

Construction Workers' Health and Safety: The Effect of Safety Boots on Comfort, Performance, Mobility, Musculoskeletal Disorders, Slips, and Falls

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August 2024

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Introduction

Introduction



- It is one of the most unsafe industries globally, accounting for 20% of workers' compensation claim costs in Canada (Anwer et al., 2021; WorkSafeBC, 2024).
- Safety boots are essential personal protective equipment for mitigating foot injuries in construction (OSHA, 2024; Dobson et al., 2017a).
- Safety boots often prioritize safety over comfort, performance, and mobility (Dobson et al., 2018).

Background

Background

Study	Findings	Limitations	Identified safety boot features for construction workers
Chander et al. (2016)	Slip-resistant shoes significantly reduce slipping incidents among firefighters.	Limited to firefighters; may not generalize to other occupations or different footwear types.	Slip resistance
Dobson et al. (2017a)	Boot design affects gait and could potentially influence the development of foot-related disorders.	Conducted in a controlled environment; may not apply to the real world.	Gait and discomfort
Janson et al. (2021)	End-users (both men and women) reported comfort and fit as critical factors in safety footwear.	Was not focused on the construction workers. Evaluated a limited number of the safety boots features.	Comfort and fit
Hsu et al. (2016)	Slip resistance varies significantly among different winter conditions (wet ice, dry ice, snow).	Laboratory setting; lacks real-world distractions and obstacles.	Slip resistance in different conditions
Bagheri et al. (2019b)	Most winter footwear performs poorly on icy surfaces.	Laboratory conditions; focused on a specific demographic (personal support workers).	Performance of safety boots and environmental factor
Dobson et al. (2017b)	Types of foot problems and locations of foot pain differed between the users of gumboot and lace-up boots.	Focused on underground coal miners; May not apply to other occupations or environments.	Specific foot problems and pain locations
Maidana-de Zarza et al. (2020)	Inappropriate footwear can cause muscle cramps, malleolar edema, and other foot issues.	Limited to nursing professionals.	General foot health, comfort, and potential MSD issues
Lee et al. (2023)	High prevalence of work-related musculoskeletal disorders among construction workers in China.	Other region and environmental conditions; findings may not generalize to other regions, countries, or environments.	MSDs and the overall health impact of safety boots

Objective

Evaluate the effect of construction workers' winter safety boots on comfort, performance and mobility, slips, falls, and MSDs due to slips and falls during winter in Canada

Methodology

Methodology

Observational Approach

Inclusion criteria: At least one year of experience as a construction worker and regularly wearing winter safety boots in winter in Canada

Exclusion criteria: Taking medication that causes dizziness, or experiencing similar conditions due to other health reasons

The 33-question survey was divided into four sections

Research Ethics Board approval

Pilot testing

112 participants filled out paper or online (Google Forms) questionnaires

Methodology

Data Analysis

Descriptive analysis

Univariate and
bivariate

Multivariate analysis

Binary logistic
regression model

Final models were
implemented with the
first category of each
predictor as the
reference

Descriptive Analysis Results

(univariate and bivariate)

Results

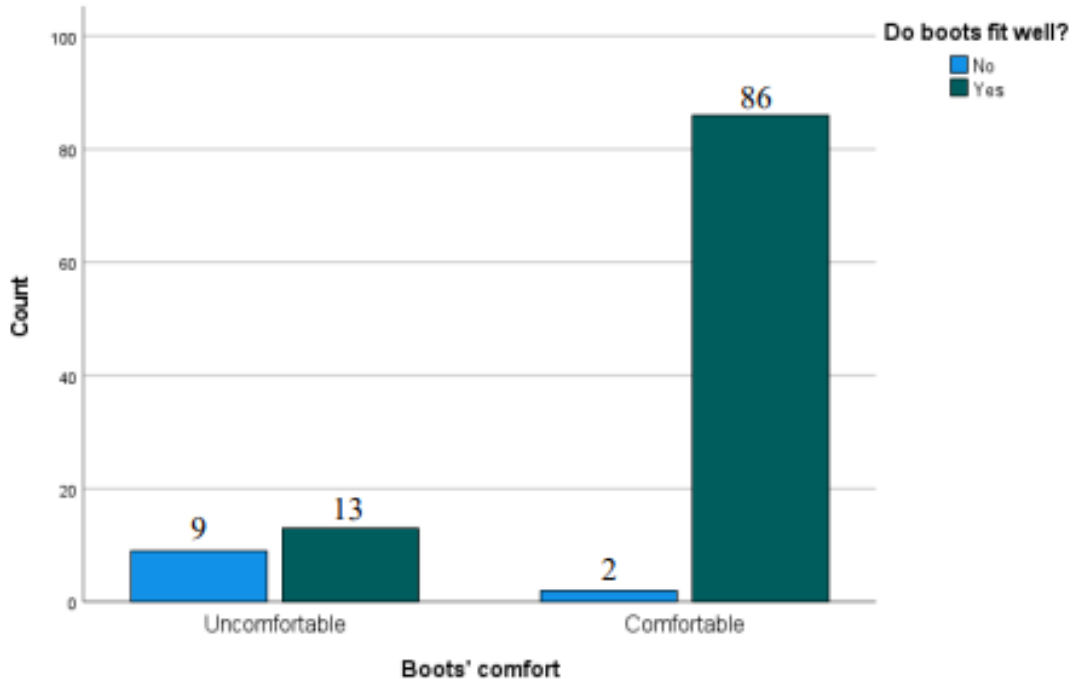
- The sample included 81.8% men and 18.2% women.
- 60.4%, were 40 years old or younger, while 39.6% were over 40 years old.
- 49.1% had been in their current job for five years or less, and 50.9% for more than five years.
- 74.3% wore their safety boots for more than eight hours (daily average).

Results

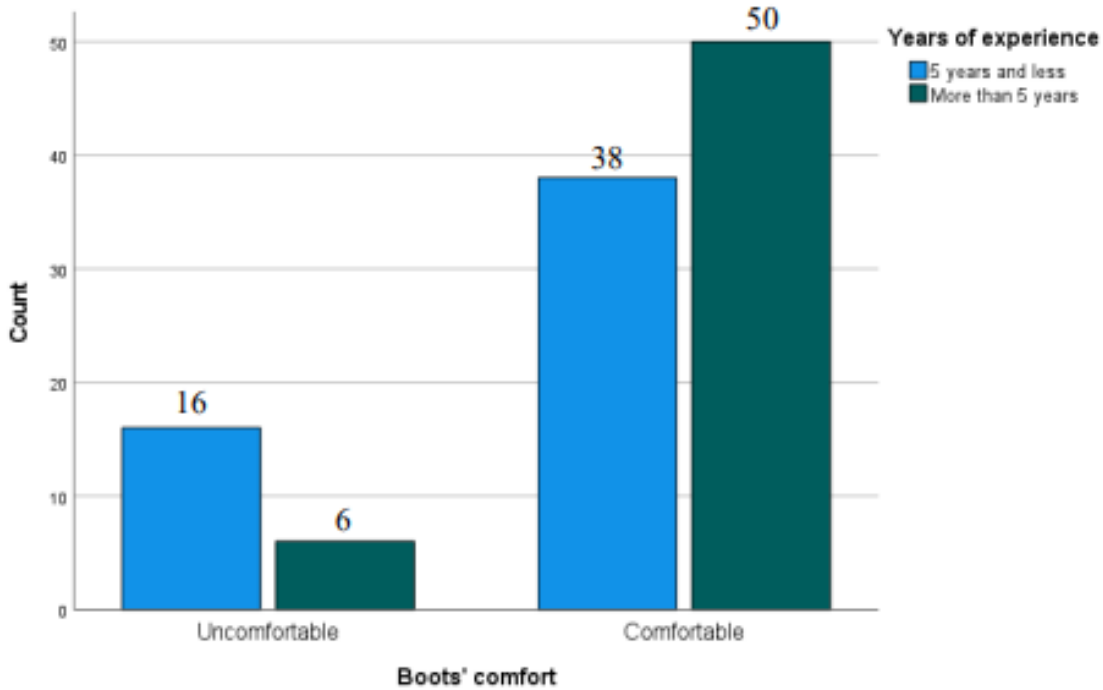
- 80% found their boots comfortable.
- 59.1% reported that their boots improved performance and mobility (walk and work).
- 29.4% reported foot discomfort lasting more than three months, 22.3% ankle discomfort, 12.6% knee discomfort, and 18.4% back discomfort.
- 57.8% and 28.2% experienced two or more slips and one or more falls over the past winter, respectively.

Comfort

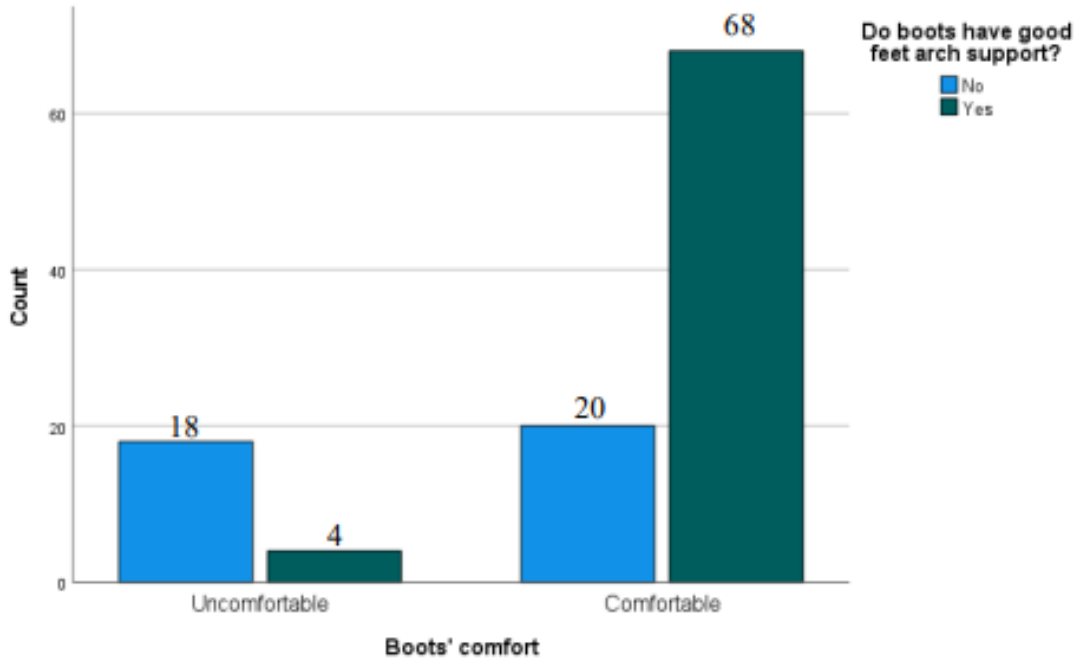
Descriptive frequency of the different factors that had significant associations with Comfort (1)



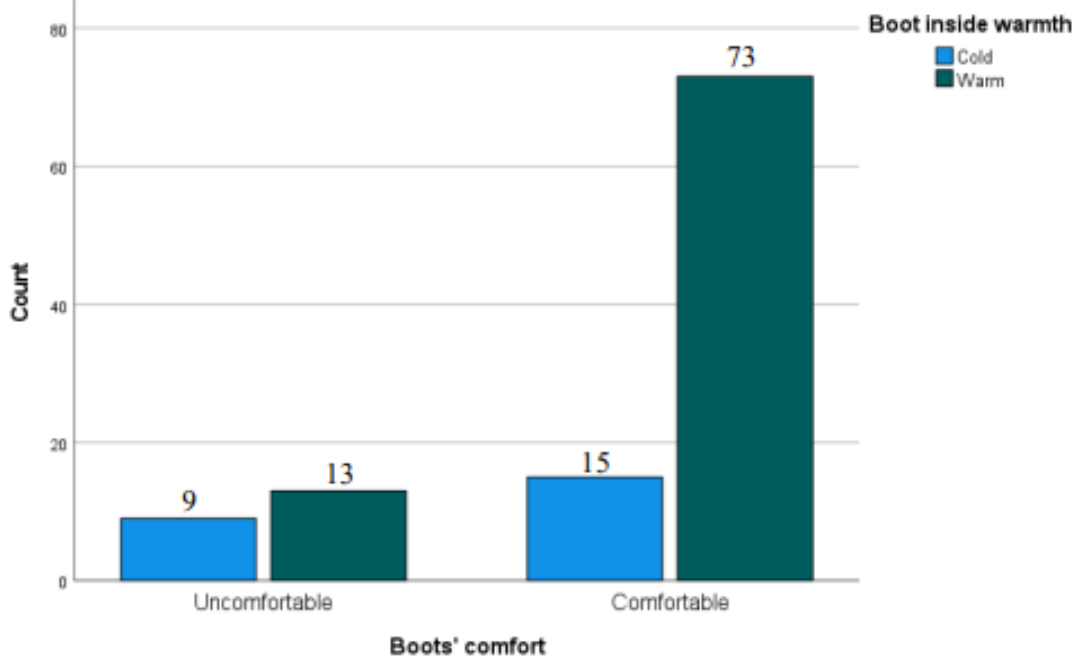
P-value < 0.001



P-value = 0.013

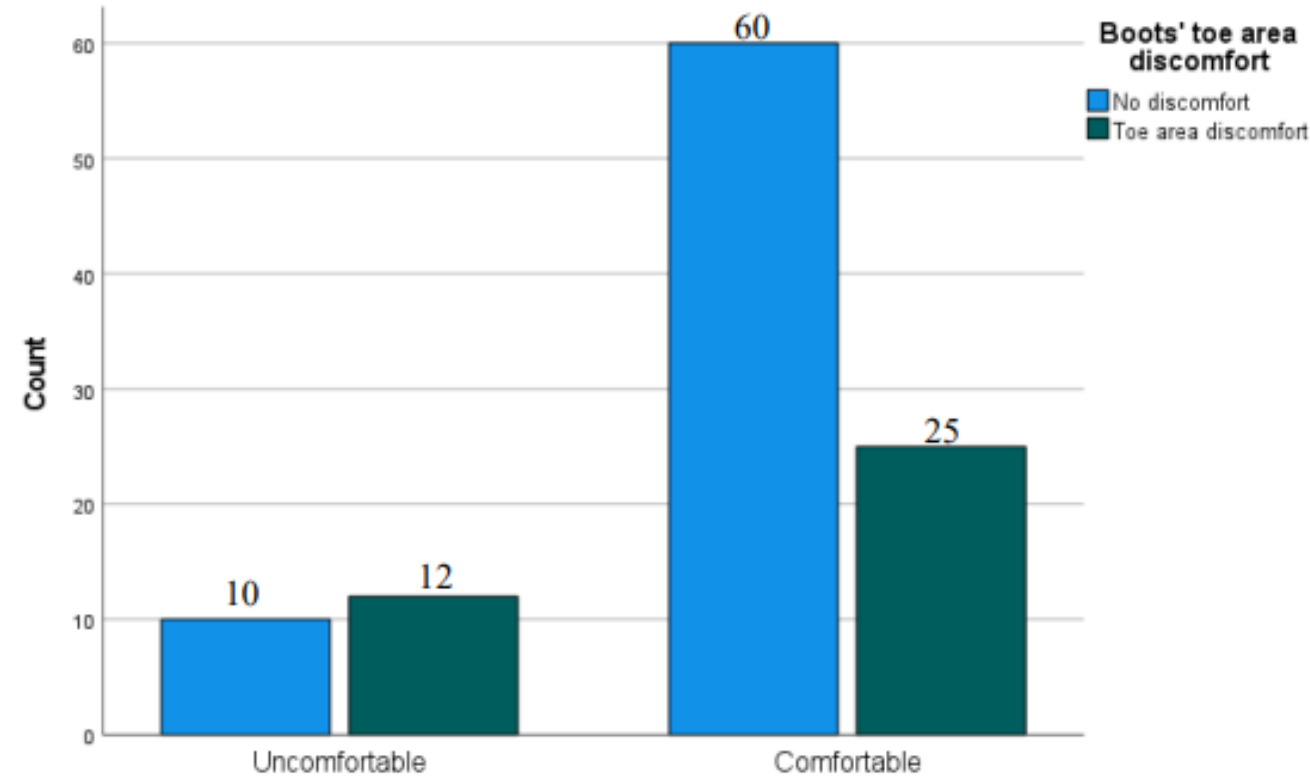


P-value = 0.001

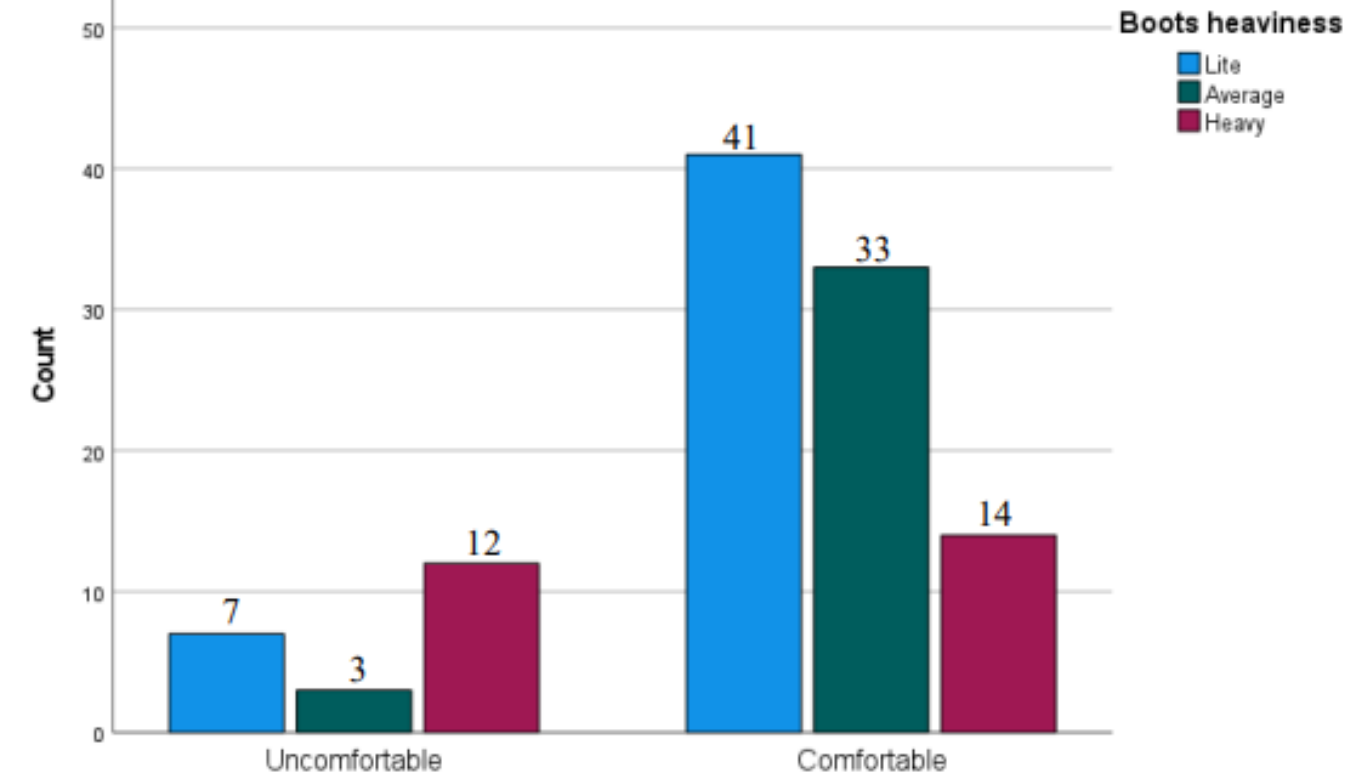


P-value = 0.015

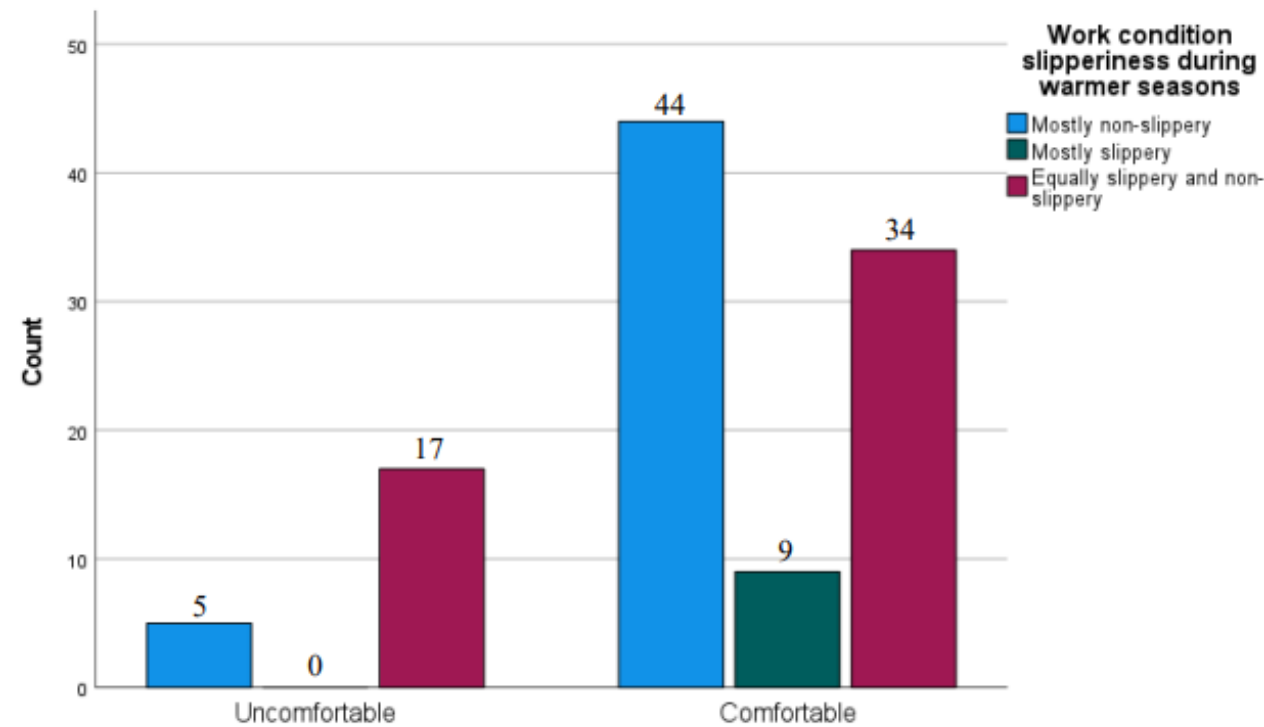
Descriptive frequency of the different factors that had significant associations with Comfort (2)



Boots' comfort
P-value = 0.027



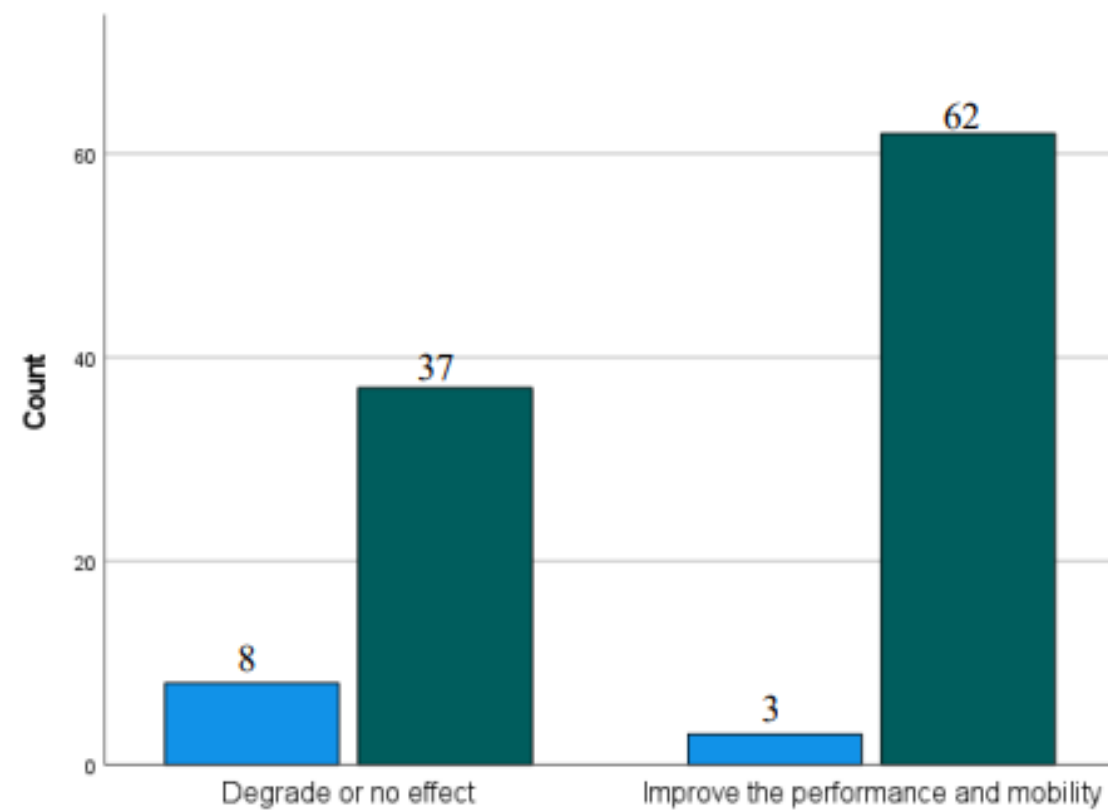
Boots' comfort
P-value < 0.001



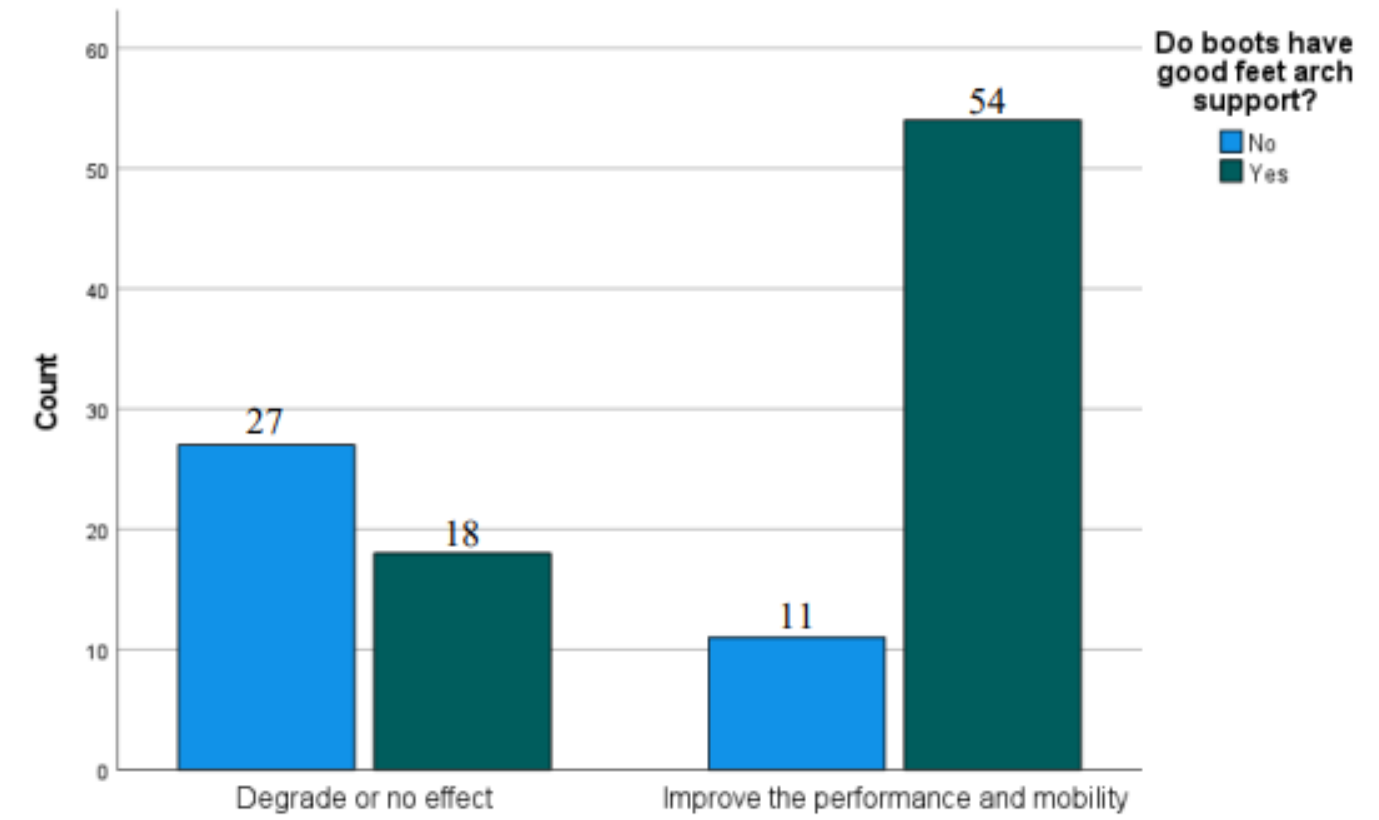
Boots' comfort
P-value = 0.005

Performance and Mobility

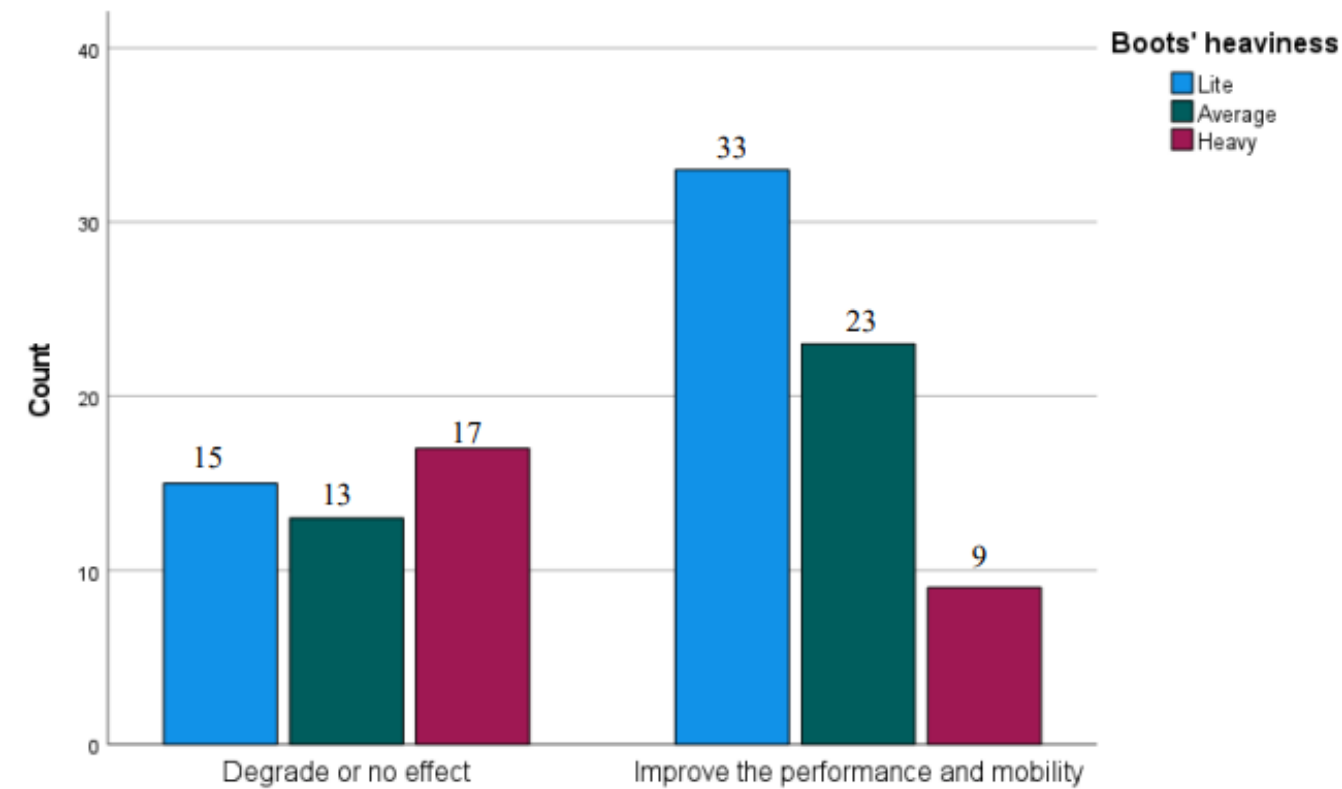
Descriptive frequency of the different factors that had significant associations with Performance and Mobility (1)



P-value = 0.024

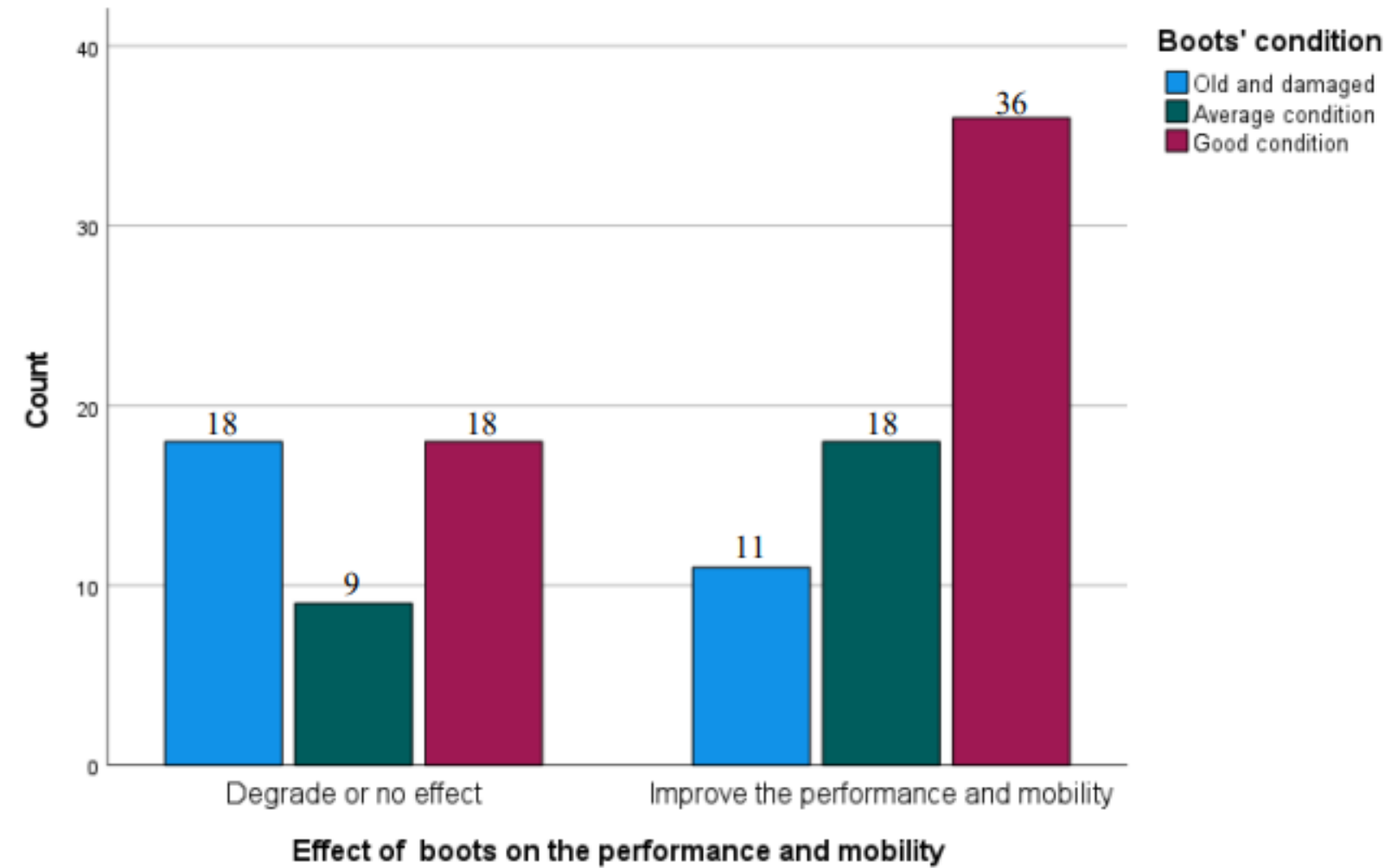


P-value < 0.001

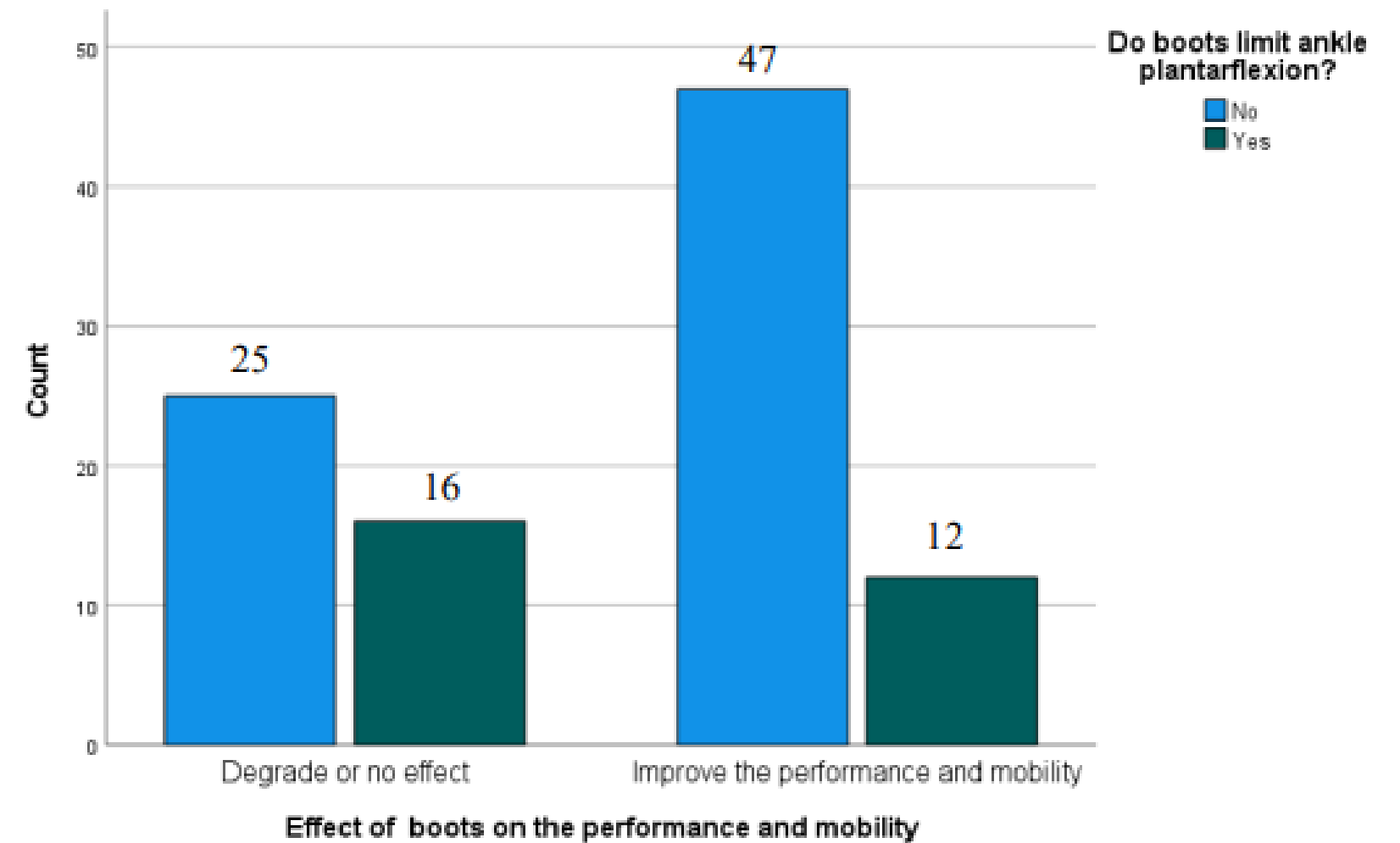


P-value = 0.013

Descriptive frequency of the different factors that had significant associations with Performance and Mobility (1)



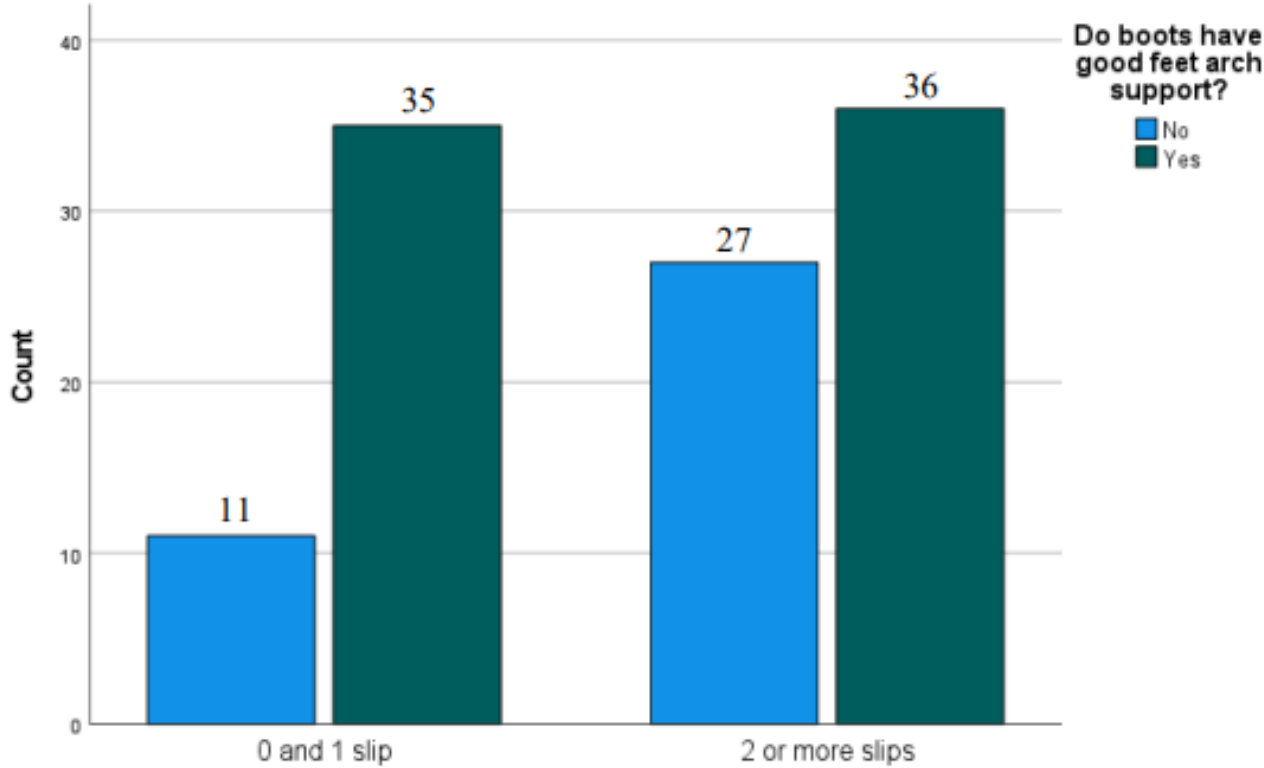
P-value = 0.026



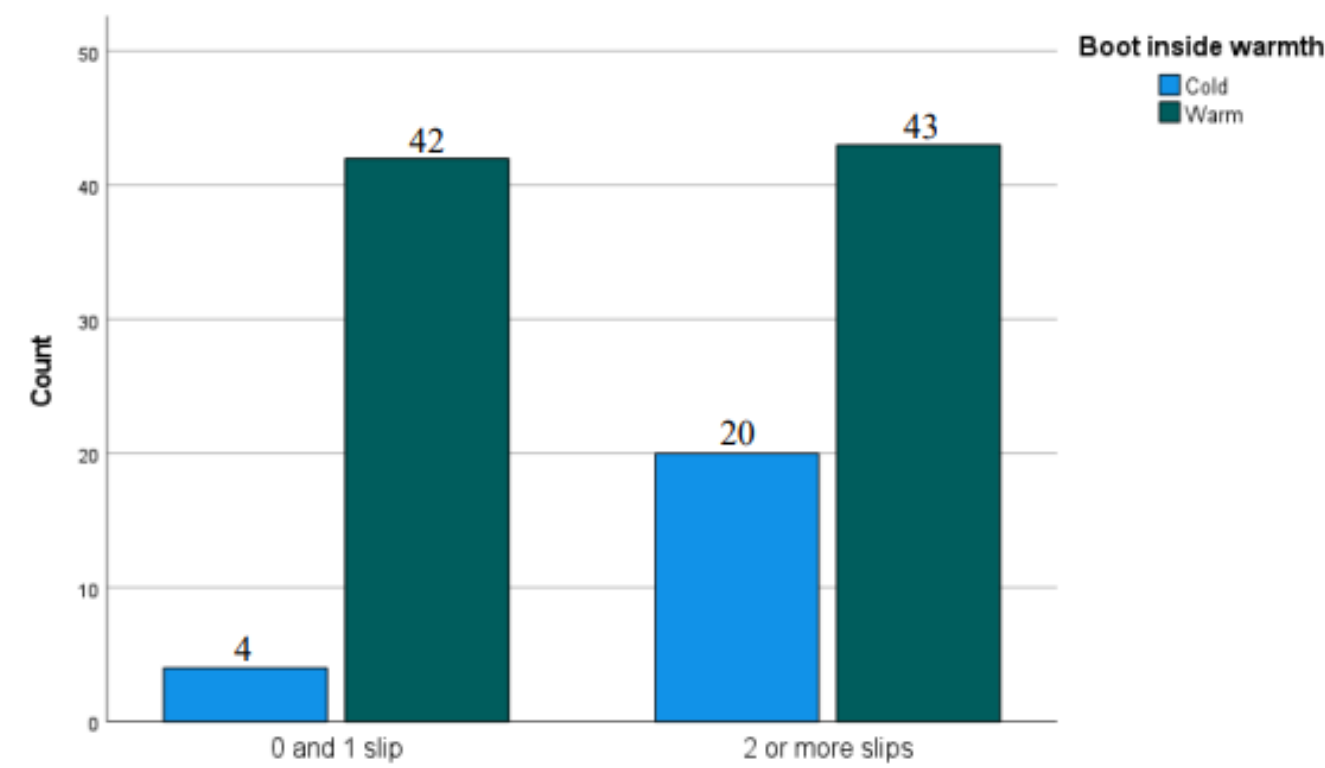
P-value = 0.041

Number of Slips

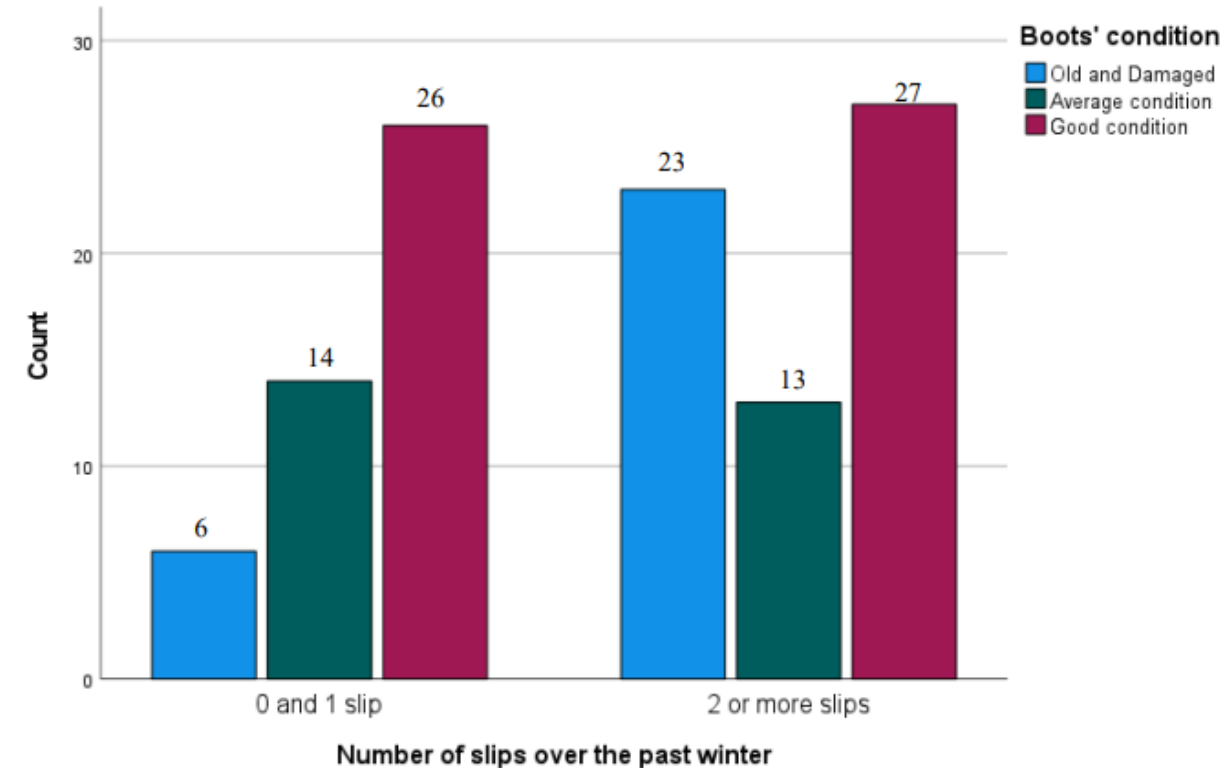
Descriptive frequency of the different factors that had significant associations with the Number of Slips (1)



Number of slips over the past winter
P-value = 0.040

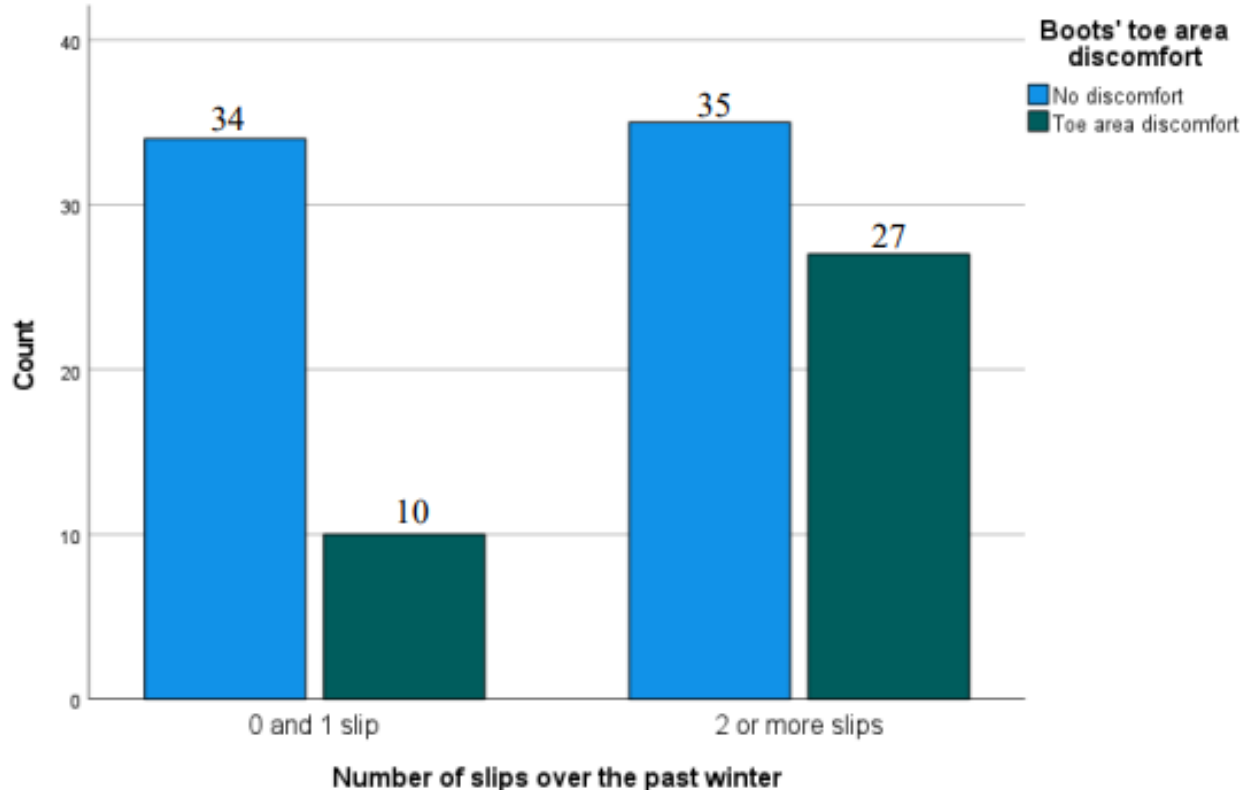


Number of slips over the past winter
P-value = 0.004

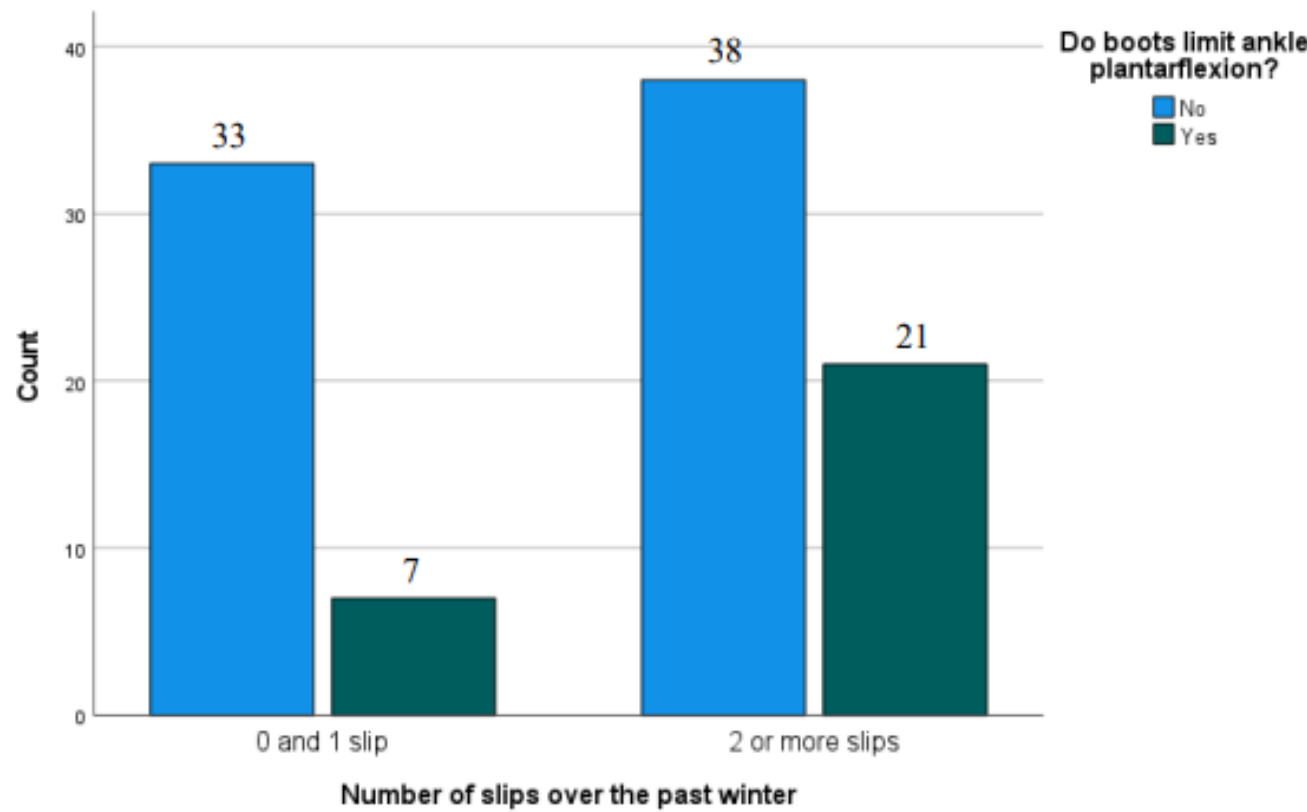


Number of slips over the past winter
P-value = 0.023

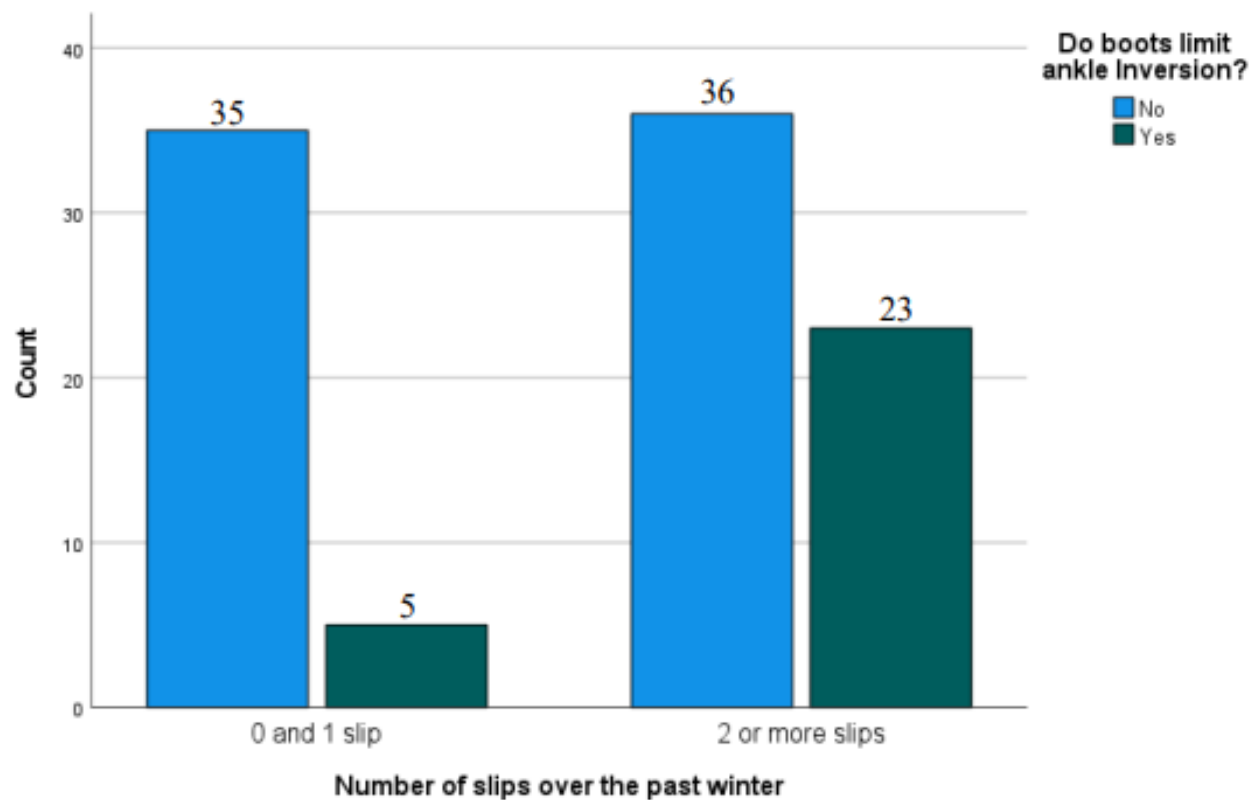
Descriptive frequency of the different factors that had significant associations with the Number of Slips (1)



P-value = 0.027



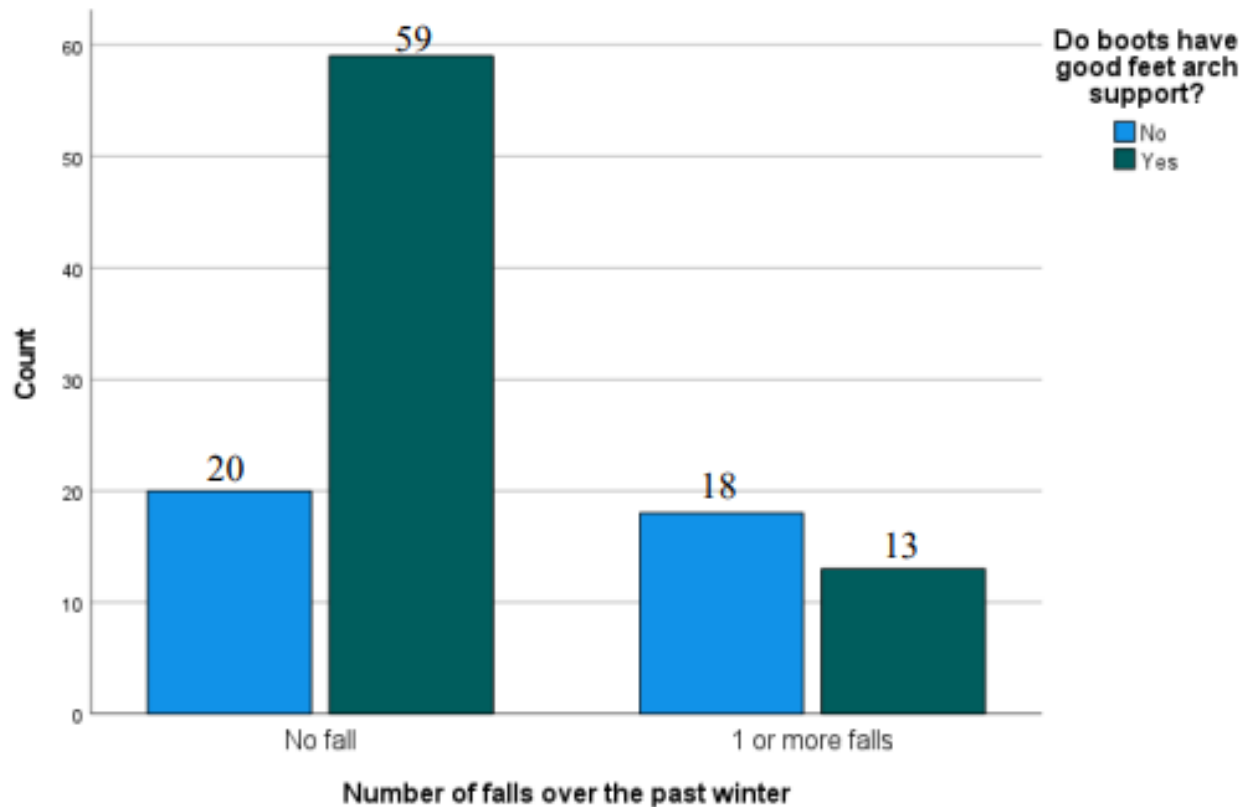
P-value = 0.050



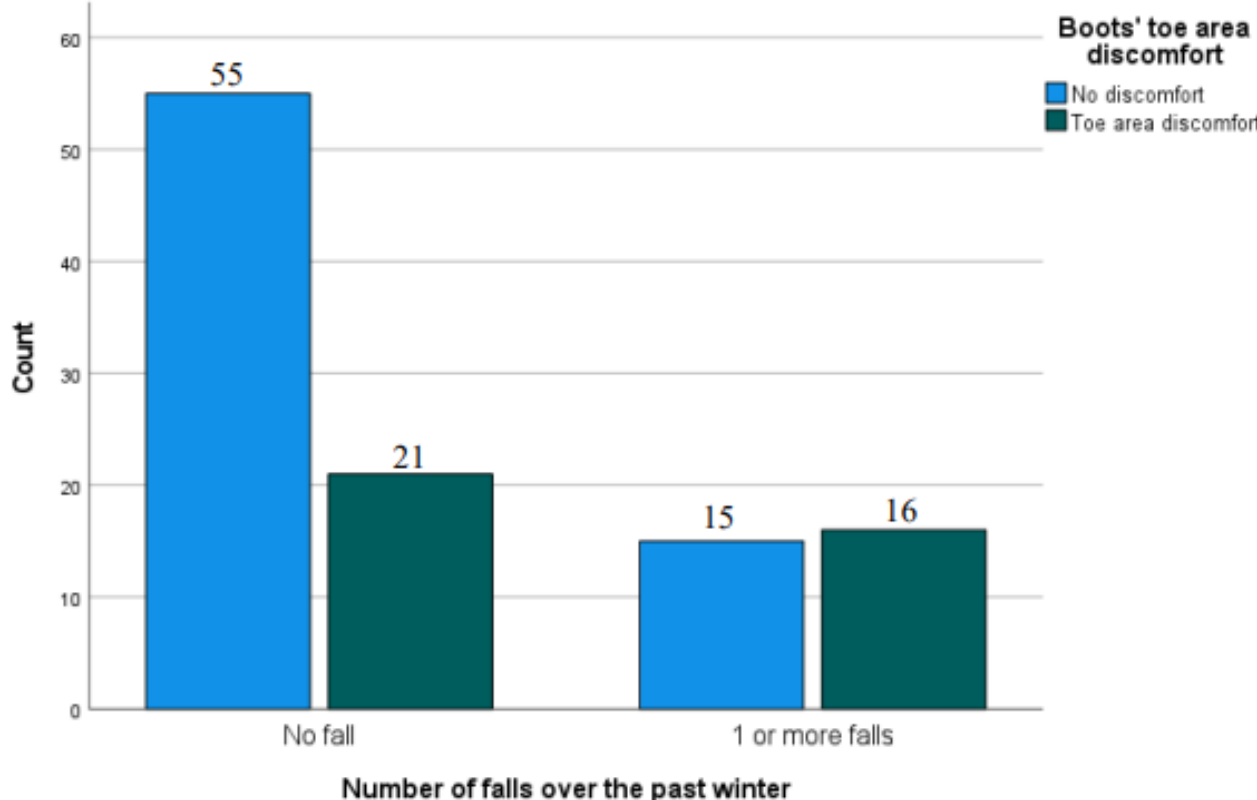
P-value = 0.004

Number of Falls

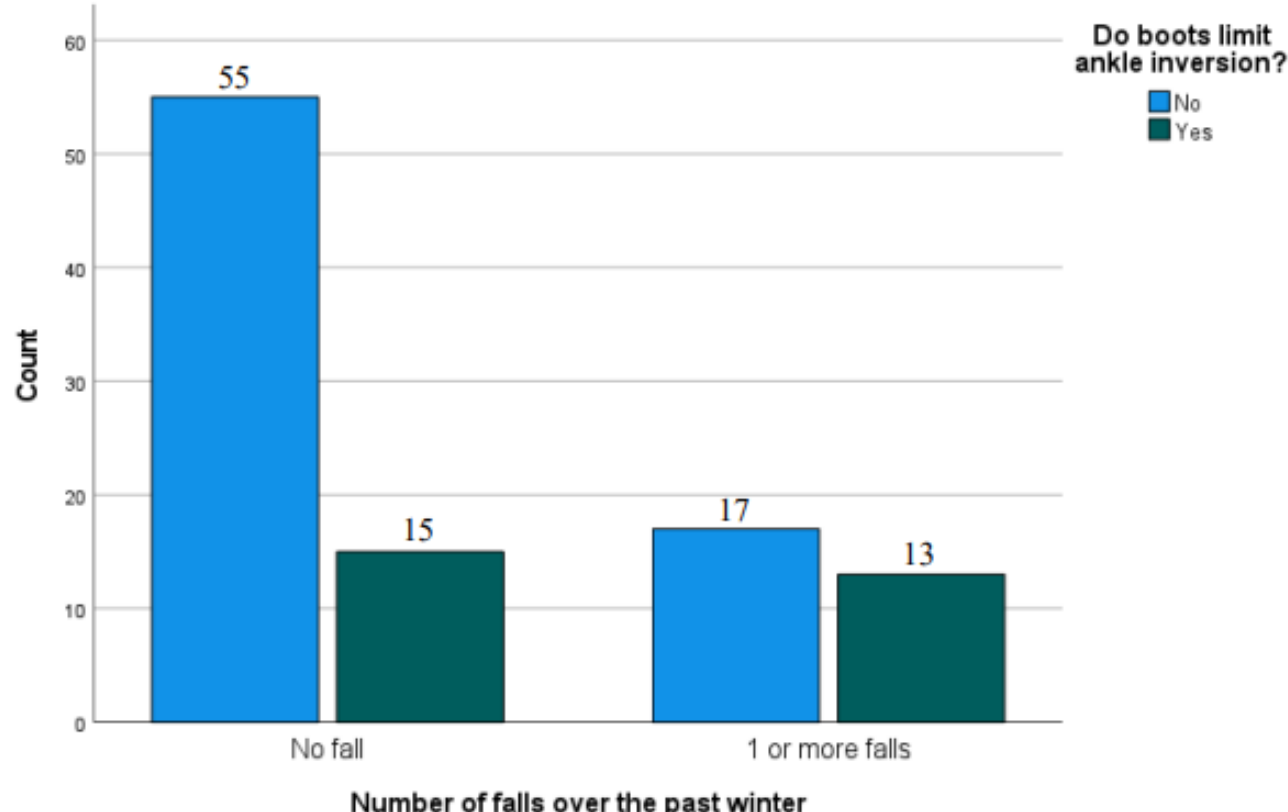
Descriptive frequency of the different factors that had significant associations with the Number of Falls



P-value = 0.001



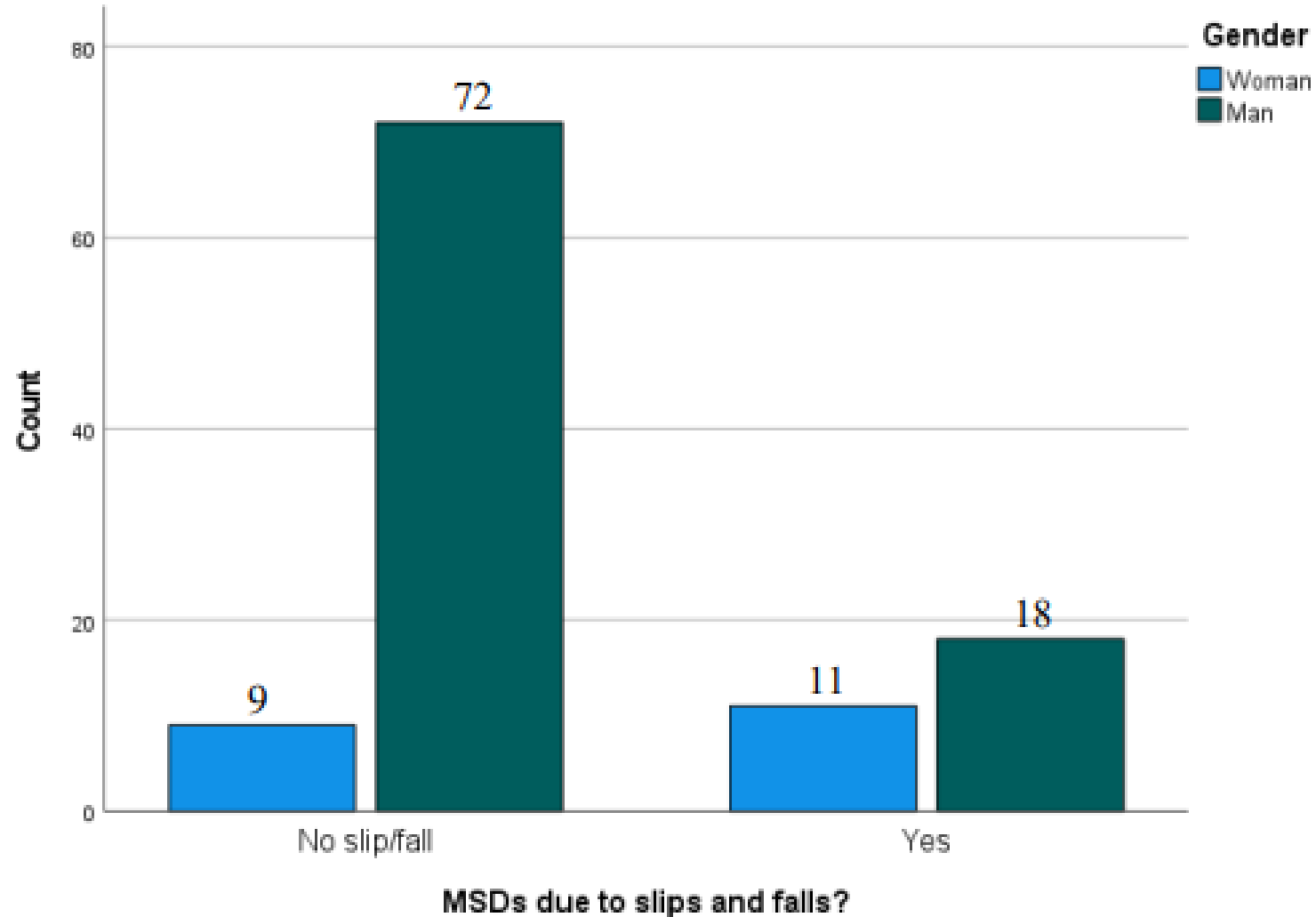
P-value = 0.018



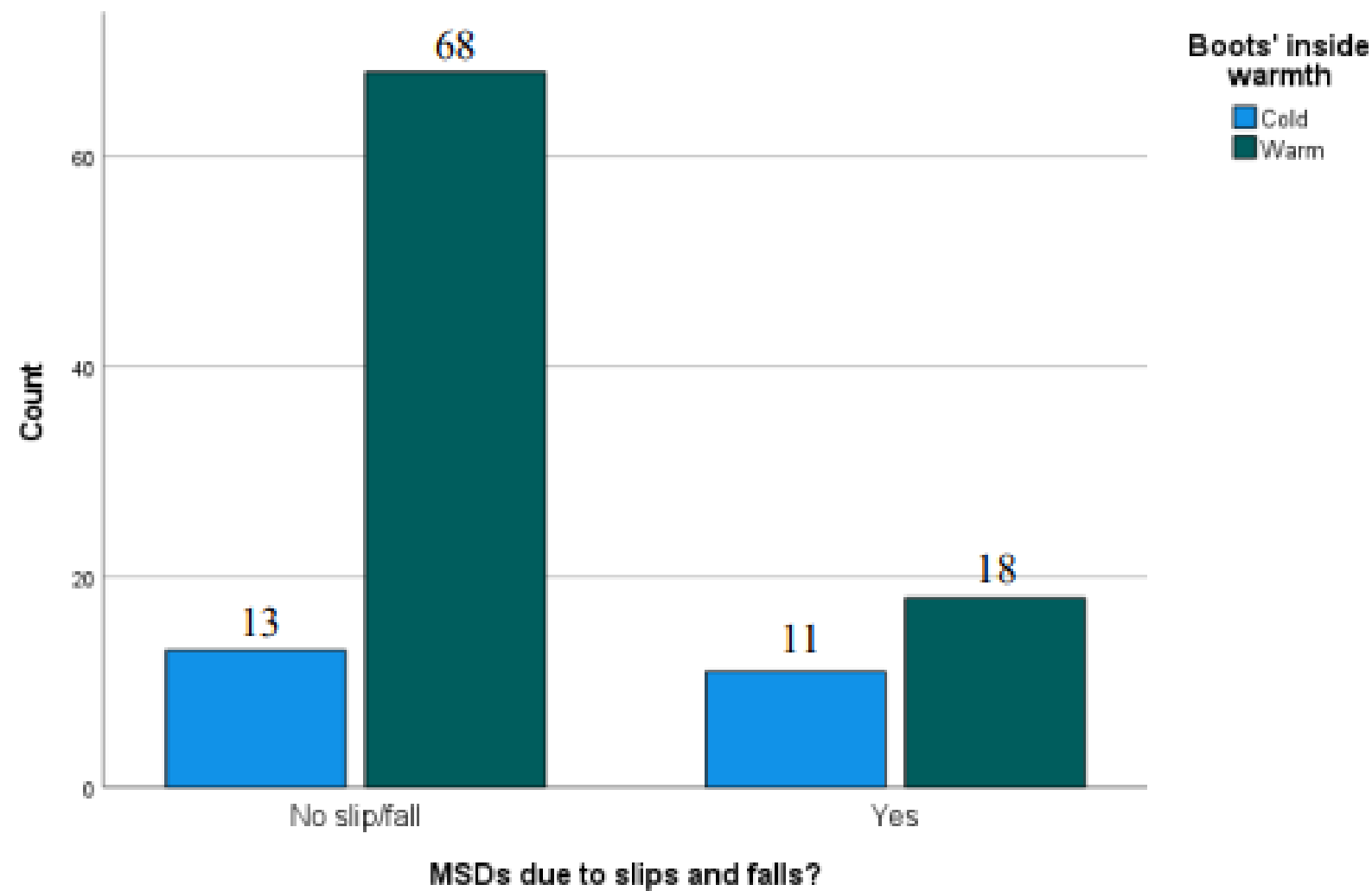
P-value = 0.025

MSDs Due to Slips and Falls

Descriptive frequency of the different factors that had significant associations with MSDs Due to Slips and Falls



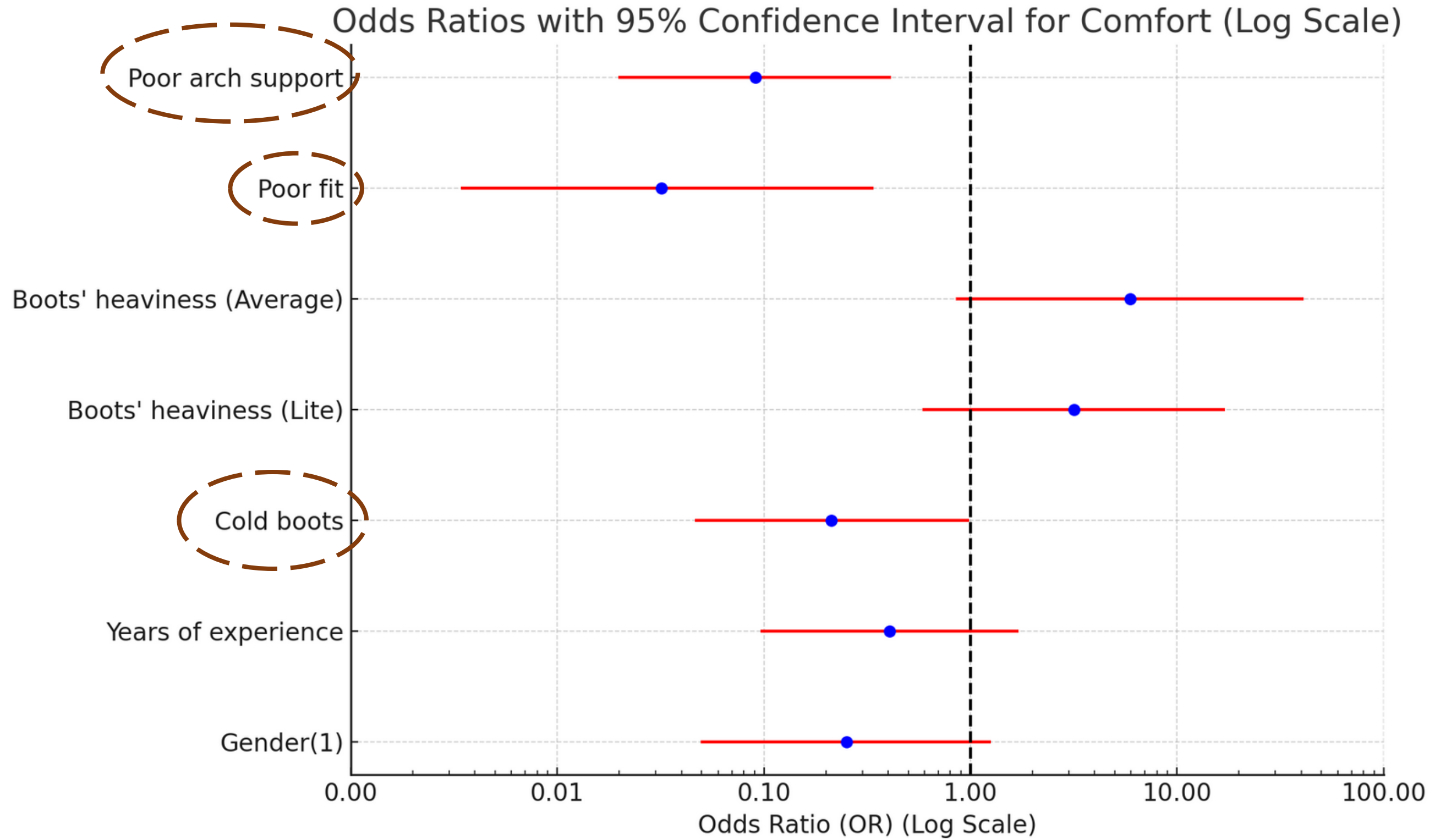
P-value = 0.001



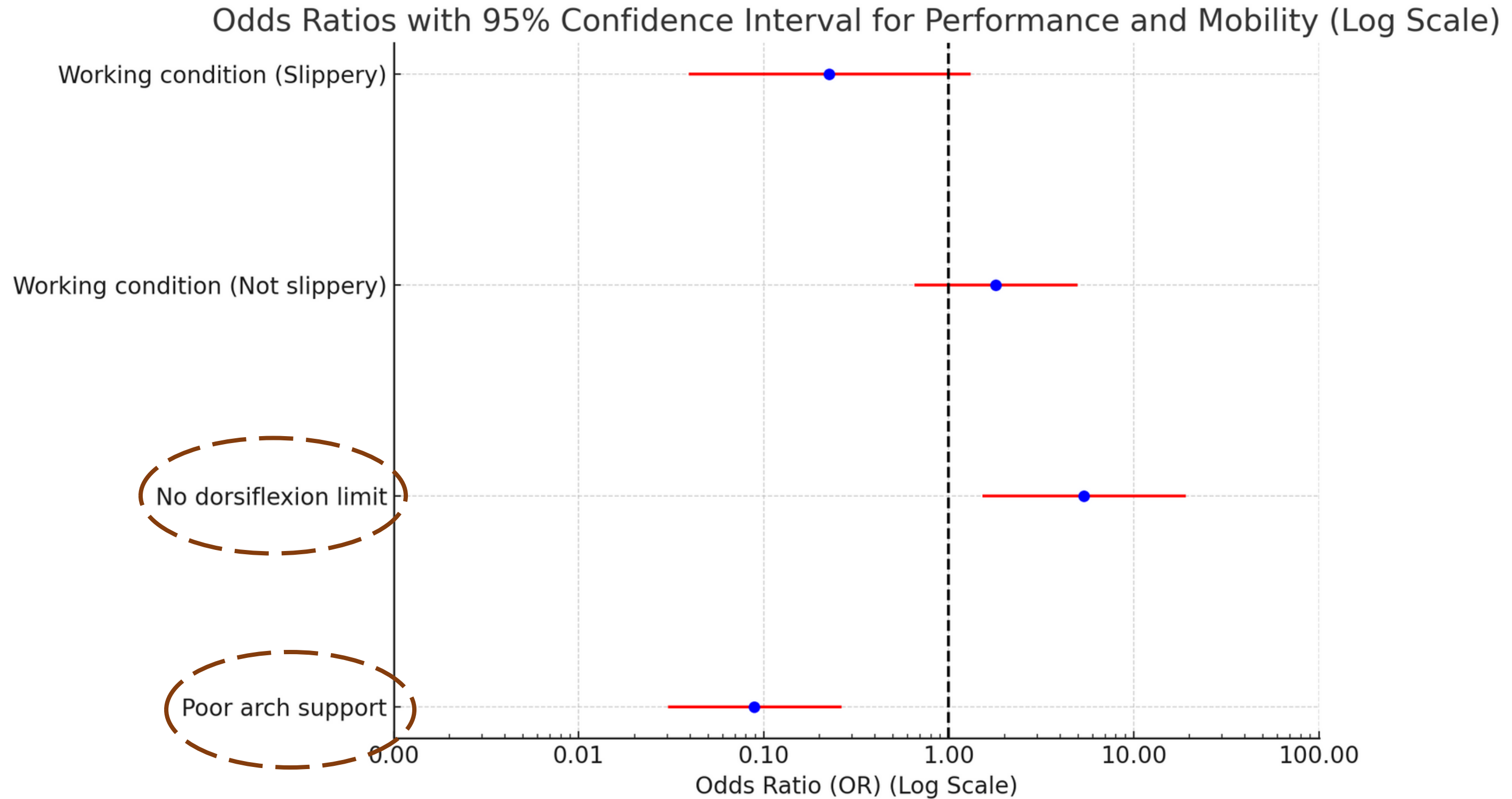
P-value = 0.014

Multivariate Analysis Results and Discussion

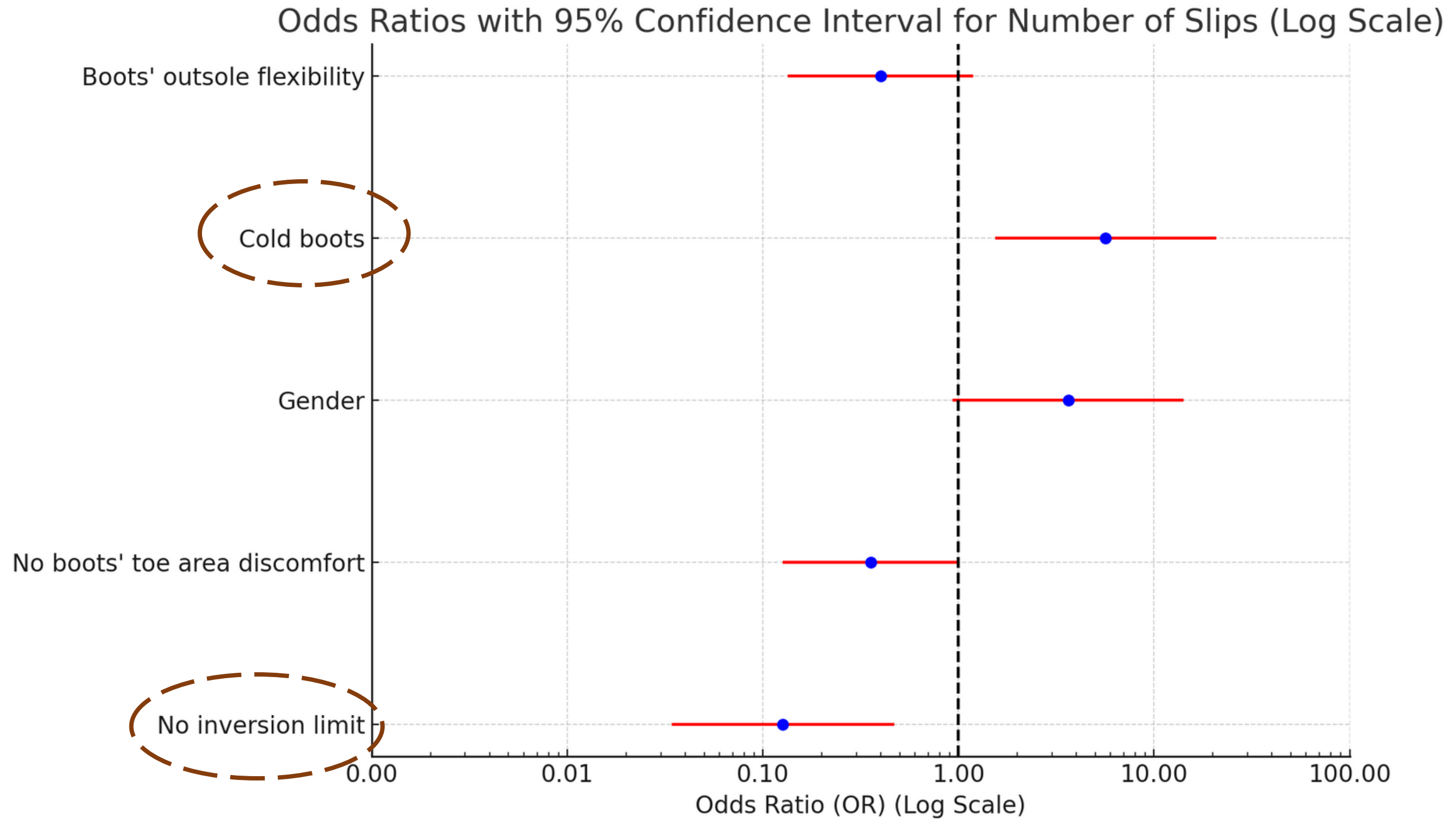
Comfort



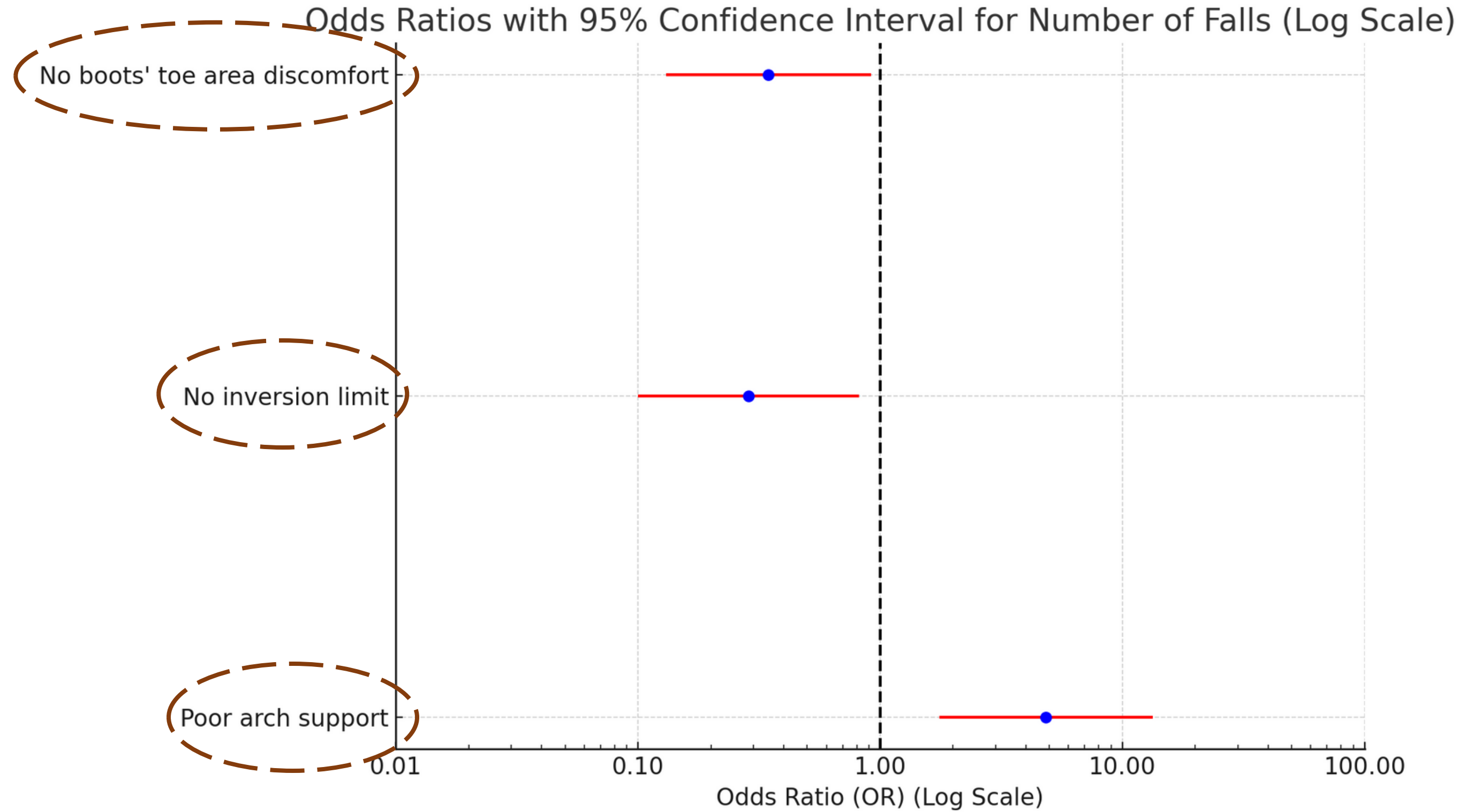
Performance and Mobility



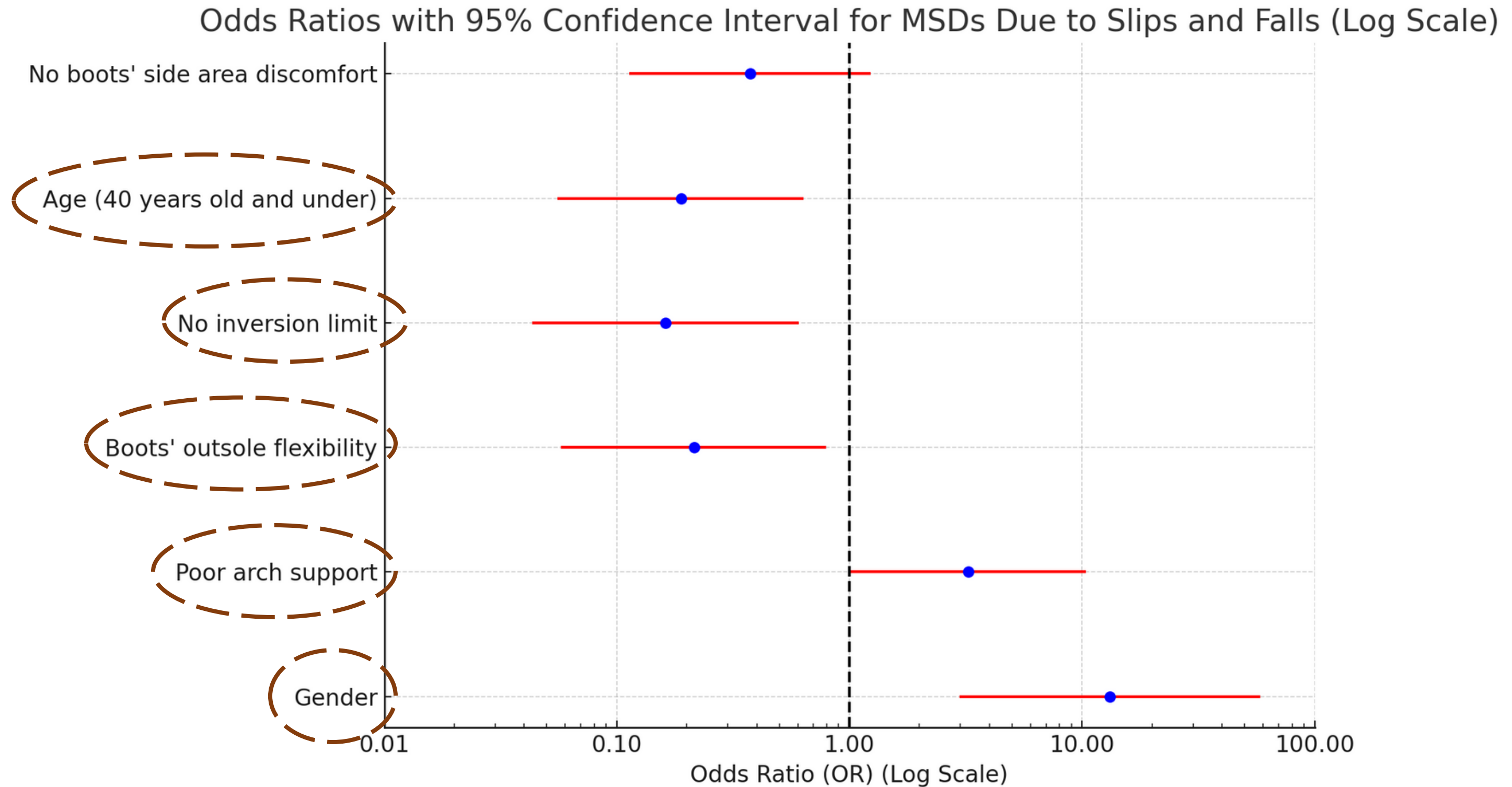
Number of Slips



Number of Falls



MSDs Due to Slips and Falls



Limitations and Future Research

Limitations

- **Self-reported Data**
- **Limited Time Frame**
- **Generalizability**
- **Cross-Sectional Design**
- **Sample Size**

Future Research

- Longitudinal Studies
- Expanding Sample Sizes
- Controlled Experimental Studies
- Brand Comparisons
- Mixed-Methods Approach

Conclusions and Implications

Conclusions

This study underscores the importance of safety boots designed with proper fit, arch support, warmth, and outsole and shaft flexibility, as these features are critical for enhancing comfort, performance, and mobility while reducing the risk of slips, falls, and MSDs due to slips and falls among construction workers in winter conditions.

Implications

- Safety Standard bodies and Regulators
- Designers & Manufacturers
- Construction Companies
- Construction Workers
- Researchers

Acknowledgment

- Professor Mohammad Abdoli
- Dr. Aida Haghighi
- Dr. Morteza Bashash
- Committee Members
- School of Occupational and Public Health at Toronto Metropolitan University

Thank you for your attention

Questions?