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## Introduction

A survey conducted in 2007 by The Vision Care Institute, LLC, a Johnson and Johnson company, and the United States Olympic Committee (USOC) found that 87 percent of American Olympic athletes and hopefuls believed that vision played an important role in their success in their sport.[Falcetti C, Esterow G, (2008)] Despite this perceived importance of vision, approximately 25% of athletes have never had an eye exam.[Beckerman SA, Hitzeman S, (2001)] Of those who have never had an eye exam, approximately 30% need some sort of vision correction.[Beckerman SA, Hitzeman S, (2001)]

In order to combat this need for vision care in the athletic population, a sports vision clinical care program has been developed for varsity athletes (Waterloo Warriors) at the University of Waterloo. This program consists of 4-stages or assessments: (1) a vision screening to identify potential issues, (2) a full eye exam, (3) sports vision assessments and (4) sports vision training.

The purpose of this particular study, was to evaluate the results of the spring vision screening that was run over four days in March 2014.

## Methods

### Vision Screenings

- Vision screenings were conducted at the School of Optometry & Vision Science, University of Waterloo, Waterloo, Ontario, Canada over four days in March 2014
- Vision screenings consisted of the following:
  - A brief history questionnaire, logMAR visual acuity (VA), contrast sensitivity (CS), autorefractometry, binocular vision (BV), stereopsis, colour vision (CV), eye-hand (EH) and eye-foot (EF) visual-motor reaction times (RT), coincidence anticipation (CA), King-Devick concussion test (KD), balance and ocular health

### Study Design

- Retrospective analysis of the vision screening data collected during the Waterloo Warriors spring vision screening program.
- Results of the specific clinical assessments were examined in the population, as were general factors related to overall feasibility and effectiveness of the intervention
- 79 athletes participated in this study
  - 10 athletes played an individual static sport
    - Swimming, track & field, golf, cross country, figure skating, triathlon
  - 21 athletes played an individual dynamic sport
    - Squash, baseball, tennis, badminton
  - 47 athletes played a team dynamic sport
    - Ice hockey, field hockey, football, rugby, soccer, basketball, volleyball

## Results

### Case History Questionnaire

#### Refractive Correction

- 40 athletes (51%) had a refractive correction on the day of their screening
  - Spectacles only = 22%
  - Contact lenses only = 3%
  - Spectacles and contact lenses = 27%

#### Ocular History

- 51 athletes (65%) reported significant ocular history finding which included:
  - Light sensitivity = 14%
  - Difficulty focusing = 9%
  - Squinting = 22%
  - Double vision = 0%
  - Eye infection as a child = 13%
  - Concussion = 25%

#### Previous Eye Exam

- 48 athletes (61%) had had an eye exam in the last 2 years (see Figure 1)
  - 20 athletes (25%) had not had an eye exam in >3 years

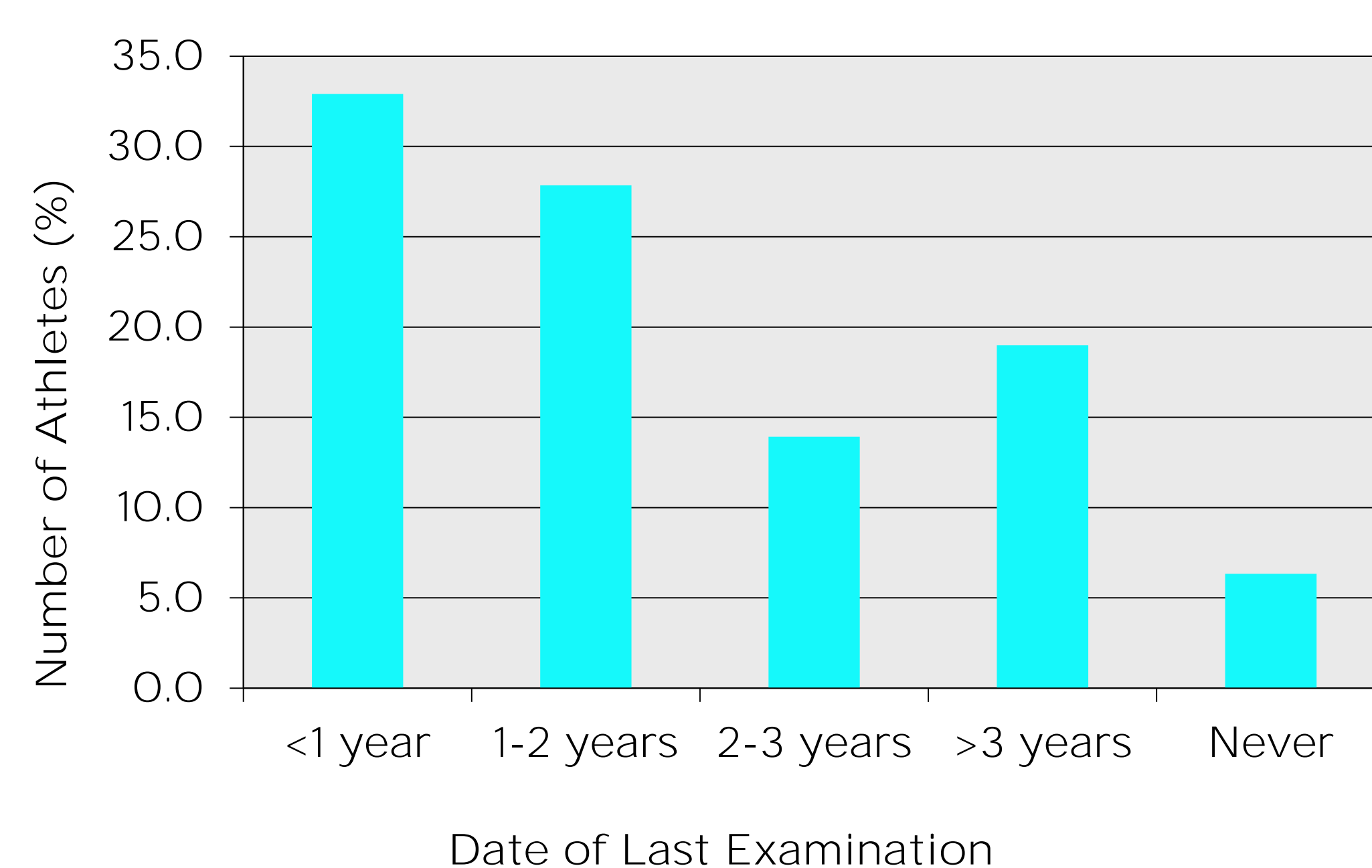


Figure 1: Distributions of last eye exam (LEE) and last medical exam (LME) dates for varsity athletes

A quarter of the athletes (25%) had not had a full eye exam in >3 years

5 athletes (6%) had never had an eye exam

### Vision Examination

#### High Contrast Visual Acuity

- Overall both binocular and monocular visual acuities were good (Figure 2)
  - Binocular =  $-0.09 \pm 0.13$  (range: 0.42 to -0.28)
  - Monocular =  $-0.02 \pm 0.16$  (range: 0.72 to -0.28)

#### Contrast Sensitivity

- Overall both binocular and monocular contrast sensitivities were good (Figure 3)
  - Binocular =  $1.78 \pm 0.16$ , (range: 1.05 to 2.20)
  - Monocular =  $1.63 \pm 0.16$ , (range: 0.60 to 1.95)

#### Binocular Vision

- 6 athletes (8%) had a binocular vision problem
  - 4 (5%) had exophoria
  - 2 (3%) had esophoria

#### Colour Vision

- 1 athlete (1%) had abnormal colour vision

#### Reaction Time (ms)

- Sports Vision Trainer
  - Central =  $478.2 \pm 99.7$  (range: 315.7 to 969.7)
  - Peripheral =  $780.7 \pm 127.2$  (range: 571.3 to 1142.0)

#### FitLight = $0.62 \pm 0.12$ (range: 0.40 to 1.00)

- Coincidence Anticipation (number of lights)
  - Distance Accuracy =  $5.07 \pm 1.73$  (range: 2.33 to 14.00)

#### Balance (n=49)

- Centre of Pressure displacement (ML)
  - Eyes Open:  $0.0050 \pm 0.0021$
  - Eyes Closed:  $0.0064 \pm 0.0022$
- Centre of Pressure displacement (AP)
  - Eyes Open:  $0.0068 \pm 0.0033$
  - Eyes Closed:  $0.0076 \pm 0.0035$

#### King-Devick

- Baseline:  $44.1 \pm 8.73s$  (Errors:  $0.10 \pm 0.35$ )

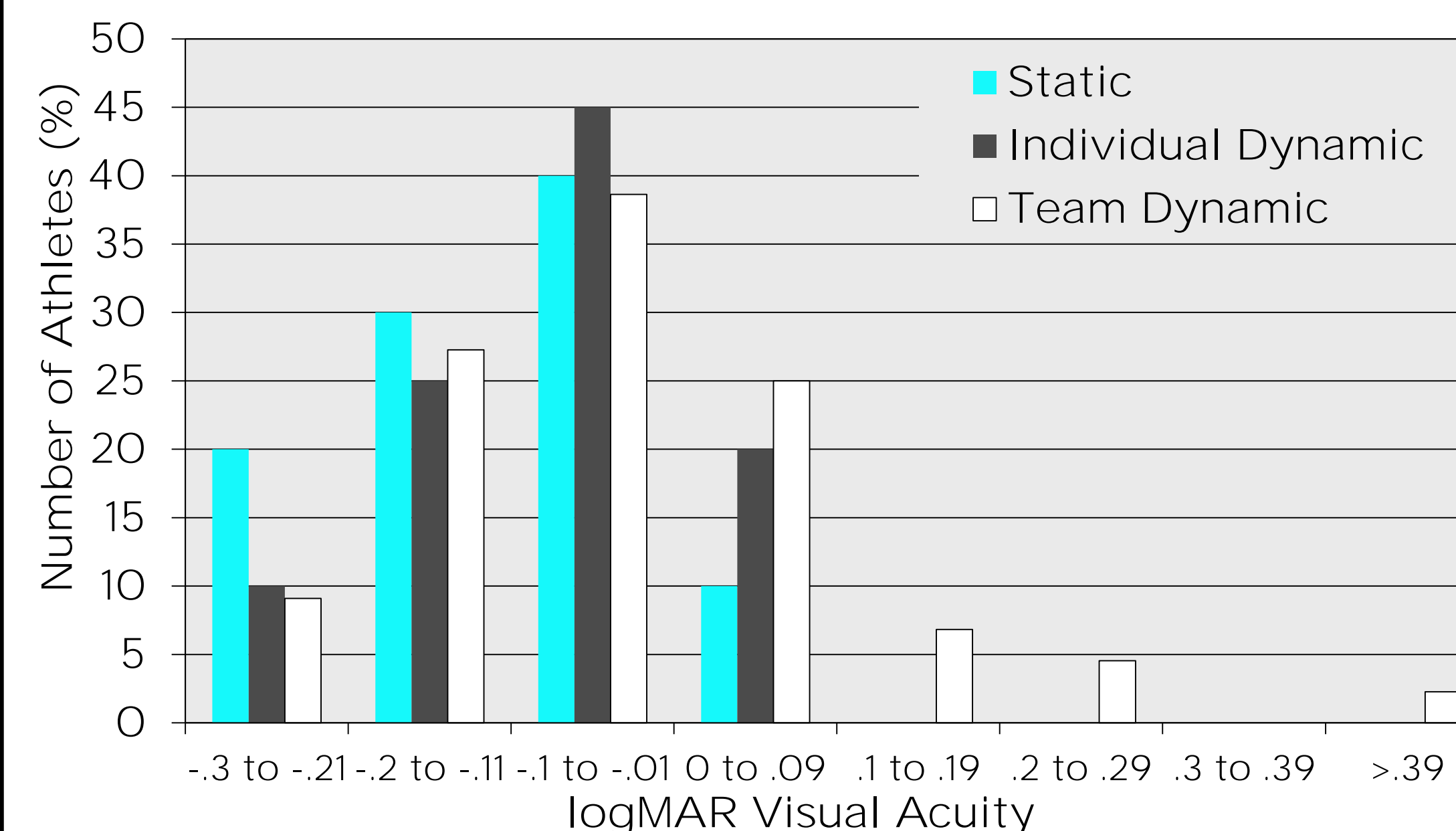


Figure 2: Distributions of binocular high contrast visual acuities by type of sport

## Conclusions

Over half of the varsity athletes examined in this program (53%) failed their vision screening. Outdated eye exams (34%) and visual symptoms (36-46%) were the most common reasons for failing. In addition to identifying athletes in need of full eye exams, this vision screening program allowed for the collection of a large amount of normative data on sport-specific visual function tests. This data can now be used to help determine population norms on these tests for future use. In future vision screening programs, it would be beneficial to include an ocular health assessment, such as retinal photography.

## Acknowledgements

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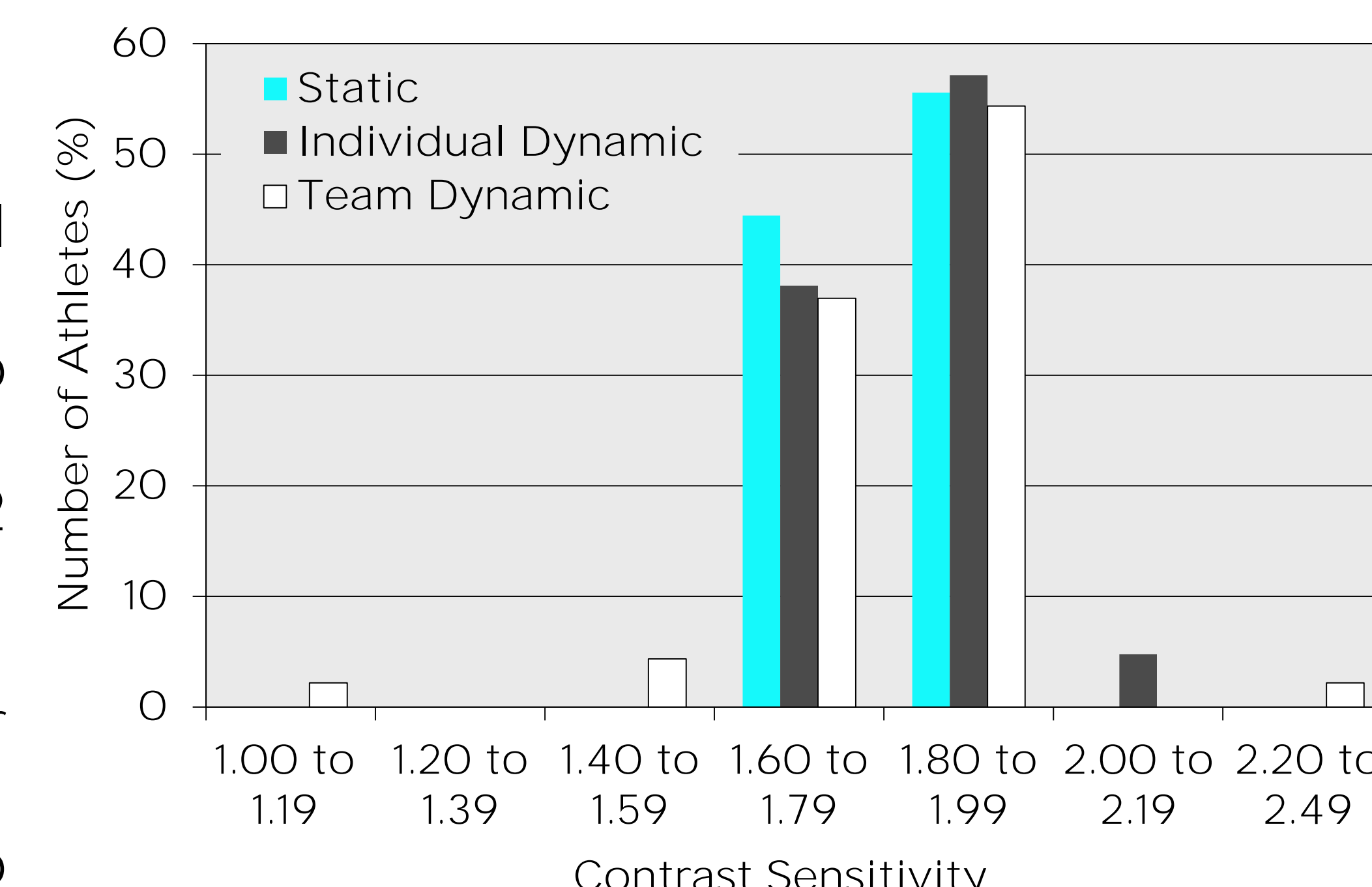


Figure 3: Distributions of binocular contrast sensitivity by type of sport

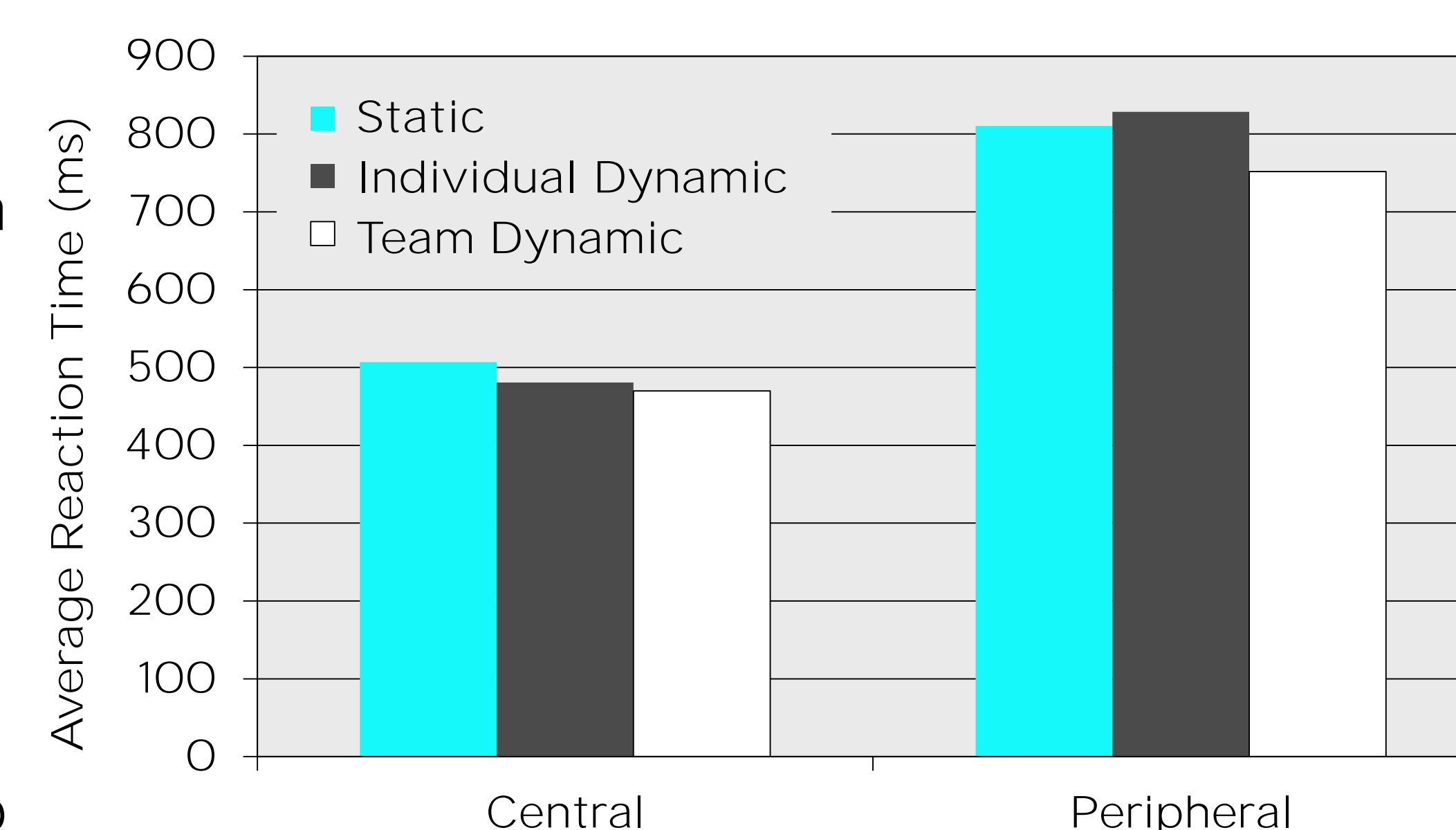


Figure 4: Average reaction time on Sports Vision Trainer central and peripheral tests by type of sport

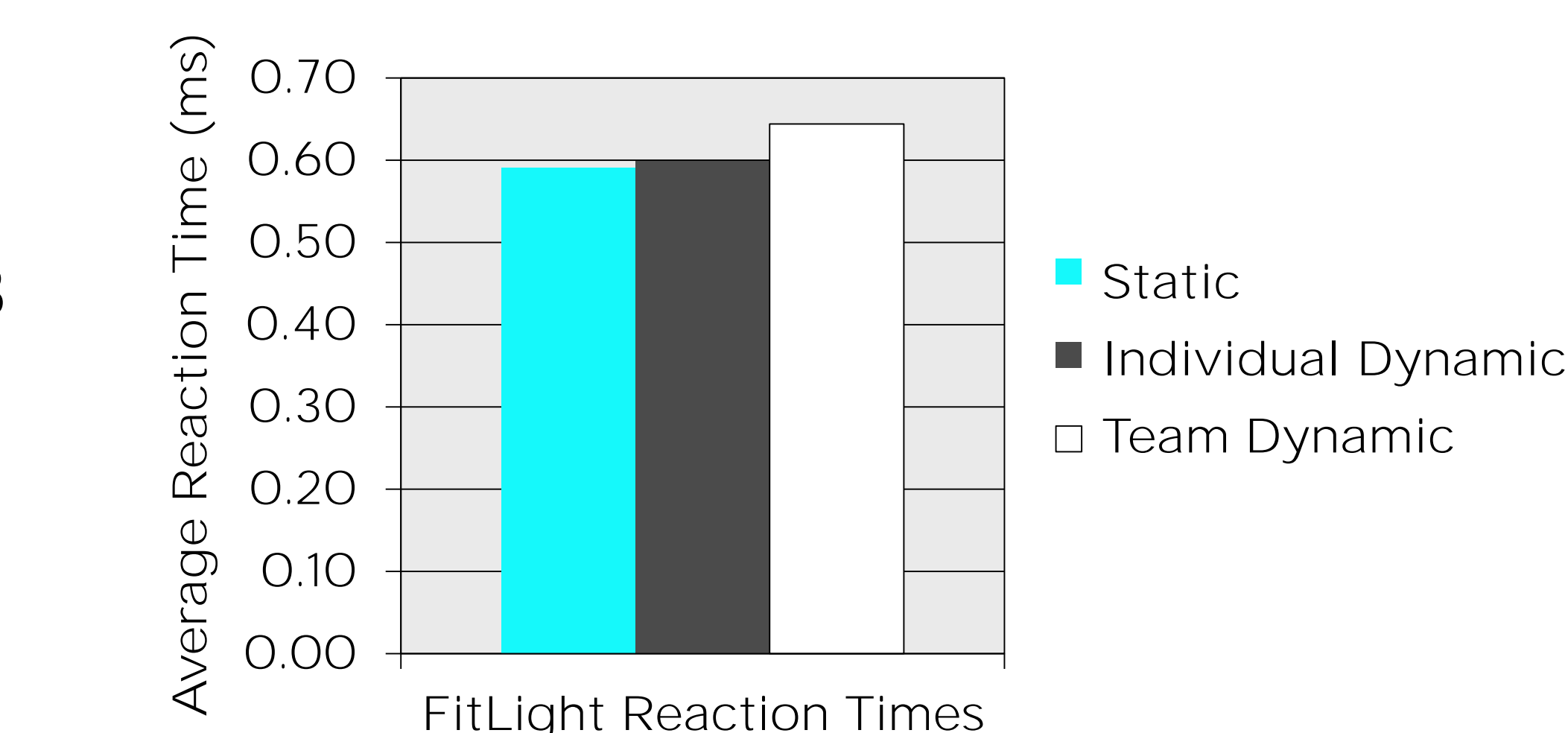


Figure 5: FitLight reaction times (eye-foot) by type of sport

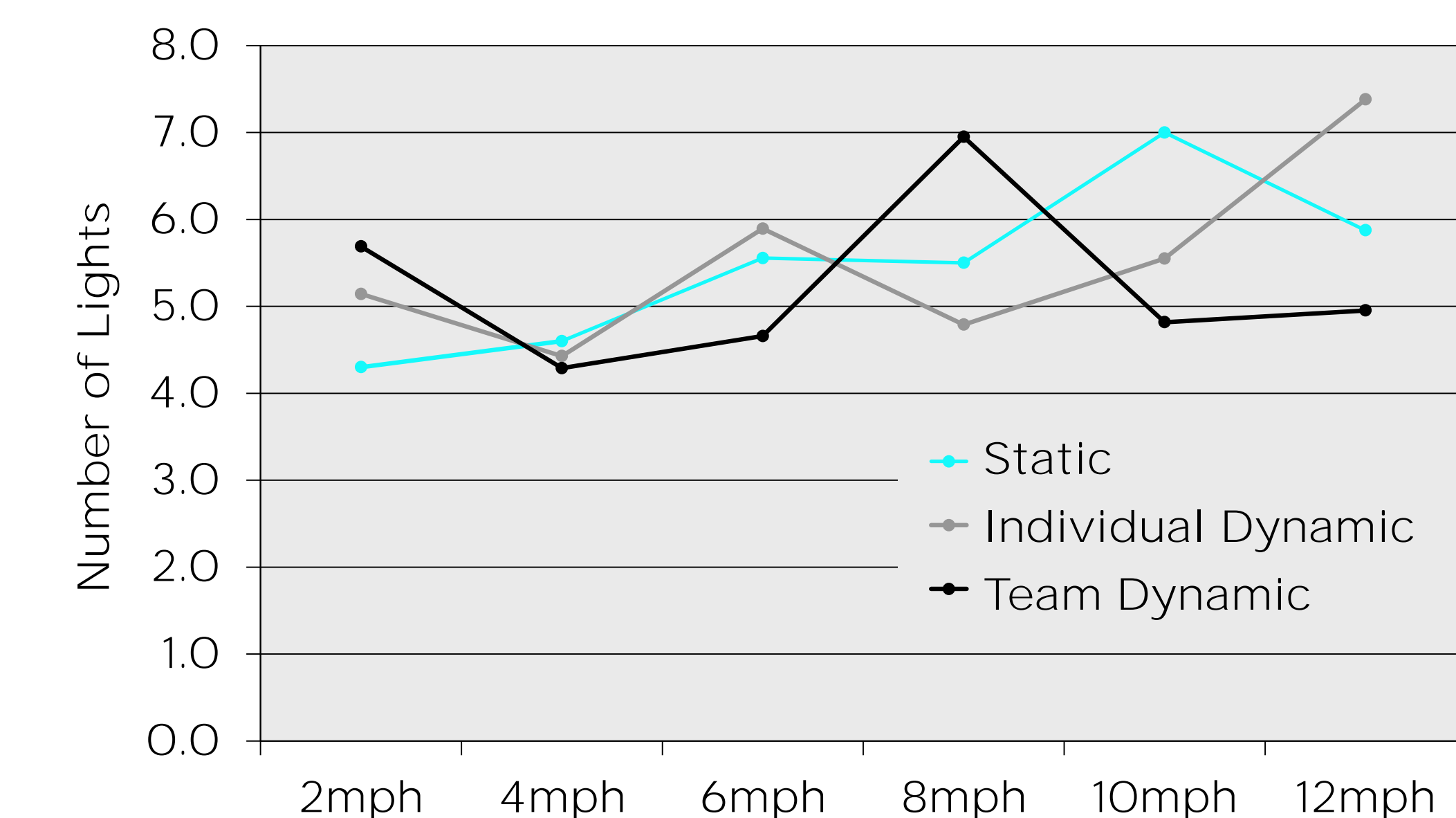


Figure 6: Coincidence anticipation (absolute light accuracy) by type of sport

Overall, 42 of 79 (53%) athletes failed the vision screenings and were asked to return for full eye exams