

Mr HO Siu Hang

BSc (Hons) in Surveying, Department of Design and Architecture

Supervisor: Sr Dr LAU Wai Kin Elvis, Assistant Professor

1. Introduction

- The rising rate of construction injuries in Hong Kong (Figure 1)
- The most notable increase in manual handling injuries up to 2023, as depicted in Figure 2
- New innovation technologies have had a significant impact around the world; it recommends the adoption of exoskeletons

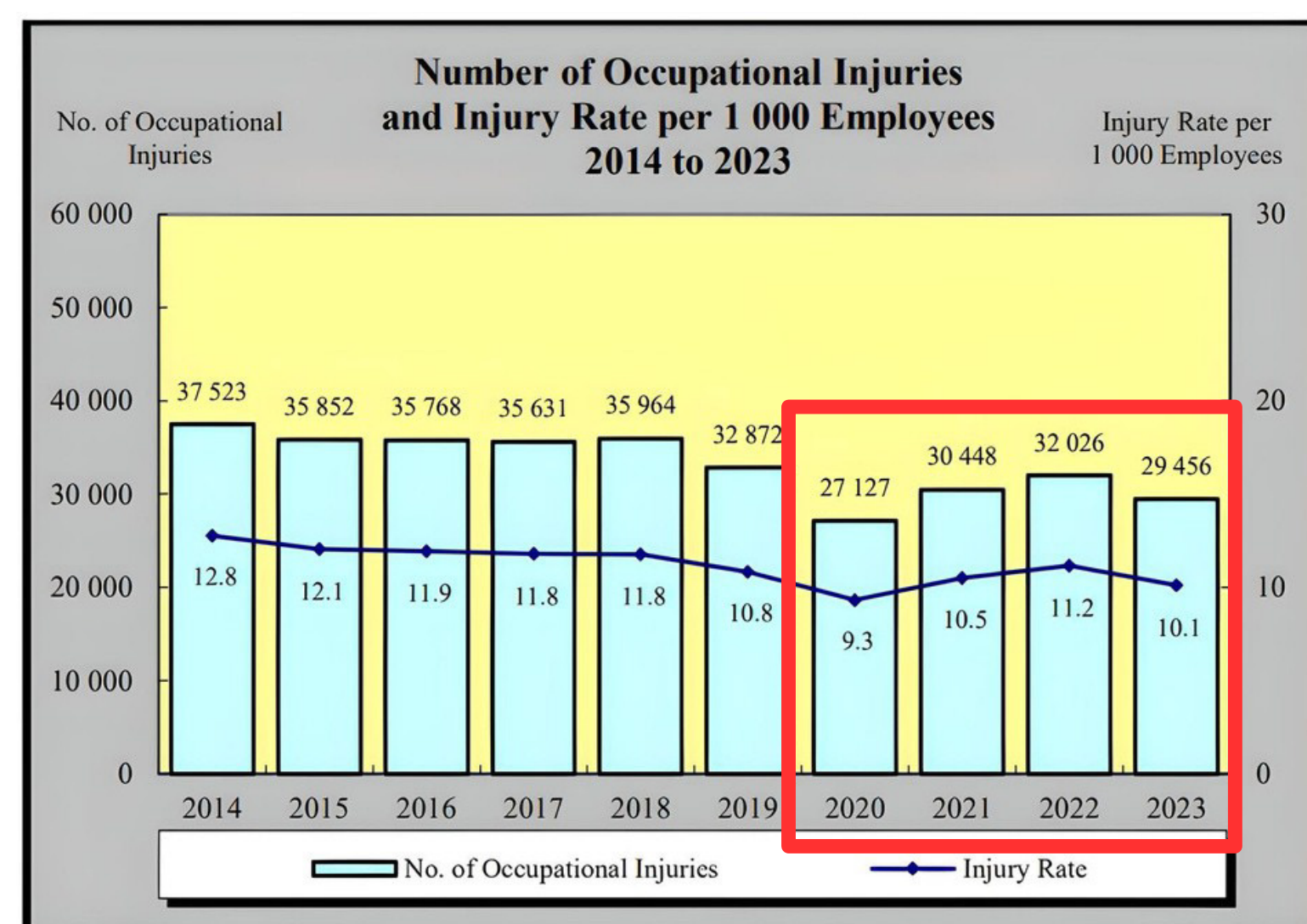


Figure 1: Injury Rate of Construction Industry (from 2012-2023)

Types of Accidents	No. of Accidents (% of total no. of accidents)			
	2021	2022	2023	Changes between 2022 & 2023
Slip, Trip or Fall On Same Level	37 (17.7%)	54 (27.4%)	60 (25.8%)	6 (11.1%)
Injured Whilst Lifting or Carrying/ Manual Lifting/ Manual Handling/ Handling Without Machinery	36 (17.2%)	25 (12.7%)	33 (14.2%)	8 (32.0%)
Fall of Person From Height	25 (12.0%)	20 (10.2%)	28 (12.0%)	8 (40.0%)
Struck By Moving or Falling Object	22 (10.5%)	32 (16.2%)	27 (11.6%)	-5 (-15.6%)
Striking Against Fixed or Stationary Object	25 (12.0%)	11 (5.6%)	19 (8.2%)	8 (72.7%)

Figure 2: Injury Reason of Construction Industry (from 2021-2023)

4. Findings

(a) From Questionnaire

- A total of 58 workers participated in the questionnaire (Figure 3)
- Cover aspects of Workplace Safety Environment, Manual Handling and Injuries, and Application on Technology
- Labourers, Drainlayers and Woodworkers** have the highest manual handling injury rates and the most frequent material transportation tasks

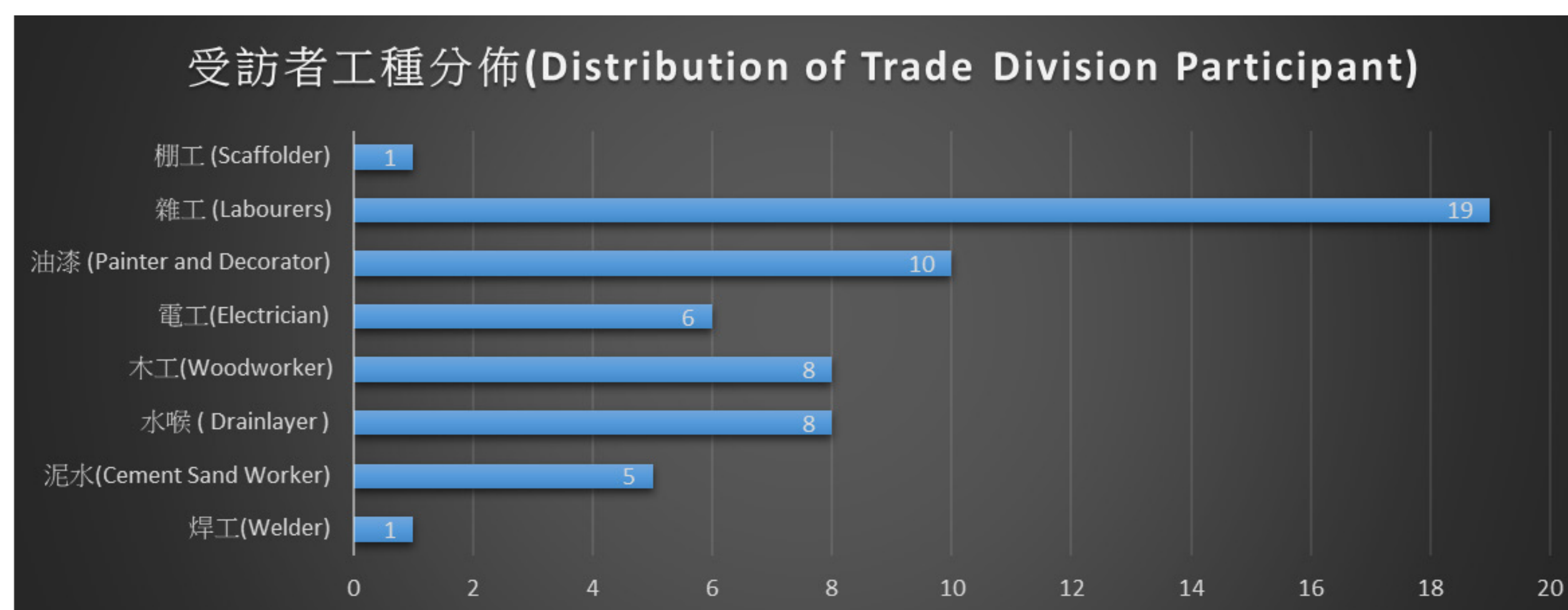


Figure 3: Distribution of Workers in The Trade Division

(c) From Interview

- Moderate feedback on his first experience wearing the exoskeleton

General Feeling



User Experience



5. Conclusion

The findings from questionnaires, trial studies, and interviews collectively indicate that properly implemented exoskeletons offer substantial benefits in reducing manual handling injuries among construction workers.

2. Objectives

- To identify and analyze the causes and examples of injuries of workers caused by material transportation
- To investigate the potential application of exoskeletons in the construction environment
- To investigate the benefits of deploying exoskeletons for materials transportation.

3. Research Methodology.

- Questionnaire
- Trial Study
- Interview

(b) From Trial Study

- Focus on two days of site operations and work tasks: oone day without exoskeleton (Figure 4) and one day with exoskeleton (Figure 5)

Item	Description
Worker	Drainlayers (Male)
Duration	8:30am to 12:30pm and 2:00pm to 5:00pm
Heart Rate	Apple watch monitor (Every 15 minutes to check activities)
Details	Record the performance of worker with and without exoskeleton
Inspection	Record per hour of manual handling jobs: - Record their jobs performing - Their posture Can remove during lunch and wear back after lunch

Day One

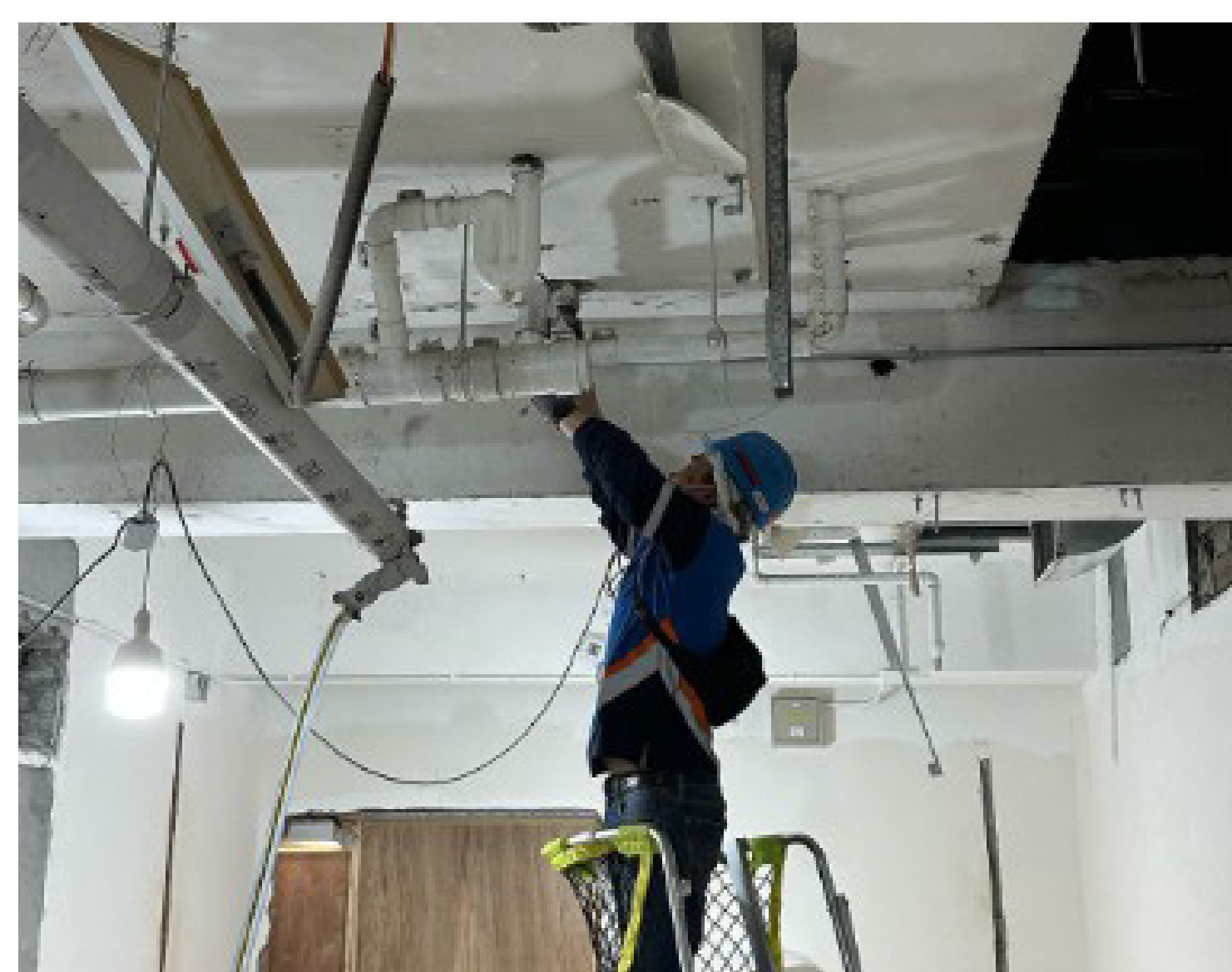


Figure 4: Day 1 Sequence of Work

Day Two



Figure 5: Day 2 Sequence of Work

Heart Rate

- Manual handling tasks and jobs performed with an exoskeleton lead to a lower heart rate than those performed without one.
- The use of exoskeleton has been shown to reduce both physical exertion and energy consumption.

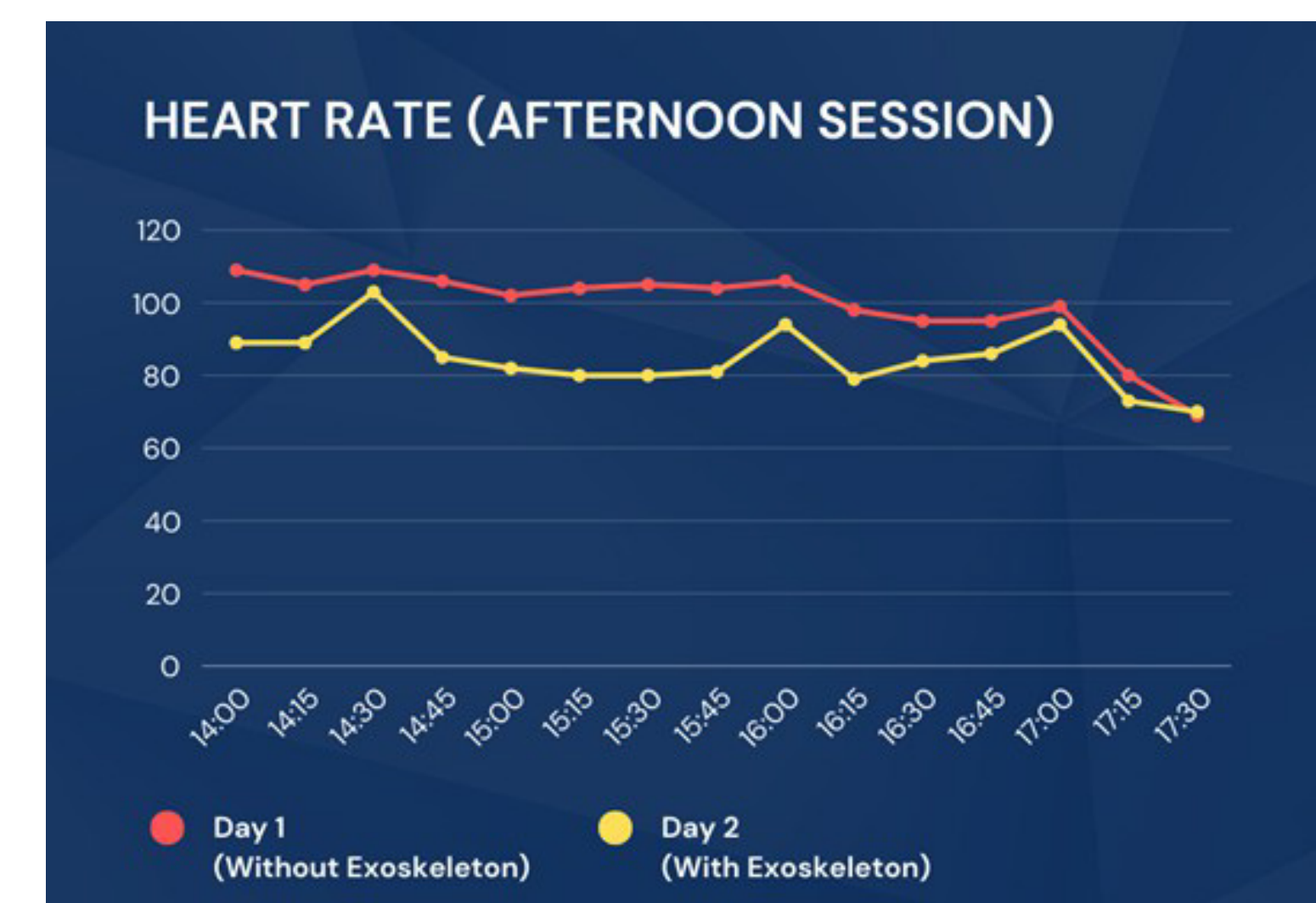
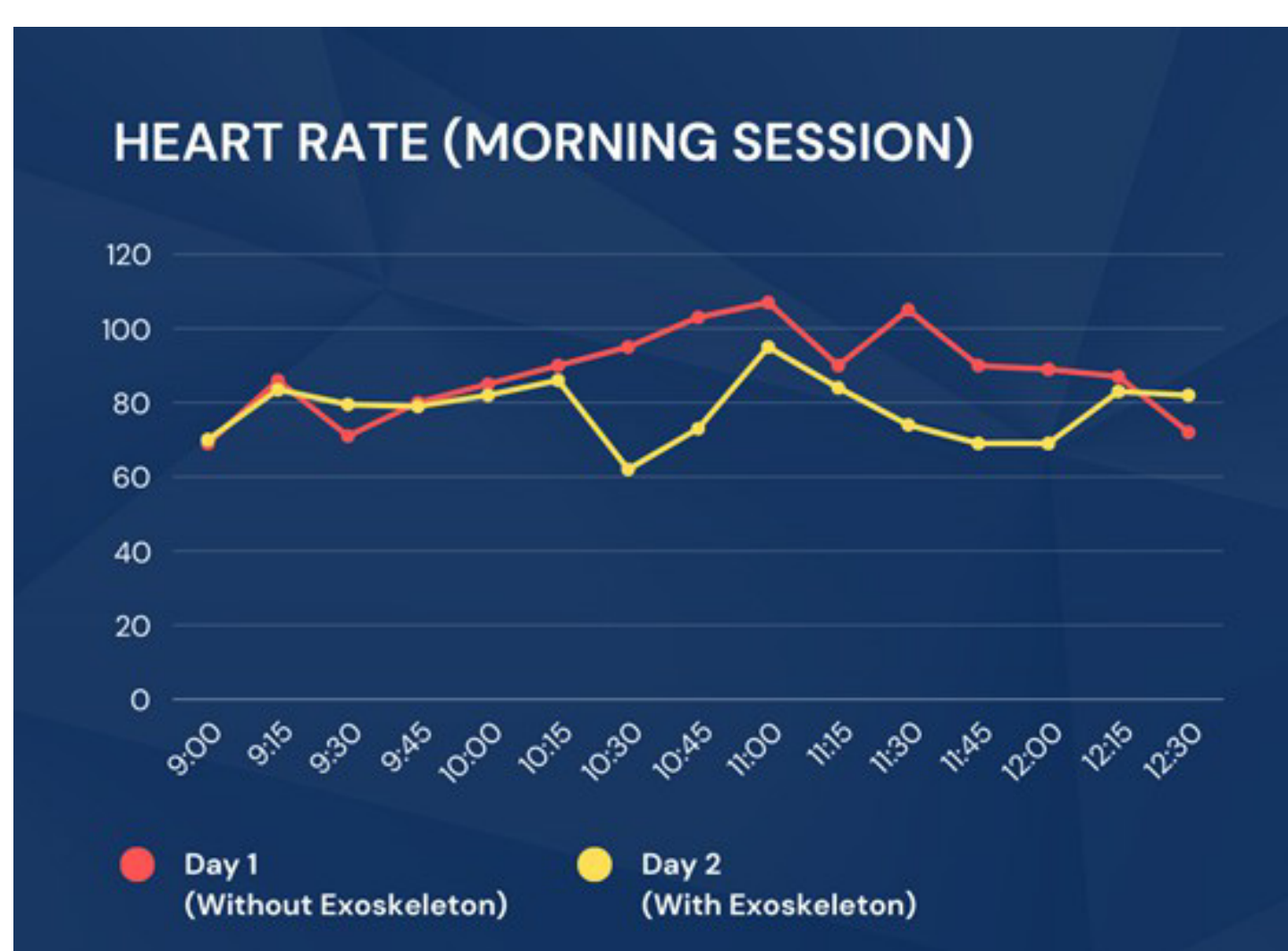


Figure 6: Heart Rate Distribution in Morning Session

Figure 7: Heart Rate Distribution in Afternoon Session