prevention*, Volume 133,

- Larsson, P., Tingvall, C. (2013). The Safe System Approach – A Road Safety Strategy Based on Human Factors Principles. In: Harris, D. (eds) Engineering Psychology and Cognitive Ergonomics. Applications and Services. EPCE 2013. Lecture Notes in Computer Science, vol 8020. Springer, Berlin, Heidelberg.
- Lucas, K. G. Mattioli, E. Verlinghieri, A. Guzman (2016) Transport poverty and its adverse social consequences Proc. Inst. Civ. Eng.–Transp., 169 (6) (2016), pp. 353-365
- McMahon, P. J., Zegeer, C. V., Chandler Duncan, Knoblauch, R. L., Stewart, J. R. & Khattak, A. J. (2001) An Analysis of Factors Contributing to "Walking Along Roadway" Crashes: Research Study and Guidelines for Sidewalks and Walkways Chapel Hill, NC 27599-3430: University of North Carolina Highway Safety Research Center.
- McIlroy RC, Kokwaro GO, Wu J, Jikyong U, Nam VH, Hoque MS, Preston JM, Plant KL, Stanton NA. (2020) How do fatalistic beliefs affect the attitudes and pedestrian behaviours of road users in different countries? A cross-cultural study. *Accid Anal Prev.* May;139:
- Nævestad, T.-O.; Phillips, R.; Levlin, G.M.; Hovi, I.B. (2017) Internationalization in Road Transport of Goods in Norway: Safety Outcomes, Risk Factors and Policy Implications. *Safety*, 3, 22
- Nævestad, T.-O.; Laiou, A.; Phillips, R.O.; Bjørnskau, T.; Yannis, G. Safety Culture among Private and Professional Drivers in Norway and Greece: Examining the Influence of National Road Safety Culture. *Safety* 2019, 5, 20.
- Nævestad, T.-O. E. F. Sam, J. Blom, A. Fiangor, L. E. Egner, R. Elvik (2024) Comparing national road safety culture among bus drivers in Norway and Ghana, paper presented at the African Transport Research Conference, Cape Town, South Africa, 5 – 7 March 2024
- Petridou E, Moustaki M. Human factors in the causation of road traffic crashes. *Eur J Epidemiol.* 2000;16(9):819-26. doi: 10.1023/a:1007649804201. PMID: 11297224.
- Reason J. (2000) Human error: models and management. *BMJ.* 2000 Mar 18;320 (7237): 768-70.
- Torfs, K., Delannoy Sh., Schinckus, L., Willocq, B., Van den Berghe, W. & Meesmann, U. (2021) Road Safety culture in Africa. Results from the ESRA2 survey in 12 African countries. ESRA project (E-Survey of Road users' Attitudes). Brussels, Belgium: Vias institute.
- Tulu, Getu Segni, Washington, Simon, King, Mark, & Haque, MD. Mazharul (2013) Why are pedestrian crashes so different in developing countries? A review of relevant factors in relation to their impact in Ethiopia. In O'Keeffe, B (Ed.) Australasian Transport Research Forum 2013 Proceedings. Australasian Transport Research Forum, Australia, pp. 1-18..
- Useche, S.A. & F. J. Llamazares, (2022) The guilty, the unlucky, or the unaware? Assessing self-reported behavioral contributors and attributions on pedestrian crashes through structural equation modeling and mixed methods, *Journal of Safety Research*, Volume 82, Pages 329-341
- Zhu, Motao; Zhao, Songzhu; Coben, Jeffrey H.; Smith, Gordon S. (2013) Why more male pedestrians die in vehicle-pedestrian collisions than females: a decompositional analysis, *Inj Prev.* 19(4):227-231
- The United Nations Economic Commission for Africa (UNECA) (2015)
- United Nations Economic Commission for Africa (UNECA) (2023) <https://www.uneca.org/road-safety>
- WHO (2013a) Global Status Report on Road Safety 2013 Supporting a Decade of Action. Geneva: World Health Organisation.
- WHO (2016) ROAD SAFETY IN THE AFRICAN REGION 2015, https://www.afro.who.int/sites/default/files/2017-06/Road_Safety_AFRO_for_web_0.pdf

WHO (2018) 'Global status report on road safety'. World Health Organization.

WHO, UN (2021) 'Global Plan: Decade of action for road safety 2021-2030'. World Health Organisation and the United Nations Regional Commissions.

WHO 2022. Available online: <https://www.who.int/news-room/fact-sheets/detail/road-traffic-injuries>

WHO (2023) Global status report on road safety 2023,
<https://iris.who.int/bitstream/handle/10665/375016/9789240086517-eng.pdf?sequence=1>

Zhang, C., F. Conrad (2014) Speeding in Web Surveys: The tendency to answer very fast and its association with straightlining, Survey Research Methods 8(2):127-135,