

# The Relationship Between Cycling Risk Perception and Skill Level of Different Age Groups

Fadi Alhomaidat\*, Valerian Kwigizile\*, Jun-Seok Oh\*, Ala Al-Fuqaha#, Sepideh Mohammadi#

\*Department of Civil and Construction Engineering  
Western Michigan University  
1903 W. Michigan Ave, Kalamazoo, Michigan, 49008  
email: fng5137@wmich.edu

# Department of Computer science  
Western Michigan University  
1903 W. Michigan Ave, Kalamazoo, Michigan, 49008  
email: ala.al-fuqaha@wmich.edu

**Keywords:** cyclist's skill level, perceived safety, questionnaire survey, urban cycling.

## 1 INTRODUCTION

Cycling is considered an alternative mode of transportation that has social, economic, and environmental benefits. Oja et al. [1] found that cycling regularly reduces relevant disease risk factors, such as cardiovascular problems, cancer, and obesity in middle-aged and elderly men and women. It was also found that walking and cycling minimize the cost associated with traffic crashes and congestion. Carbon emission from transportation can be reduced if cycling or walking are frequently used [2]. Researchers in the last two decades have intensively focused on the perceived risk factors of cyclists. Lawson et al. [3] stated that presence and quality of cycling infrastructure, road geometry, traffic operation, and regulation of the road environment are considered important a network-specific variables. Pooley et al. [4] pointed out that the lack of dedicated cycle infrastructure is a significant hindrance of cycling. Sanders [5] argued that traffic remains the most important anxiety for cyclists and potential cyclists. Cycle facilities change cyclists' perception on safety [6]. Furthermore, some scholars found that cyclists' perceptions and concerns are varied when they were asked to rank a driver's overtaking behavior [7]. Eventually, the aforementioned studies lead to the conclusion that there is no doubt cyclist's decision to use a bicycle on a regular basis as a mode of commuting is related to the presence of infrastructure, traffic, and other facilities in a network. Researchers have not focused sufficiently, on how bicyclist's safety is perceived at different skill levels, age groups, and gender. Therefore, this study examines the relationship of age and skill level on the ability to define hazards while cycling; namely, risk perception.

## 2 METHODOLOGY

This study employs a survey to capture risk factors perceived from cyclists. The survey includes cycling hazardous conditions identified from previous studies and by meeting members of Kalamazoo bicycle group. Risk factors were classified into three categories: infrastructure-related, traffic-related and facility-related. Several studies [8] [9] identified the different types of transportation infrastructure that affect bicycle safety such as bike lanes, bike paths, shared lane arrows, street lighting, bicycle specific signage, lack of bike lane continuity, high traffic volume, driver behaviors, unsafe riding habits of bicyclists, lack of bicycle route maps, pavement surface and low-angled grades reduce the risk of crashes. The survey contained three main questions that addressed the risk factors relating to cycling. The first question investigated the impact of twenty infrastructure related risk factors. The second question investigated the impact of seven traffic-related risk factors while the third one focused on the impact of twelve facility-related risk factors. The Likert scale with five levels (1 is least impact, 5 is most impact) was adopted in this survey, since near misses and collisions were found to influence cyclist's perception of traffic risks to varying degrees [5].

## 3 ANALYSIS

In May 2015, an online survey was disseminated to bicycle groups, students, and university faculty members who claimed to know how to ride a bike. There was a total of 256 responses to the survey, and 182 respondents (71.09%). This work is licensed under the Creative Commons Attribution 4.0 Unported License. To view a copy of this license,

visit <http://creativecommons.org/licenses/by/4.0/>.

of the total) completed the whole survey. In the sample, 24 participants who do not ride a bicycle were dropped out. Among 182 respondents, 61 percent were males and 39 percent were females.

Descriptive Statistics (DS) and Ordered Probit Model (OPM) were chosen for analyzing the survey responses. DS summarized the survey responses based on the sample group. OPM is a powerful tool in establishing probabilities related typically to ordinal dependent variables.

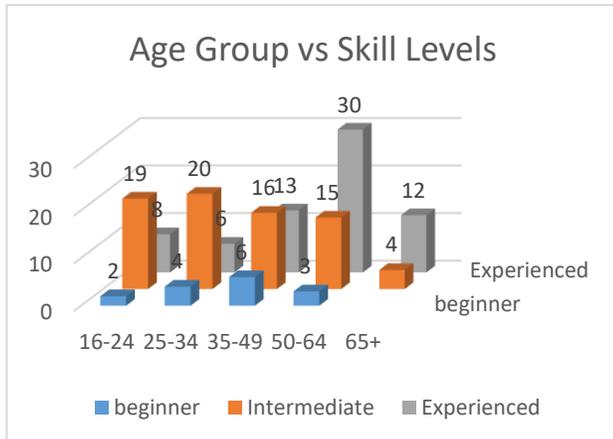


Figure 1: Age group vs Skill levels

Figure 1 shows participants’ demographics and self-reported skill level of cycling. The largest age group involved those aged 50 to 64. 30 percent of the participants who considered themselves experienced cyclists were male, while 8 percent of participants who placed with this group were female. 19 percent of total participants who considered themselves as intermediate cyclists were female, while 21 percent of participants who placed with this group were male.

The highest ranked hazards, based on the mean score for infrastructure-related questions, are shown in Table 1. The three highest perceived risk factors are potholes, lack of a dedicated bicycle lane, and pavement rutting. It can be noticed that there is a clear difference in the mean scores for beginners, intermediate, and experienced cyclists. Traffic-related facilities were ranked also based on mean score, aggressive driver behaviors, high speed traffic, and high traffic volume were the highest three perceived risk factors, respectively. Finally, debris, lack of signage devoted to bicycle, and lack of bike racks were the highest facility-related risk factors.

Table 1: Overall mean scores (Infrastructure-related) of different skill levels, age groups, and gender

Infrastructure – related (Top Four)	16-24	25-34	35-49	50-64	65+	Beginner	Intermediate	Experienced	Male	Female
<b>Potholes</b>	4.071 (1)	4.033 (1)	3.353 (3)	3.979 (1)	4.062 (1)	3.286 (4)	3.918 (1)	3.957 (1)	3.887 (1)	3.845 (1)
<b>Lack of dedicated bike lane</b>	3.571 (3)	3.9 (2)	3.441 (2)	3.625 (2)	3.375 (6)	3.786 (1)	3.726 (2)	3.435 (4)	3.505 (2)	3.759 (2)
<b>Pavement rutting</b>	3.231 (4)	3.655 (3)	3.176 (4)	3.542 (3)	4 (2)	3.769 (2)	3.38 (6)	3.522 (2)	3.406 (3)	3.571 (4)
<b>Pavement cracking</b>	3.607 (2)	3.31 (8)	2.824 (8)	3.417 (4)	3.875 (3)	3.077 (7)	3.288 (7)	3.464 (3)	3.247 (5)	3.526 (5)

Table 2: OPM (gender, age groups, and skill levels) significant finding of perceived risk factor at different level

Gender		Age group					skill-level		
Male	Female	16-24	25-34	35-49	50-64	65+	Beginner	Intermediate	Experienced
Raised lane markers, and Signs too close to roadway	-	-	lack of shared bicycle lane signs, Narrow bicycle lanes, Bus stop on bicycle lane, Aggressive driver behavior, and Lack of bike racks		unsmooth patches	parallel bars, Open Drainage Ditches, wide pavement joints, Steep sloped gutters, and Rumble strips	Narrow bicycle lanes, Bus stop on bicycle lane, unsmooth patches, pavement friction, Rumble strips, and Speed bumps	standing water, Lack of information about existing facilities, Curbside auto parking, Signs too close to roadway, Unpruned trees and overgrowing vegetation, and Poorly managed work zones	-

This work is licensed under the Creative Commons Attribution 4.0 Unported License. To view a copy of this license,

visit <http://creativecommons.org/licenses/by/4.0/>.

OPMs were used to develop a model for each hazard in each question. As shown in Table 2, statistically significant differences were observed between skill levels and twelve risk factors (narrow bicycle lane, bus stop on bicycle lane, unsmooth patches, pavement friction, and standing water, lack of information, rumble strips, speed bumps, debris, and poorly managed work zones). Age groups were significantly different in eleven risk factors (lack of shared sign, narrow bicycle lane, bus stop on bicycle lane, parallel bars, open drainage ditches, unsmooth patches, wide pavements joints, steep sloped gutters, aggressive drivers, rumble strips, and lack of bike racks). In addition, gender was significantly different in two risk factors (raised lane markers, and sign too close to roadway).

The results are presented that the beginner cyclists were more likely to perceive narrow bicycle lane, bus stop on bicycle lane, unsmooth patches, pavement friction, rumble strips and speed bumps as a hazard compared to the experienced cyclists. In other hand, age group 65+ considered parallel bars, open drainage ditches, wide pavement joints, deep sloped gutters, and rumble strips riskier than age group 16-24 as shown In Tables 1 and 2. Raised lane markers and signs too close to roadway are the only hazards that were perceived differently by the two genders.

#### 4 CONCLUSIONS

The survey addressed how cyclists perceived risk factors with respect to skill levels, age, and gender. Respondents perceived potholes to result in the severest risk factor in terms of infrastructure. Aggressive drivers' behavior was perceived to result in the severest risk factor in traffic-related factors. An OPM was used to analyze perceived risk factors among different skill levels, gender, and age groups. Gender was found to be statistically significant for two hazardous actions in facility-related factors; age group was found to be statistically significant for eight risks in infrastructure-related factors; and skill level was found to be statically significant for twelve risks. Therefore, age, gender, and skill level influence defining cycling risk factors.

#### REFERENCES

- [1] P. Oja, S. Titze, A. bauman, B. de Geus, P. Krenn, B. Reger-Nash and T. Kohlberger, "health benefits of cycling:a systematic review," *Scandinavian journal of medicin and science in sport*, vol. 21, no. 4, pp. 496-509, 2011.
- [2] E. Maibach, L. Steg and J. Anable, "Promoting physical activity and reducing climate change oportunities to replace short car trips woth active transportation," *Preventive medicine*, vol. 49, no. 4, pp. 326-327, 2009.
- [3] A. R. Lawson, V. Pakrashi, B. Ghosh and W. Y. Szeto, "Perception of Saety of Cyclists in Dublin City," *Accident Analysis & Prevention* , vol. 50, pp. 499-511, 2013.
- [4] C. pooley, M. Tight, T. Jones, D. Horton, G. Schedeman, A. Jopson and S. Constantine, 20101. [Online]. Available: [http://www.its.leeds.ac.uk/fileadmin/user\\_upload/UWCReportSept2011.pdf](http://www.its.leeds.ac.uk/fileadmin/user_upload/UWCReportSept2011.pdf).
- [5] R. L. Sanders, "Perceived traffic risk for cyclists: The impact of near miss and collision Experiences," *Accident Analysis & Prevention*, pp. 26-34, 2015.
- [6] M. Winter, S. Babul, H. J. Jack becker, J. R. Brubacher, M. Chipman, P. Crompton and K. Teschke, "Safe Cycling: How Do Risk Pereption Compare with Observed risk?," *Cansian Jurnal of public Heath*, vol. 103, 2012.
- [7] J. Parkin and C. Meyers, "The effect of cycle lanes on the proximity between motor traffic and cycle traffic," *Accident Analysis & Prevention*, vol. 42, no. 1, pp. 159-165, 2010.
- [8] C. Reynolds, M. Harris, K. Teschke, P. Crompton and M. Winters, "Exposure-based cycling crash, near miss and injury rates: The Safer Cycling Prospective Cohort Study protocol.," *Injury Prevention*, 2011.
- [9] C. Hamann and C. Peek-Asa, "On-road bicycle facilities and bicycle crashes in Iowa," *Accident Analysis & Prevention*, pp. 103-109., 2013.

This work is licensed under the Creative Commons Attribution 4.0 Unported License. To view a copy of this license,

visit <http://creativecommons.org/licenses/by/4.0/>.