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An investigation of factors that influence running footwear selection and subjective perceptions

A thesis

submitted in fulfilment

of the requirements for the degree

of

Doctor of Philosophy in Health, Sport and Human Performance

at

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by

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## Abstract

**Background:** Many runners consider shoes important to sport participation. Selecting running shoes requires runners to navigate marketing claims and anecdotal evidence to find shoes that meet their needs. Salespeople in running stores often guide runners in their footwear selection, with runners often selecting shoes based on their subjective perceptions of comfort, performance, and injury risk reduction. The validity of this approach is questionable as the advice from salespeople can lack evidence base and runners' footwear perceptions may be biased. Although previous research identifies the importance of salespeople in shoe selection, little is known regarding how runners choose their shoes in store. Furthermore, it may be possible to influence runner behaviour through education-based interventions and salespeople recommendations, although the effects of education and recommendation on shoe choice are largely unknown.

**Aim:** To explore the in-store running shoe selection process and the influence of education and expert recommendation on runners' shoe selection and subjective perceptions.

**Methods:** This Thesis is comprised of seven Chapters, five of which are formatted as academic papers suitable for peer-reviewed publication. First, a systematic review was conducted on factors that influence road running shoe selection. Secondly, 101 runners visiting specialty running stores were surveyed on their running shoe choice, running history, conscious behaviour, and perceived influence of salespeople on their shoe selection. Thirdly, a thematic analysis was used to evaluate how 38 salespeople perceived the salesperson-to-runner interactions. Fourthly, in a double-blind randomised controlled trial (RCT), 56 runners were randomly assigned to a control or educational video prior to purchasing new running shoes. Runners reported shoe

selection behaviours, running history, consciousness during purchase, injuries, and subjective perceptions over three months using online surveys. Lastly, in a single-blind crossover RCT, 21 female runners underwent a clinical gait analysis process and ran on a treadmill at a self-selected pace using their own shoes and two experimental shoes with different product descriptions. One shoe was described as a basic running shoe, whereas the other as a shoe gait-matched to their running style. Subjective perceptions including comfort, performance, and injury risk were reported using visual analogue scales (VAS), and spatiotemporal parameters and resultant tibial acceleration were monitored during running trials.

Results: Forty factors reported to influence running shoe selection were sourced from the seven studies included in the systematic review. These factors were thematically sub-grouped in five categories: subjective, shoe-specific characteristics, market features, peer evaluation, and runner characteristics. From the 101 runners surveyed in specialty running stores, over 43% of them primarily sought advice from running shoe stores (salespeople) and 25% sought advice from other runners (i.e., family, friends, and running clubs). Runners consistently prioritised fit, comfort, familiarity, and gait analysis during shoe selection. These priorities were aimed at reducing injury risk, with over 20% of surveyed runners in-store reporting sustaining a running-related injury in the previous six months. Based on the 38 interviews conducted, salespeople aimed to build relationships through demonstrating expertise to drive business by making a sale and creating future business. In the RCT providing evidence-based education to runners on shoes, runners that thought less about which shoes to buy were more satisfied at three months post-purchase ( $89.7 \pm 11.2$  mm versus  $79.8 \pm 25.7$  mm,  $p = 0.023$ ) and all runners reported increased subjective performance in new shoes compared to old ones ( $p = 0.006$ ) based on VAS scores. There was a trend ( $p = 0.054$ ) for runners to choose different makes and models of shoes

after viewing an educational video. In the laboratory-based RCT, runners preferred their own shoes over gait-matched and basic shoes, but rated subjective comfort, performance, and injury risk ( $p < 0.001$ , all measures) more favourably in gait-matched than basic shoes, while maintaining similar running biomechanics.

Conclusion: Road runners that buy shoes from specialty stores rely on the recommendations of salespeople and other runners, despite the unknown quality of this advice. Salespeople build trust with runners through demonstrating expertise and using gait analysis to sell shoes and create future business. Runners in specialty stores focus on subjective factors derived from trying on shoes in-person, such as comfort and fit, with the main goal of reducing injury risk. The subjective perceptions of footwear of runners are manipulable, which further complicates choosing shoes based on desirable factors such as comfort or risk reduction. Additionally, runners typically buy shoes that are familiar to them despite interacting with scientific evidence that they believe influence their behaviours. Runners that think less consciously about their shoe choice are more satisfied with their shoe selection. Current practice of in-store gait analysis and shoe recommendation may not be effective in meeting runners' desired goals or be evidence-based, with the most appropriate shoe recommendation practices for individuals a challenge to establish.

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## List of abbreviations

$\Delta$  Mean: Mean difference

ANOVA: Analysis of variance

ANZCTR: Australian New Zealand clinical trials registry

CI: Confidence interval

CONSORT: Consolidated standards of reporting trials

COREQ: Consolidated criteria for reporting qualitative research

CV: Coefficient of variation

ES: Effect size

HCP: Healthcare provider

ICC: Intraclass correlation coefficient

PRISMA: Preferred reporting items for systematic reviews and meta-analyses

RCT: Randomised controlled trial

RUN-CAT: The running shoe comfort assessment tool

SD: Standard deviation

SEM: Standard error of measurement

UTT: Unconscious Thought Theory

## Research outputs arising from this Thesis

### Published manuscripts presented in this Thesis

#### Chapter 2

Fife, A., Ramsey, C., Esculier, J. F., & Hébert-Losier, K. (2023). How do road runners select their shoes? A systematic review. *Footwear Science*, 15(2), 103-112. <https://doi.org/10.1080/19424280.2023.2180543>

#### Chapter 3

Fife, A., Ramsey, C., Esculier, J. F., & Hébert-Losier, K. (2024). How do road runners select their shoes? An in-store experience. *Footwear Science*, 1–9. <https://doi.org/10.1080/19424280.2024.2353597>

### Conference presentations arising from this Thesis

Fife A., Esculier JF, Ramsey C, Hebert-Losier K. How do road runners select their shoes? An in-store experience. Sport and Exercise Science New Zealand Conference, Wellington, New Zealand, November 2023 (Oral Presentation).

# Chapter 1

Introduction, background, and rationale of the Thesis

## **Running overview**

Running is popular in the USA and worldwide, with 21% of Americans participating in running (Foundation, 2021; van der Worp et al., 2015). Most runners can be classified as recreational runners (Besomi et al., 2018). Recreational runners typically have more than six months of regular running experience and typically run one to five sessions weekly (Honert et al., 2020). Therefore, this Thesis primarily is focused on recreational runners rather than novice or high-calibre runners. The focus on the majority of the running population increases generalisability and potential impact of findings. Many runners feel that it is important to use sport-specific shoes for running (Walton & French, 2016) and consider running barefoot an extreme practice. Most runners seek advice from running shoe salespeople in speciality running stores (Nguyen et al., 2022); however, there is little information available on the in-store process and how runners select their shoes in specialty stores.

Early modern cushioned running shoes were constructed in 1964, which led to the advent of a global market and general belief that cushioned running shoes are requisite to the sport (Davis, 2014). Running shoes are available in a variety of constructions that can be classified on a scale from minimalist to maximalist (Esculier et al., 2015). While minimalist construction approximates a barefoot running experience, modern shoes typically present with cushioning, pronation control devices, and other technologies marketed to reduce injury (Agresta et al., 2022) or improve performance (Hunter et al., 2019). Antithetical to minimalist shoes and barefoot running, ergogenic shoes may include several technologies including specific geometries, increased stiffness, carbon plates, and motion control devices (Kram, 2022). Most runners are

likely to choose modern cushioned running shoes over minimalist shoes (Walton & French, 2016), while extremely maximalist shoes with advanced footwear technology are recommended primarily for racing (Muniz-Pardos et al., 2021), but runners must nonetheless select shoes from a vast array of choices.

### **Shoe selection**

Over several decades, different recommendation strategies and shoe technologies have been implemented to improve the running experience, with a special focus on reducing running-related injury (Agresta et al., 2022; Saragiotto et al., 2014). Injury reduction is central to the goals of recreational runners (Fokkema et al., 2019) and is associated with factors such as running surface, shoe age, distance, and previous injury (van der Worp et al., 2015). The overall lower extremity injury rate of runners is reported to range between 19.4% to 79.3% (Van Gent et al., 2007), with this large variation in injury incidence in large part linked with differences in study methodology and definition. More recently, injury incidence was reported to be 8.8% to 91.3% across skill levels, with competitive runners injured most frequently and novice runners injured least often (Fredette et al., 2022).

Manufacturers have implemented technologies in shoes that individuals use to recommend shoes, including pronation control technologies. Alongside technologies, different approaches and theories have been developed to guide shoe recommendation practices, such as impact force modification, habitual joint path, and the comfort filter (Agresta et al., 2022). Presently, there is little evidence to support past or current shoe recommendation practices (Relph et al., 2022). Regardless, experts including academics, journalists, coaches, industry scientists, bloggers, and physicians continue to make shoe recommendations to runners to improve comfort, performance, and reduce injury risk (Honert et al., 2020). Despite some

consensus on these goals, expert recommendation has not been effective in reducing injury incidence (Knapik et al., 2009) and running shoe recommendation strategies to prevent injury lack strong evidence (Agresta et al., 2022). It is possible that runner behaviours and choices outside of shoe selection may impact injury incidence, which impacts cannot be simplified with biomechanical analysis and shoe prescription alone (Malisoux & Theisen, 2020). Despite continued efforts to optimise shoe prescription, little is known about runners' behaviours in selecting shoes.

Runners buy shoes for a variety of reasons, including replacement (Brooks, 2020), concurrent use (Malisoux et al., 2015), or to target racing (Hébert-Losier et al., 2024). During the selection process, runners must navigate marketing claims and anecdotal experience. Runners commonly visit specialty running stores to work with a trained salesperson and may be prescribed shoes designed to match their foot shape and arch height (Knapik et al., 2009). Although Gibson (2012) describes an in-store experience of shoe selection, the typical process is largely unreported in the literature. One technique salespeople use to make recommendations includes conducting a clinical gait analysis to evaluate running mechanics and inform shoe recommendation (Gibson, 2012). Some runners are more trusting of stores that provide in-store clinical gait analysis (Walton & French, 2016), while others consider gait analysis a gimmick and sales tactic (Ramsey et al., 2022). Salespeople recommend shoes to runners based on their personal beliefs and experiences in consideration of the goals of the runner they are serving, although the quality of this advice is unknown and may not be evidence-based (Wolthon et al., 2020). Runners will interact with salespeople with a variety of experience, training, and knowledge to choose from a large assortment of brands and models with a breadth of intended use and specialised technologies, which complicates the matter.

Runners have identified injury prevention, performance, and comfort as important to shoe selection through an online survey (Dhillon et al., 2020), but there is a paucity of information regarding which factors are most important to runners when shopping in-store. Previous methodologies have not been designed to evaluate factors that influence running shoe selection directly, or in ways generalisable to most runners. Furthermore, several other factors can influence shoe choice, including country (Kong et al., 2015), gender (Kong & Bagdon, 2010), and shoe construction (Westerman et al., 2007). An enumeration of factors that influence running shoe selection is preliminary to identifying their relative importance.

### **Comfort defined**

Although several factors appear to influence shoe selection, comfort has been identified as one critical aspect (Dhillon et al., 2020). Therefore, it is important to understand how comfort is defined and assessed in the context of running footwear. In areas not directly addressing running shoes, comfort has been defined as a ‘pleasant state or relaxed feeling of a human being in reaction to its environment’ (Vink & Hallbeck, 2012), ‘the state of being physically relaxed and free from pain’ (Menz & Bonanno, 2021), and ‘a positive sensation’ (Goonetilleke, 2013). Footwear comfort is assessed using multiple techniques, including Likert scales, visual analogue scales, and ranking systems (Lindorfer et al., 2019).

### **Comfort assessment**

Researchers most commonly use 150 mm or 100 mm visual analogue scales in addition to Likert-type scales in assessing footwear comfort (Matthias et al., 2021). Visual analogue scales allow participants to make a mark or move a selector along the length of the scale, while Likert scales typically use five-level items. Both tools typically use anchor statements at the ends and middle of the scales to instruct users. For example, anchors may include descriptors such as

‘strongly disagree’, ‘neutral’, or ‘strongly agree’. Likert scales have the benefit of simplicity, but are less reliable and less granular than 100 mm visual analogue scales during shoe comfort rating (Lindorfer et al., 2019; Mills et al., 2010).

Ranking between shoes in a head-to-head manner may be most applicable to an in-store experience in which runners can try on multiple shoes back-to-back or concurrently, with a different shoe on each foot (Kong et al., 2015). Therefore, ranking shoes against each other may be most applicable in specialty stores and during shoe selection, but visual analogue scales may be most useful when conducting shoe comfort research. As comfort can be defined or influenced in multiple ways, some researchers have developed specialised tools to assess footwear comfort, such as the running shoe comfort assessment tool (RUN-CAT) that uses a composite score of discreet aspects of shoe comfort to create a final score (Bishop et al., 2020). RUN-CAT has been implemented in recent research (Hébert-Losier et al., 2024), and is one footwear comfort tool specific to running.

### **Comfort stability**

Comfort may not be a robust measurement to base shoe selection on. Individuals may not provide reliable scores across sessions for the same running condition (Hoerzer et al., 2016) when assessing comfort. Differences in intra-rater comfort may indicate that subjective perceptions can be influenced by physical or psychological state (Menz & Bonanno, 2021). Behaviour is influenced both independently and additively by broad personality traits and situational characteristics (Sherman et al., 2015). Therefore, it is likely that runners’ subjective comfort can be influenced by physical (e.g., foot morphology) and psychological (e.g., agreeableness) characteristics, but also vary by situation. For example, runners rated shoes described as expensive and unavailable on the market as being more comfortable than shoes

described as regular and already on the market (Chan et al., 2020). Similarly, salespeople telling runners that specific shoes are best suited to their individual biomechanics may increase comfort compared to less favourable shoe descriptions.

A scoping review of the literature describes the lack of standardised measurement protocols regarding footwear product comfort (Tunprasert et al., 2021). This lack of standardisation makes it more difficult for researchers and healthcare professionals to effectively make comparisons and draw accurate conclusions from the existing literature regarding footwear comfort. For example, a hypothetical shoe purchase experiment combined ‘comfort/fit’ as one attribute (Westerman et al., 2007), while another used ‘fit and comfort’ as a single descriptor (Hennig, 2011) despite fit potentially influencing comfort (Miller et al., 2000). Hence, fit and comfort should be considered as separate attributes. Footwear comfort may be influenced by several other factors than fit (Menz & Bonanno, 2021), such as cushioning (Kong & Bagdon, 2010; Walton & French, 2016), product description (Chan et al., 2020), and branding (Hennig & Schulz, 2011). The existence of these confounding factors influencing comfort may reduce the utility of comfort measurements across research and in practical settings when taken in isolation. Furthermore, researchers may make inaccurate comparisons when studies do not define which aspects of comfort are assessed and reported.

### **Factors influencing comfort**

Overall, there is no clear consensus definition or measuring tool for footwear comfort, which is multifactorial in nature. Many publications simply report a comfort score without explicit definitions (Menz & Bonanno, 2021), which is problematic considering its subjective nature. For example, generic comfort scores reported in research may be compared without considering nuances in construction and intended use of footwear. Running shoes that are stiffer

or more minimal may be comfortable for racing conditions or speed workouts, whereas more maximalist shoes may be more comfortable for longer and slower workouts (Hébert-Losier et al., 2024). Likewise, ‘thermal comfort’ and shoe microclimate are aspects of comfort that have been considered regarding trekking shoes, ski boots, and sandals, as described by Menz and Bonanno (2021), but are potentially secondary considerations in running shoes. However, a warmer or more breathable shoe may be seasonally beneficial to running comfort.

Despite its potential for day-to-day variability (Hoerzer et al., 2016) and multifactorial nature, researchers have proposed that runners should choose running shoes based on comfort (Nigg et al., 2015). Experts also believe that shoe comfort is a footwear priority to runners regardless of their running level (Honert et al., 2020). While this approach may not be inherently harmful, and may even be positive, choosing shoes based on a subjective feeling of comfort that can be situationally influenced and is multifactorial in nature presents its challenges and limitations. Choosing shoes based solely on comfort is neither sufficiently supported to reduce injury (Agresta et al., 2022), nor is the runner able to accurately identify comfort based on physical characteristics of shoes alone (Chan et al., 2020) or interchangeably across rating systems (Lindorfer et al., 2019).

### **Conscious behaviour**

Product selection can vary based on the level of consciousness applied during decisions. Currently, conscious behaviour during running footwear selection is not yet documented. The amount of conscious thought applied during choices can influence the quality of the decision and level of satisfaction of individuals making choices (Dijksterhuis & Van Olden, 2006) as described in the Unconscious Thought Theory (UTT) (Dijksterhuis & Nordgren, 2006). People classified as ‘unconscious’ may make better decisions (Bos et al., 2011) through automatic

weighing of choices. Shoppers choosing complex products with unconscious processes make better choices and are more satisfied than more conscious shoppers (Dijksterhuis & Van Olden, 2006). Alternatively, people may benefit from more conscious states when choosing simple products. A state of reduced consciousness can also be induced through introducing a distracting tasks during decisions (Dijksterhuis et al., 2006). The running shoes discussed in this Thesis can be considered complex products due to the large number of factors that influence shoe selection. Furthermore, the typical in-store process involves a degree of complexity as runners work with salespeople to choose from a variety of shoe options. Runners may be distracted or deterred by the number of available shoe choices, which may or may not benefit their shoe selection based on their level of consciousness.

An evaluation of runners' conscious behaviours in-store will establish how theoretical underpinnings of UTT apply to running shoes. Understanding the conscious behaviour of runners during shoe selection is preliminary to effectively implementing UTT to improve runners' decisions. For example, if running shoes are considered complex products, runners should make better decisions and be more satisfied if they make their decisions in a less conscious state. Longitudinal study designs can capture the long-term effects of consciousness on shoe selection and contrast outcomes to other studies using the UTT framework. Research regarding shoe-selection processes, conscious behaviour, and subjective perceptions based on interventions should assist runners and footwear prescribers during the footwear selection process. This Thesis lays the groundwork for future application of UTT to modify runner behaviour in a favourable manner.

## **The role of education in footwear selection**

Implementing scientific evidence into educational material may lead to improved running shoe selection. Currently, there is an overt gap between common practices and research, which introduces opportunities for misinformation to influence shoe prescription. The ubiquitous theory of matching runner foot shape to specific shoe constructions has been challenged for over a decade (Knapik et al., 2009), but anecdotally still in common use. While some researchers and clinicians have cautioned that common practices may not be evidence-based in the past (Richards et al., 2009), little appears to have changed regarding the beliefs of salespeople and healthcare professionals today regarding footwear prescription (Wolthon et al., 2020). Runners trust the recommendations of healthcare professionals, especially if they have a running background (Ramsey et al., 2022). Therefore, healthcare professionals and salespeople have a responsibility to seek out best practices and attempt to accurately interpret, translate, and implement current scientific findings to help those they serve. Currently, education regarding outdoor footwear recommendations from healthcare professionals may be limited or ineffectual (Barwick et al., 2019).

Online educational tools may be an ideal solution to communicate evidence-based recommendations to user groups, but may be limited compared to multimedia programmes. Some attributes recommended for continued professional development in coaching settings include creating unified legitimate messaging, making it personal, and educating in an entertaining way (Griffiths et al., 2018). The same attributes could possibly be applied to running shoe education to create an evidence-based multimedia module or video. The modalities of an evidence-based behavioural change programme may also influence its efficacy. For example, a combination of written guide and verbal seminar was effective in creating more favourable

parent-child relationships and better experiences for children participating in sport compared to parents that did not participate in the evidence-based programme or only received the written guide (Dorsch et al., 2017). However, implementing a similar programme to running shoe selection would be time and resource intensive, but may be applied in a personal setting at the running store level. An online tool-kit has been developed in the past to guide shoe recommendation conversations between podiatrists and patients (Farndon et al., 2016), and may be beneficial in the realm of running.

Although most runners prioritise advice from salespeople and prefer practical experience over academic knowledge (Walton & French, 2016), many still seek out scientific literature (Dhillon et al., 2020). Runners that viewed an evidence-based educational module believed that it would influence how they chose their next pair of shoes (Dhillon et al., 2020). In part, the educational module was designed to provide evidence to runners of the benefits of using minimalist shoes to decrease knee joint forces, which may lead to improved comfort. However, no follow-up study was conducted to confirm whether runners chose different shoes. As such, the effects of evidence-based education on running shoe selection are unknown. Ultimately, it may be possible to improve the experience of running shoe selection through the incorporation of scientific evidence and effective knowledge translation.

## **Thesis aims**

Based on the gaps identified in the running shoe selection literature, the aims of this Thesis were to:

1. Identify and summarise the factors that influence road running shoe selection from the current literature (Chapter 2).

2. Explore and describe the in-store running shoe selection experience through quantitative and qualitative methods from the perspectives of runners (Chapter 3) and salespeople (Chapter 4).
3. Investigate the effects of an educational video on running shoe selection and subjective perceptions, including comfort and performance (Chapter 5).
4. Investigate the relationship between conscious decision-making processes and satisfaction (Chapter 5).
5. Investigate the effects of simulated expert recommendation using gait analysis and favourable product descriptions on subjective perceptions of running shoes (Chapter 6).

### **Thesis hypotheses**

The hypotheses tested in this Thesis were:

1. Runners purchasing shoes in-store would think more about their purchase than non-buyers prior to visiting the store (Chapter 3).
2. Runners exposed to an educational video would choose more minimalist shoes than runners that viewed a control video (Chapter 5).
3. Runners exposed to an educational video would experience increased comfort over time compared to runners that viewed a control video (Chapter 5).
4. Runners classified as unconscious buyers regarding shoe choice would report greater satisfaction over time than conscious ones (Chapter 5).
5. Runners would score and rank gait-matched shoes more favourably than basic shoes based on visual analogue scales and head-to-head comparisons (Chapter 6).

## **Significance of the Thesis**

The results and findings of this Thesis describe the in-store experience of runners and increase the overall understanding of running shoe selection and subjective perceptions of runners, with a focus on recreational runners. Firstly, the knowledge of how runners and salespeople interact in specialty running stores during shoe selection is foundational to improving current practices. Quantifying specific aspects of decision-making processes, such as consciousness, will allow researchers to optimise selection practices and ideally increase runner satisfaction. Information regarding in-store processes can be useful to runners, salespeople, clinicians, and other parties (e.g., retailers and manufacturers) involved in making shoe recommendations.

Evaluating the effects of evidence-based educational material on running shoe selection and subjective perceptions is a first step to transferring knowledge to favourably influence shoe selection behaviour. As runners consistently seek advice from running shoe stores (salespeople) and value in-store practices such as gait analysis, evaluating the effects of expert shoe recommendation on runners' subjective perceptions can replicate the in-store experience. Typical goals of running shoe selection include improving subjective perceptions, such as comfort, performance, and injury reduction. Study designs should test the robustness of subjective perceptions to gain an understanding of the usefulness and utility of these perceptual measures.

## **Thesis structure**

The Thesis comprises seven Chapters (Figure 1). Chapter 1 is a general introduction outlining the rationale, aims, and significance of the Thesis findings. Chapter 2 comprises a systematic review of the road running shoe selection literature addressing factors that influence shoe choice. Chapter 3 explores how runners choose their shoes in specialty running stores based

on survey data. Chapter 4 focuses on the runner-salesperson interaction and shoe recommendation process from the salesperson perspective via thematic analysis of in-person interviews. Chapters 5 and 6 focus on influencing behaviour and perceptions; specifically, Chapter 5 investigates the effects of an educational video on new shoe purchase and subjective perceptions of runners over time using a randomised controlled trial with parallel groups, while Chapter 6 assesses how replicating in-store shoe selection processes may influence subjective perceptions based on gait-analysis and expert recommendation in a randomised crossover trial. The final Chapter (Chapter 7) summarises key findings, discusses limitations, and includes future research recommendations.

All Chapters excepting Chapters 1 and 7 are standalone research pieces suitable for peer-review publication. These pieces of work include a systematic literature review, cross-sectional studies, and a longitudinal study that are either published or under peer-review. As such, there may be some repetition of concepts within the Thesis as each Chapter includes its own introduction and discussion. Chapter 7 includes a summary of Thesis findings by Chapter and discusses how previous literature integrates with Thesis results. Individual Chapters prepared for journal publication are written stylistically to include multiple author contributions. Chapters 2 to 6 begin with a short prelude to explain the rationale and link each Chapter to the overall narrative of the Thesis. The Thesis is also divided topically into three Sections. Section 1 (Chapter 2) includes a review of the literature regarding road running shoe selection. Section 2 (Chapters 3-4) focuses on the in-store process of running shoe selection, while Section 3 (Chapters 5 and 6) comprises studies seeking to influence runners' shoe selection and subjective perceptions of footwear through experimental means.

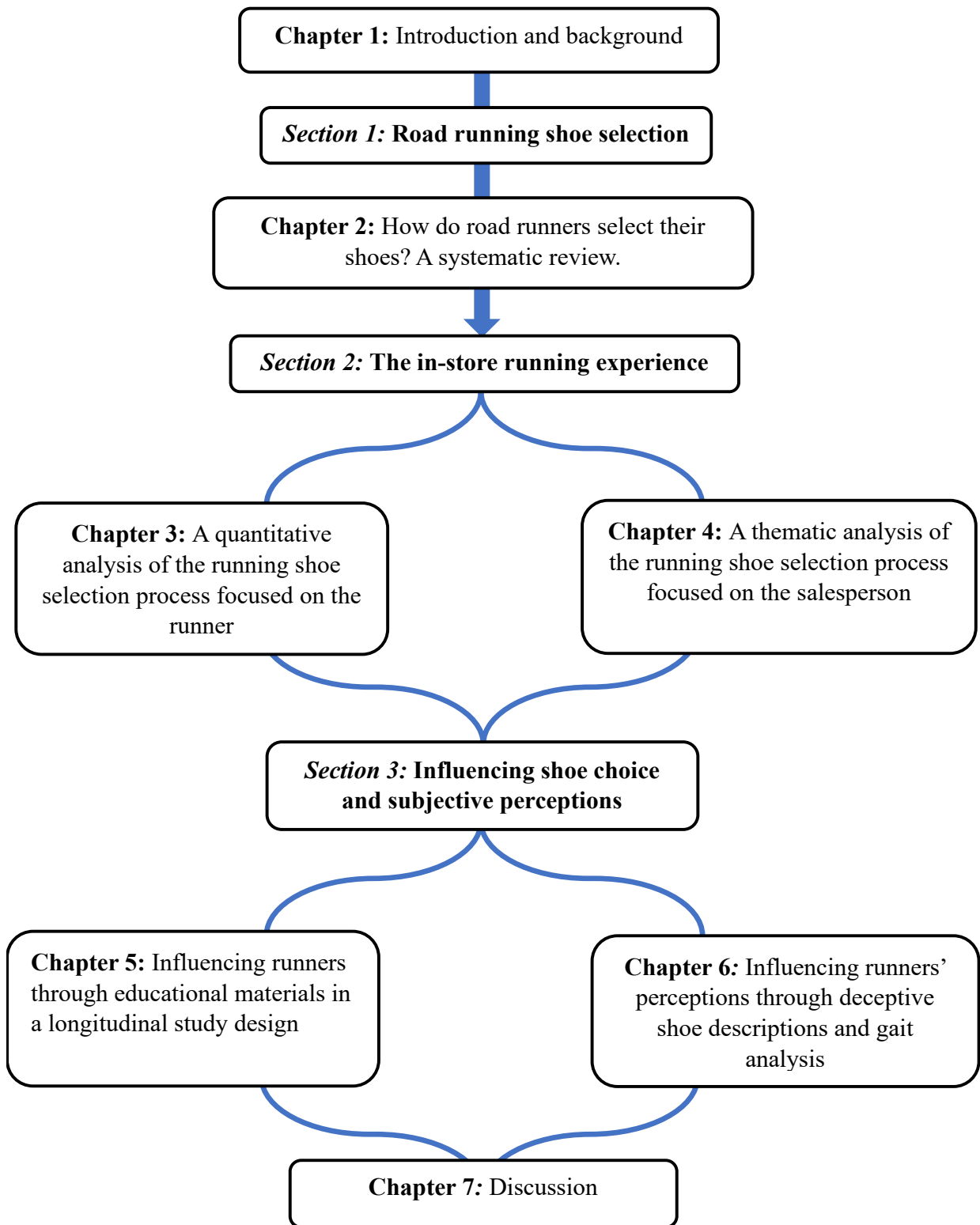


Figure 1. Thesis structure schematic.

## Section 1 – Road running shoe selection

### Chapter 2

#### How do road runners select their shoes? A systematic review

Fife, A., Ramsey, C., Esculier, J. F., & Hébert-Losier, K. (2023). How do road runners select their shoes? A systematic review. *Footwear Science*, 15(2), 103-112. DOI: 10.1080/19424280.2023.2180543

**Prelude:** Chapter 2 concentrates on the selection of road running shoes that is oftentimes anecdotally evident, but lacks scientific research. Systematic reviews of the literature use comprehensive and defined methods to summarise the literature on specific topics and can effectively describe subject knowledge when conducted rigorously. To date, there has been no systematic evaluation of factors that may influence road running shoe selection. The baseline collation of influencing factors is preliminary to understanding areas for process improvement and knowledge translation. Therefore, the aim of this Chapter is to provide a comprehensive overview of factors reported to influence road running shoe selection.

## Introduction

Running is a popular form of physical activity worldwide (Galic, 2021) associated with many health-related benefits, including a decreased risk of all-cause mortality (Pedisic et al., 2020). In fact, road running or jogging is one of the most popular outdoor activities in the USA based on 18,000 respondents aged six and over (16.7% participation) (Outdoor Foundation, 2021). Unfortunately, many runners are at risk of injury, with 14.9% of novice runners (range: 9.4 to 94.9%; follow-up: 6 weeks to 18 months) and 26.1% of recreational runners (range: 17.9 to 79.3%; follow-up: 1 to 24 months) injured across 36 studies according to a recent review (Fredette et al., 2022). Justifiably, common goals in runners include injury prevention and running longevity (Dhillon et al., 2020; Malisoux & Theisen, 2020).

Although running does not require specialised equipment for participation like many other sports (e.g., golf or mountain biking), runners generally consider shoes as essential for running participation (Walton & French, 2016). There is debate regarding the efficacy of using running shoes to prevent injury. There is no consensus on whether any shoe can prevent injury (Knapik et al., 2009; Richards et al., 2009) or whether training loads can fully explain injury rate, which highlights the multifactorial nature of running-related injuries (Blazey et al., 2021; Malisoux & Theisen, 2020).

Individuals have different preferences and goals when selecting their running shoes, including injury prevention and performance (Dhillon et al., 2020). There is no consistent terminology used in research or industry when classifying footwear (Marchena-Rodriguez et al., 2020) despite attempts from researchers to standardise terminology and develop objective criteria to distinguish minimalist from maximalist shoes (Dhillon et al., 2020). The emergence of more maximalist style 'super shoes' in recent years has led to world record running times (Dyer, 2020;

Muniz-Pardos et al., 2021), which might entice recreational runners to purchase super shoes given the running economy and performance advantage they can confer (Hébert-Losier et al., 2020). Runners therefore do not only need to navigate inconsistent terminology and technical shoe features, but also consider the overall comfort, injury reduction potential, and performance enhancing possibilities of footwear (Honert et al., 2020). Furthermore, the footwear industry and running culture constantly propagate the idea that specific running shoes can reduce injury risk and improve performance (Walton & French, 2016) despite the lack of research to substantiate these claims in relation to injury (Knapik et al., 2015) and the existence of individualised responses to footwear in terms of performance (Hébert-Losier et al., 2020; McLeod et al., 2020). As a result, runners face potential pitfalls, biases, and misinformation throughout the shoe selection process. There is no evidence-based best practice consensus regarding shoe recommendation or selection.

Running shoe prescription based on comfort has come to the forefront of the running shoe literature, with Nigg et al. (2015) proposing that runners select their shoes using a ‘comfort filter’. The comfort filter suggests selecting shoes based on comfort, which reduces injury by supporting the natural mechanics a runners (Nigg et al., 2015). However, minimal research has been undertaken to support this paradigm (Agresta et al., 2022). Blazey et al. (2021) suggest that despite the potential effect of footwear comfort on running-related injury, a comfortable shoe may not be the ideal shoe for performance. Hence, it might be difficult to runners to find a shoe that is perceived as comfortable, reducing the risk of injury, and enhancing performance at the same time, despite some footwear experts advancing that the priorities of shoe design are to improve comfort, reduce injury risk, and improve performance regardless of running ability (Honert et al., 2020).

Despite the array of research on running shoe features (Nigg et al., 2020; Sun et al., 2020) and the variety of shoes available for purchase (Barff & Austen, 1993; Ramsey et al., 2019), little

is known regarding how runners select their running shoes. Therefore, this systematised review aimed to identify factors that influence the selection of running shoes of road runners, whereby the term ‘selection’ encapsulates running shoe preference, choice, and purchase.

## **Materials and methods**

This systematised review follows the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) 2020 guidelines (Page et al., 2021). The review was pre-registered in The International Prospective Register of Systematic Reviews (PROSPERO, protocol CRD42020198955). Initially, a risk of bias assessment was planned. Due to the broad range of study designs and breadth of outcomes, as well as the exploratory nature of this review, risk of bias assessment was not implemented.

### **Eligibility criteria**

The eligibility criteria for studies were set using the Participants, Interventions, Comparisons, Outcomes, and Study Type (PICOS) framework (Moher et al., 2010). Participants: Studies that included road runners were eligible. Research was excluded if the population involved runners that trained primarily off-road or used shoes designed for another sport (e.g., rugby, football, track spikes, trail running, etc.). Intervention: Studies were eligible for inclusion when using an intervention that identified preferences, contributing factors, or reasons why runners selected (or preferred, chose, or purchased) their road running shoes. Studies were excluded when the intervention pertained to sports or shoes other than road running. Comparisons: Factors that influence running shoe selection were of interest; hence, studies that involved comparisons between running shoes were eligible. For an inclusive review, studies that also examined shoe selection (or preference, choice, or purchase) in road runners without direct comparisons between shoes were also included. Outcomes: Outcomes of interest were those quantifying or describing

factors that influence shoe selection, which could include survey responses, interviews, visual analogue scales, Likert-based scales, and rankings. Studies: Articles were eligible for inclusion if they were peer-reviewed original research written in English. Acceptable study designs included qualitative, quantitative, or mixed-methods approaches. Studies that were not original research (e.g., reviews, editorials, and conferences) or not in the English language were excluded.

### **Information sources and search strategy**

A systematic search was conducted on the 16<sup>th</sup> March, 2021, in the PubMed, Scopus®, SPORTDiscus™, and Web of Science® electronic databases. These databases were monitored until 1<sup>st</sup> February, 2022. The general search strategy applied within the main search bar of these databases was: (Running OR run\*) AND (footwear OR shoe\*) AND (select\* OR purchas\* OR choice\* OR choos\* OR prefer\* OR buy\* OR bought). English language and journal article limits were applied. The supplementary material contains a detailed description of the search syntax for each database (Supplement 1). The reference list of articles meeting inclusion were also searched for additional articles meeting inclusion.

### **Selection process**

Citations from the database search were imported into Endnote 20.0.1 (build 15043, Clarivate Analytics, Philadelphia, PA, USA) and duplicates were removed. The remaining references were then imported into the online software platform Covidence (Veritas Health Innovation, Melbourne, Australia) where additional duplicates were identified and removed. Thereafter, two reviewers (AF and CK) independently reviewed the titles, abstracts, and full-text articles, in that order, for inclusion and exclusion. At each stage, the two independent reviewers discussed any conflicts that arose. A third reviewer (KHL) was available to arbitrate any unresolved conflicts, but was not required.

## **Data collection process and items**

Reviewers independently extracted data from the full-text articles meeting inclusion using a data extraction template customised in Covidence. Data were extracted from the following categories: study design and aims; participant inclusion/exclusion criteria; population characteristics (number, age, gender, and running experience); results related to footwear selection, preference, choice, or purchase; and key conclusions. Following the independent data extraction, the two reviewers discussed any differences in data extracted. A third reviewer (KHL) provided quality assurance of the data extracted.

## **Synthesis methods**

Data extracted were compiled and analysed using Microsoft Excel 2019 (Microsoft Corp., Redmond, WA, USA). The results were summarised using weighted means and standard deviations (means  $\pm$  SD) for participant characteristics (weighted based on the sample size of the included studies), minimum-to-maximum ranges, counts, and/or percentages. Data are presented using a narrative synthesis throughout the results section. Key concepts were tabulated and thematically organised to highlight the most common factors reported to influence running shoe selection and complement the narrative synthesis.

## **Results**

### **Study selection**

Seven studies met eligibility from the 584 articles identified (Figure 2) and are summarised in Table 1. The most common reason for excluding studies was ‘wrong outcomes,’ where studies did not quantify or describe factors that influence shoe selection in road runners.

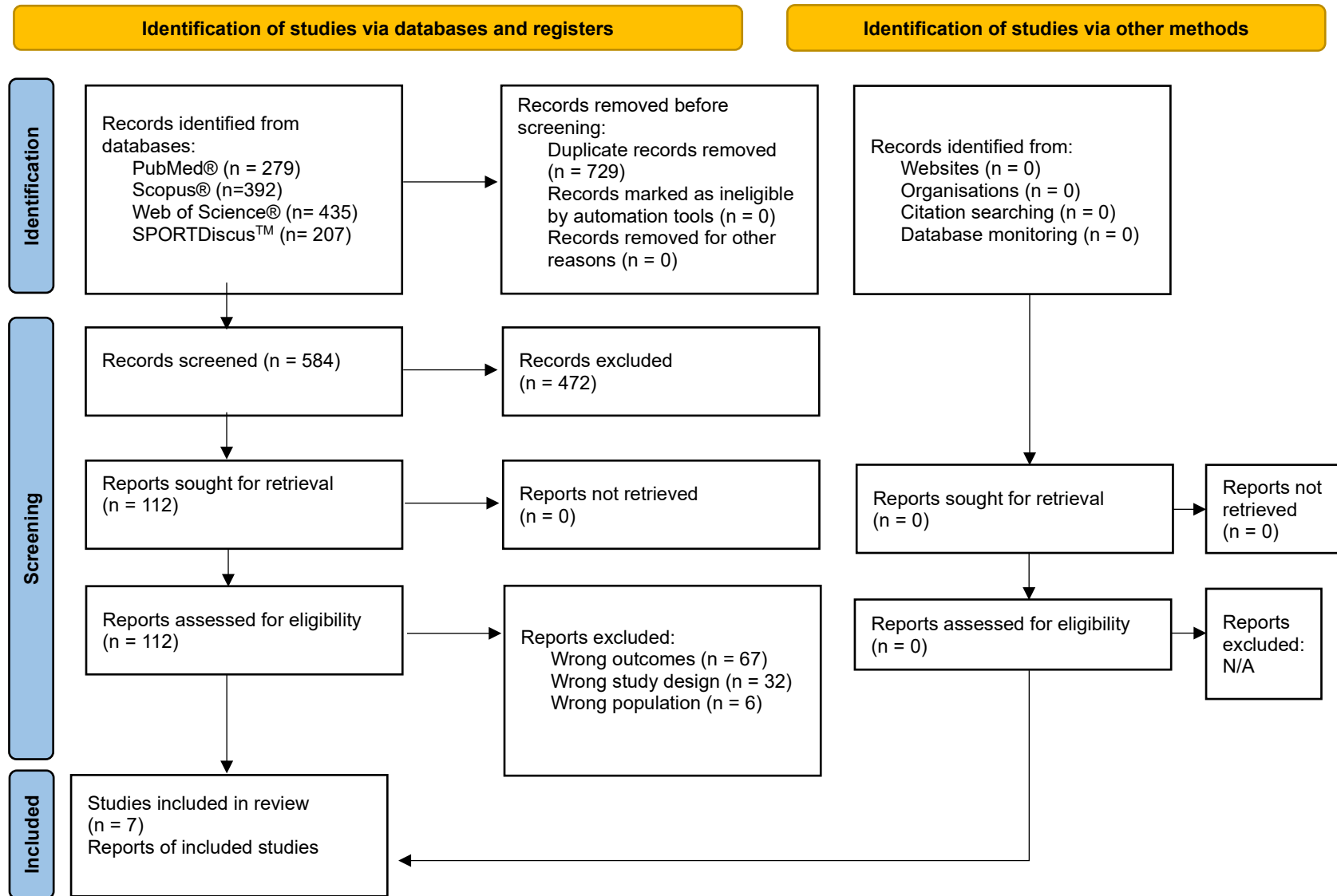


Figure 2. PRISMA flow diagram of the search strategy and article screening process.

Table 1. Summary of included studies, influencing factors examined, and key results relevant to running shoe selection.

Authors	Design and aims	Design and methods, and setting	Population	Influencing factors examined	Key results
Walton 2016	Design: qualitative research Aim: gather information about running experiences with focus on barefoot and minimalist running	Methods: in-depth interviews Setting: quiet convenient location	Sample: N = 8 (6 F, 2 M) Age: 35 y Experience: current or former recreational runners	Cushioning, support, comfort, price	Support is poorly defined, yet desirable. More expensive shoes were perceived to be of higher quality. Comfort linked to cushioning.
Dhillon 2020	Design: two-part (1) observational; (2) experimental Aim: (1) document factors considered by runners selecting footwear and compare perceptions on footwear and injury risk in runners and HCPs; (2) evaluate the perceived usefulness of an online educational module	Methods: (1) online survey; (2) pre-post online survey with an educational module Setting: online survey	Sample: N = 1564 (520 F, 1034 M) Age: 38.1 (10.5) y Experience: 8.8 (8.2) y running; 38.6 (24.2) km per week	Comfort, injury prevention, performance, brand, cost recommendations, discount, reviews, technologies, style, colour	Runners rely mainly on comfort when selecting new footwear, followed by performance and injury prevention.
Kong 2015*	Design: experimental Aim: examine perception of running shoes between China (Beijing) and Singapore; and discover if running shoe preference depends on assessment methods	Methods: within (shoe assessment method) and between (country) group comparisons Setting: gym and laboratory	Sample: N = 100 (50 Singapore; 50 Beijing) Age: 23.5 (2.6) y Experience: Beijing 4.2 (1.3) sessions/week; Singapore 2.5 (1.4) sessions/week	Comparison tool used (visual analogue scale vs. 'Head to head' method), country, fit, cushioning, arch support, stability	'Head to head' comparison differed from visual analogue scale ranking. Cushioned shoes were preferred over other models. Beijing runners ranked attributes higher than Singapore. Singapore ranked lighter shoe as much less stable than Beijing runners.
Kong 2010	Design experimental Aim: compare shoe preferences based on subjective comfort between walking and running. The effect of gender, running experience, and body mass on shoe preference were explored.	Methods: within (shoes) and between (gender) group comparisons Setting: laboratory	Sample: N = 41 (19 F, 22 M) Age: 27.4 (9.0) y Experience: sedentary to competitive runners	Gender, cushioning, shoe mass	Shoe preference based on gender. Men preferred the cushioning model, and women preferred the lightweight shoe. The stability model was the least preferred.
Tay 2017*	Design: experimental Aim: examine the strength of individual footwear perception factors to influence the overall preference of running shoes	Methods: regression analysis with four perception variables to predict overall preference Setting: gym and laboratory	See Kong 2010	Cushioning, fit, arch support, stability	Cushioning and fit were the most important variables used to predict overall preference from the four variables examined.

Willems 2019	Design: observational Aim: investigate if consumer behaviour towards footwear is a risk factor for lower extremity injuries	Methods: prospective study correlating injury rates to shoe choice Setting: online survey	Sample: N = 104 (49 F, 55M) Age: 50.0 (11.6) y Experience: 95.7% recreational 95.7%, 4.3% competitive	Colour, model, material, closure mechanism, presence of specific properties, price, quality, price quality ratio, sales and discounts, brand, fashion, advertisement, comfort, necessity, sport specificity, right fitting, technology, and store service.	Caring for the right fitting during purchase protected against injuries OR 0.11. Data are based on runners and walkers. 79.3% of participants purchased shoes from sports shop, 11.5% from specialty running store, and 1% online. 66.8% underwent gait analysis. 64.4% were influenced by advice of others.
Westerman 2007	Design: experimental Aim: report on the effectiveness of Consumer Decision Support System in the context of Internet and in-store application	Methods: imaginary purchase experiment between 5 pairs of shoes in three conditions (1) product only; (2) Decision Support System only; (3) Decision Support System with product Setting: laboratory	Sample: 30 M Age: 29.6 (9.9) y Experience: 10 advanced, 16 intermediate, 4 beginners; 11.28 (8.75) y running (range: <1 to 30 y)	Durability, flexibility, tread, weight, cushioning, stability, support, reflective material, price, aesthetics, brand, colour, upper material, technical, build quality, fashionable, previous use, maintenance, toe area, comfort/fit, recommendation, water resistant, dual purpose, sole parts, inside, laces	Durability, price, support, weight, cushioning, flexibility, stability, tread, and reflective material were weighted most to least important in shoe selection. Aesthetics and brand were most frequently considered as additional attributes.

Note. Relevant data extracted from the included studies of the present review. \*denotes that both studies used the same data set. Abbreviations: F, female; M, male; OR, odds ratio.

## **Study characteristics**

Four studies were experimental (Dhillon et al., 2020; Kong & Bagdon, 2010; Kong et al., 2015; Tay et al., 2017), two were observational (Westerman et al., 2007; Willems et al., 2019), and one was a qualitative interview-based study (Walton & French, 2016). Across studies, 1,947 runners were examined (31% female, 69% male), where 80.3% of the total sample originated from a single study (Dhillon et al., 2020). Four studies included males and females (Dhillon et al., 2020; Kong & Bagdon, 2010; Walton & French, 2016; Willems et al., 2019) and the remaining three involved males only (Kong et al., 2015; Tay et al., 2017; Westerman et al., 2007). The weighted mean age of participants was 35.4 (4.4) years.

Most studies required participants to meet a specified running frequency or distance, often once or twice per week for a period of at least one month (Dhillon et al., 2020; Kong et al., 2015; Tay et al., 2017; Willems et al., 2019). The other studies involved current or former runners (Walton & French, 2016), runners with less than one year to 30 years of running experience (Westerman et al., 2007), or runners with unreported running experience (Kong & Bagdon, 2010).

## **Results of individual studies and syntheses**

Forty factors were identified from the seven included studies (Table 2) and were grouped thematically into the following five subcategories: subjective (n = 7 factors, 17.5%), shoe-specific characteristics (n = 18 factors, 45%), market features (n = 9 factors, 22.5%), peer evaluation (n = 2, 5%), and runner characteristics (n = 4, 10%). Comfort (Dhillon et al., 2020; Kong & Bagdon, 2010; Walton & French, 2016; Westerman et al., 2007; Willems et al., 2019) and cushioning (Kong & Bagdon, 2010; Kong et al., 2015; Tay et al., 2017; Walton & French, 2016; Westerman et al., 2007) were the most frequently cited factors to influence shoe selection, identified in five articles

each. Fit (Kong et al., 2015; Tay et al., 2017; Westerman et al., 2007; Willems et al., 2019) and price (Dhillon et al., 2020; Walton & French, 2016; Westerman et al., 2007; Willems et al., 2019) were the next most common factors, cited in four articles each. Twenty-five (62.5%) of the 40 factors identified were referenced once only.

Table 2. Summary of factors that influence running shoe selection and the number of studies (frequency) that addressed each specific factor.

Category	Factor	Frequency	Reference
Subjective	Comfort	5	1, 2, 5, 6, 7
	Fit	4	3, 4, 6, 7
	Comparison tool	1	3
	Dual purpose	1	6
	Injury prevention	1	1
	Performance	1	1
	Sport specificity	1	7
Shoe-specific characteristic	Cushioning	5	2, 3, 4, 5, 6
	Stability	3	3, 4, 6
	Technologies	3	1, 6, 7
	Arch support	2	3, 4
	Material	2	6, 7
	Shoe mass	2	2, 6
	Support	2	5, 6

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	Quality	2	6, 7
	Closure mechanism	1	7
	Durability	1	6
	Flexibility	1	6
	Inside	1	6
	Laces	1	6
	Maintenance	1	6
	Sole parts	1	6
	Toe area	1	6
	Tread	1	6
	Water resistant	1	6
Market features	Price	4	1, 5, 6, 7
	Colour	3	1, 6, 7
	Style	3	1, 6, 7
	Discount	2	1, 7
	Advertisement	1	7
	Brand	1	1, 6, 7
	Model	1	7
	Value	1	7
	Store service	1	7
Peer evaluation	Recommendations	3	1, 6, 7
	Reviews	1	1

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Runner characteristic	Country	1	3
	Necessity	1	7
	Previous use	1	6
	Gender	1	2

Note. Factors identified to influence running shoe selection. References: <sup>1</sup> Dhillon et al. (2020); <sup>2</sup> Kong and Bagdon (2010); <sup>3</sup> Kong et al. (2015); <sup>4</sup> Tay et al. (2017); <sup>5</sup> Walton and French (2016); <sup>6</sup> Westerman et al. (2007); <sup>7</sup> Willems et al. (2019)

In terms of subjective factors, runners identified comfort (Dhillon et al., 2020; Kong & Bagdon, 2010; Walton & French, 2016; Westerman et al., 2007; Willems et al., 2019) and fit (Kong et al., 2015; Tay et al., 2017; Westerman et al., 2007; Willems et al., 2019) as important factors when choosing their road running shoes, in addition to running injury and performance considerations (Dhillon et al., 2020). Shoe-specific characteristics influencing running shoe selection included stability (Kong et al., 2015; Tay et al., 2017; Westerman et al., 2007) and technologies (Dhillon et al., 2020; Westerman et al., 2007; Willems et al., 2019). The market features identified included price (Dhillon et al., 2020; Walton & French, 2016; Westerman et al., 2007; Willems et al., 2019), colour (Dhillon et al., 2020; Westerman et al., 2007; Willems et al., 2019), and style (Dhillon et al., 2020; Westerman et al., 2007; Willems et al., 2019). Despite the relative importance of price on shoe selection, only one article reported the price of shoes, and identified that price was not related to injury (Willems et al., 2019). Runners in the included studies were also influenced by peer evaluations such as recommendations (Dhillon et al., 2020; Westerman et al., 2007; Willems et al., 2019) and reviews (Dhillon et al., 2020). In terms of runner characteristics, runners from the included studies selected footwear differently based on country (Kong et al., 2015), necessity (Willems et al., 2019), previous use (Westerman et al., 2007), and gender (Kong & Bagdon, 2010).

## **Discussion**

### **Subjective factors**

Comfort was the most frequently cited factor alongside cushioning to influence footwear selection in road runners. Despite comfort being consistently identified to affect shoe selection (Dhillon et al., 2020; Kong & Bagdon, 2010; Walton & French, 2016; Willems et al., 2019), footwear research in general lacks standard definitions and protocols when addressing comfort (Menz & Bonanno, 2021). Comfort has been defined as a ‘pleasant state or relaxed feeling of a human being in reaction to its environment’ (Vink & Hallbeck, 2012). This definition highlights the subjective nature of comfort and the potential difficulty in measuring or comparing comfort meaningfully. Menz and Bonanno (2021) advanced two key comfort concepts relevant to footwear, ‘pure comfort’ and ‘thermal comfort’, which illustrates the importance of clearly defining what and how footwear comfort is being measured.

There are few validated tools and standardised measurement protocols used to assess product comfort (Tunprasert et al. 2021). Kong et al. (2015) identified that different comfort assessment tools influence outcomes. More specifically, runners’ shoe rankings were different when based on ratings from a 15 cm visual analogue scale than from a ‘head to head’ comparison of two shoes simultaneously worn on each foot. This finding led the authors to recommending that runners use a ‘head to head’ comparison when selecting shoes (Kong et al., 2015). Despite this recommendation being made to runners, more recent recommendations for researchers advise the use of visual analogue scales for measuring footwear comfort, with 10 cm and 15 cm scales most frequently used (Menz & Bonanno, 2021). While visual analogue scales may be useful in research, runners typically do not use such scales when trying on or selecting shoes, and rather employ a ‘head to head’ approach to compare shoe comfort.

Footwear comfort is multifactorial in nature (Menz & Bonanno, 2021). The running shoe comfort assessment tool (RUN-CAT) uses metrics such as heel cushioning, forefoot cushioning, shoe stability, and forefoot flexibility to create a composite comfort score (Bishop et al., 2020). The RUN-CAT tool highlights the interplay between comfort and cushioning, where two of the four metrics relate to comfort. The concept extends further when considering overall shoe preference, whereby cushioning and fit were the most important variables in predicting overall shoe preference when considering fit, cushioning, arch support, and stability (Tay et al., 2017). Hence, the apparent interrelation between comfort, cushioning, and other subjective factors like fit may confound their individual importance in footwear selection.

Indeed, like cushioning, fit also appears linked to comfort (Hennig, 2011). The appropriate size of shoes or their construction (e.g., last shape or upper flexibility) may affect the perception of shoe fit and comfort. When trying on running shoes at a specialty store, a sales associate may guide runners through the shoe-selection process (Gibson, 2012). Differences in sizing create fit discrepancies across brands and models and complicate fit comparisons (Jurca & Dzeroski, 2021). Runners may perceive the sales associate as an authority with expertise and source of reliable information, although the recommendations may not be evidence based (Malisoux & Theisen, 2020; Richards et al., 2009). The subjective nature of shoe comfort and individual preference may create a challenge in defining what constitutes the ‘right fit’. Willems et al. (2019) identified that runners who cared about purchasing a shoe with the ‘right fit’ were less likely to sustain a running-related injury, although this result could be due to many factors, including differences in personalities, training habits, and sleep quality and quantity (Mousavi et al., 2021). Following comfort, injury prevention was the second most important factor reported to influence running

shoe selection in the largest cohort of runners from the seven studies reviewed herein (Dhillon et al., 2020).

### **Shoe-specific characteristics**

Cushioning was cited just as often as comfort with regards to influencing running footwear selection (Kong & Bagdon, 2010; Kong et al., 2015; Tay et al., 2017; Walton & French, 2016; Westerman et al., 2007), although only two studies reported cushioning properties (Kong et al., 2015; Tay et al., 2017). As a result, cushioning could also be considered as subjective rather than a measured construct defining shoe properties. Comfort and cushioning also appear linked (Walton & French, 2016, p. 460), with cushioned running shoes most often perceived as the most comfortable (Dinato et al., 2015; Kong & Bagdon, 2010; Sterzing et al., 2013).

Runners may have difficulty perceiving differences in the mechanical cushioning properties of shoes (Delattre & Cariou, 2018). For instance, runners report no differences in perceived comfort of cushioning at the forefoot and rearfoot regions, regardless of cushioning technologies (Dinato et al., 2015). Nonetheless, adding cushioning technologies (i.e., Air, Gel, and Adidas-Adiprene) was perceived as more comfortable overall compared to using only ethylene-vinyl acetate (EVA) foam as the impact absorption system. This result may be due to the greater density and lower cushioning of EVA. Given that all runners in the latter study were rearfoot strikers (Dinato et al., 2015), the link between forefoot and rearfoot cushioning and overall comfort due to cushioning technologies requires further exploration, as it is potentially influenced by gait patterns (Sterzing et al., 2013). Furthermore, runners who ranked cushioned shoes as more comfortable than minimalist shoes ran less (average 26.5 km/week) than those who ranked minimalist shoes as more comfortable (average 33.7 km/week) (Mills et al., 2018). This observation suggests that experience level may also affect the cushioning – comfort relationship.

Although cushioning appears to influence runners' shoe selection; like comfort, it is not consistently defined or measured in a standardised manner across the footwear literature (Ramsey et al., 2019).

### **Market features**

Finances appear to play a role in the selection of road running footwear. Price, discount, and value were identified in several articles as factors influencing shoe selection (Dhillon et al., 2020; Walton & French, 2016; Westerman et al., 2007; Willems et al., 2019). Willems et al. (2019) reported the average price of shoes at 125.75 (43) EUR, or 140 (48) USD, which is significant considering that shoe manufacturers recommend replacing shoes every three to six months or after 300 to 500 miles of wear (Brooks, 2020), the equivalent of ~480 to 800 km of wear. The recommendation to replace shoes by distance may be related to diminished cushioning after 500 km (~310 miles) of use compared to new (Wang et al., 2012). Although runners might prioritise comfort, cushioning, fit, and price, runners also seek shoes that are stylish (Dhillon et al., 2020; Westerman et al., 2007; Willems et al., 2019). Historically, fashion has played a large role in influencing the footwear industry (Thompson & Coughlin, 1994), which is also seen in runners selecting road running shoes based on colour and style (Dhillon et al., 2020; Westerman et al., 2007; Willems et al., 2019).

### **Peer evaluation**

Amongst others, recommendations from peers encapsulate retailers, healthcare providers, friends/family, running clubs, and elite athletes (Dhillon et al., 2020). Recommendations from others was reported to influence 64.4% of individuals during footwear selection (Willems et al., 2019). Despite footwear prescription not being evidence-based (Agresta et al., 2022; Richards et al., 2009; Walton & French, 2016; Warne et al., 2021), recommendations from peers appeared in

almost half (n = 3, 43%) of the articles included. Runners look to others to guide them in their shoe selection, although it is unclear how helpful recommendations actually are. The individual preference of one person may not apply to another. Therefore, it may be problematic to implicitly trust coaches, team mates, or friends in terms of footwear recommendations.

### **Runner characteristics**

The runner characteristics category highlights the individualised nature of running shoe selection, which includes considerations based on country and gender. In terms of country, runners from Beijing ranked the same shoes more favourably than runners from Singapore (Kong et al., 2015). In terms of gender, shoe preference based on the subjective feeling of comfort differed between males and females (Kong & Bagdon, 2010). More specifically, when presented with a cushioned, stability, and lightweight shoe for running, most males preferred the cushioned shoe whereas most females preferred the lightweight one. Westerman et al. (2007) found that runners sometimes select shoes based on past experience, and select the same model as their previous ones. Although not addressed in the reviewed articles, age is another factor linked to runners that likely influences running footwear selection. Indeed, the priorities of more mature individuals during apparel and footwear selection differ from those of younger individuals (Moschis et al., 2011), which likely extend to running footwear.

### **A note on injury**

Given the relatively high injury incidence in runners, it is unsurprising that injury prevention was identified as an important factor in running shoe selection in the study with the largest cohort of runners in this systematised review (Dhillon et al., 2020). Runners may perceive wearing the wrong shoes for their foot type, shoes without cushioning, or worn-down or old shoes as affecting their injury risk (Saragiotto et al., 2014). Changing running shoes is a relatively easy

intervention compared to more active interventions, such as gait retraining or training load monitoring, and makes shoe choice an appealing solution to injury prevention. Runners should be conscious of the multifactorial nature of running injuries (Warne et al., 2021) rather than relying solely on shoe choice for injury prevention. Malisoux and Theisen (2020, p. 1221) advance ‘the role of running shoe technology in injury prevention has been largely overrated.’ Recently, a longitudinal study with a large cohort (n = 848) identified that shoes with higher cushioning properties may have a protective effect against injury in lighter runners (Malisoux et al., 2021). The authors of the present review are not aware of evidence that supports a comfort-based shoe selection approach to reduce injury incidence. If comfort is critical to shoe choice and potentially related to injury, research should be conducted to standardise comfort definitions, measurements, and reporting methodologies.

### **Strengths and limitations**

Although examining the frequency of factors is a useful first step in identifying themes across research, citation frequency does not necessarily represent their relative importance in road running footwear selection. Out of the 40 factors that influenced shoe selection, 25 (62.5%) were referenced only once, which reflects the differences in study designs and selected outcome measures as opposed to their potential influence in running footwear selection. For instance, a runner’s previous use of a given shoe may be a primary determinant of footwear selection, but this aspect was addressed in only one study (Westerman et al., 2007). Similarly, an individual runner may prioritise the existence of a particular technological feature, such as motion control or the presence of a carbon-fibre plate, or recommendations from peers above other factors.

One limitation of the studies reviewed is that none of the included studies took place in a running store, which limits external validity. When comparing or ranking shoes against one

another, it is challenging to understand which specific factors influence preference (Kong & Bagdon, 2010; Kong et al., 2015; Tay et al., 2017; Westerman et al., 2007). Runners may prefer many aspects of a specific shoe, such as its comfort, style, and price, but select a different shoe because of the lacing pattern. Running shoe selection is a nuanced process where runners must consider many parts that lead to overall preference.

A large proportion of runners represented in this review derives from a single online survey study (Dhillon et al., 2020), with some studies having limited sample sizes that might preclude generalisation of findings (Walton & French, 2016). The low number of studies in the area highlights the paucity of research directly exploring footwear selection from a runner's point-of-view.

## **Conclusion and future directions**

The present review identified factors that influence the selection of road running shoes. Studies designed to directly address how runners select their shoes are necessary to create a robust source of knowledge from runners themselves. Future studies designed specifically to identify running shoe selection will strengthen our understanding of what factors are important to runners. Studies examining in-store shoe selection would increase the external validity of findings as would reflect real-life situations, and provide a basis for potential intervention studies on injury prevention or performance.

In conclusion, comfort, cushioning, fit, and price were the most cited factors to influence running shoe selection. Comfort is multifactorial and poorly defined, with both cushioning and fit shown to affect comfort. The interrelatedness of factors makes it difficult to parse the relative importance of individual factors. The types of factors that are important to runners fall into multiple categories, and individual preferences may vary between runners.

Acknowledgement: The authors thank Claire Kelly for contributing to the screening and data extraction process.

## Section 2 – The in-store running experience

### Chapter 3

#### How do road runners select their shoes? An in-store experience.

Fife, A., Ramsey, C., Esculier, J. F., & Hébert-Losier, K. (2024). How do road runners select their shoes? An in-store experience. *Footwear Science*, 10.1080/19424280.2024.2353597

**Prelude:** Section 1 (Chapter 2) summarised and categorised factors reported to influence road running shoe selection based on original published research. Comfort, fit, and cushioning were most frequently cited as factors influencing selection. Reviewing the literature also supported the central nature of running stores in shoe selection, although no study included in the systematic review had been conducted in specialty running stores. The aim of Chapter 3 is to evaluate how runners experience the in-store shoe selection process and which factors they prioritise during shoe selection in specialty stores. The results of Chapter 3 may assist in developing knowledge translation materials and informing sales processes that are runner-focused to ultimately improve current selection practices. The present Chapter introduces Unconscious Thought Theory into the Thesis and assesses runner decision-making patterns.

## Introduction

Many factors influence running shoe selection, including subjective perceptions of comfort (Dhillon et al., 2020; Kong & Bagdon, 2010; Walton & French, 2016) and fit (Kong et al., 2015; Westerman et al., 2007; Willems et al., 2019). Shoe-specific characteristics and market features such as cushioning (Kong & Bagdon, 2010; Kong et al., 2015; Westerman et al., 2007), price, and colour (Dhillon et al., 2020; Westerman et al., 2007; Willems et al., 2019) also contribute to shoe choice (Fife et al., 2023). Although certain of these factors are relatively independent from each other, some of them are intrinsically linked like comfort and cushioning, which confounds their relative importance in footwear selection (Fife et al., 2023).

The process of selecting new shoes may also require runners to engage with marketing materials, research studies, specialty running websites, and other information sources. This undertaking is relatively frequent for runners as manufacturers recommend replacing running shoes every 300-500 miles (Brooks, 2020). Beyond shoe replacement, runners may purchase additional shoes for specialised training, racing (Hébert-Losier et al., 2020), or to use in rotation with other pairs (Malisoux et al., 2015). Seeking advice from retailers, specialised websites, friends, and healthcare professionals is common practice (Dhillon et al., 2020; Ramsey et al., 2022) among runners and can affect their decision-making processes.

In the current footwear retail environment, runners have access to an immense amount of information in-store and online. There is hence an opportunity for salespeople and runners to have more knowledge on footwear. However, there is also an increased risk of misinformation and difficulty in interpreting or applying this information. Extensive choices in the marketplace may lead to decreased satisfaction and regret in product selection (Iyengar & Lepper, 2000). Shoe recommendation practices may be improved by identifying whether runners consciously

think about their shoes during selection and purchase. Unconscious Thought Theory illustrates the differences in choice quality and satisfaction based on thought patterns (Dijksterhuis & Van Olden, 2006). Product satisfaction tends to be greater when individuals make conscious decisions about simple products and unconscious ones about complex products (Dijksterhuis et al., 2006). The running shoes in the present study should be considered complex as runners selecting specialty footwear are influenced by many factors (Fife et al., 2023) and seek advice to guide their choices from running stores (Dhillon et al., 2020). As such, Unconscious Thought Theory would suggest that runners classified as unconscious during shoe selection may make better choices or be more satisfied. Determining the conscious behaviour during running shoe selection may help improve recommendation practices and runner satisfaction.

Previous studies have exclusively examined running shoe selection based on recall (Ramsey et al., 2022; Willems et al., 2019) or hypothetical experiments without the act of purchasing shoes (Westerman et al., 2007). There is a lack of studies performed in-store that examine shoe selection in an ecological setting. Salespeople play a central role in footwear selection and are the intermediary between manufacturers and runners in-store. Understanding how both salespeople and runners experience the shoe selection process may allow runners to better judge their trust in the individuals helping them (Ramsey et al., 2022; Walton & French, 2016). Moreover, the absence of in-store studies prevents runners and salespeople from fully understanding the complex system that underpins the shoe selection process. The primary aim of the study was to identify factors that influence running shoe selection in-store. The secondary aim was to identify any differences during the shoe selection process between buyers, non-buyers, and salespeople.

## **Materials and methods**

### **Sample size**

Three paper-based surveys of approximately 5-minute duration were used to collect data from runners in the greater Seattle area (WA, USA); a 23-question survey for runners that bought shoes (buyers); a 22-question survey for runners that did not buy shoes (non-buyers); and a 15-question survey for salespeople. The sample size was determined by estimating the running population in Seattle based on national average running participation (15%) (Galic, 2021). When considering the metro area population of 3.4 million, which leads to an estimated 510,000 runners, a sample size of 97 participants was sufficient to achieve 95% confidence level with a 10% margin of error (Hassouna, 2023). A minimum convenience sample of two salespeople from each of the eight participating stores was sought, although any salesperson working was invited to participate.”

### **Participants**

Eligible runners were aged 18 years or older, running at least once per week for a minimum of one month, visiting a running-speciality store seeking shoes for road running. Runners seeking shoes for trail (Gibson, 2012) or track (Greensword et al., 2012) running were excluded due to potential differences in footwear priorities. All salespeople working in the involved speciality stores were eligible to participate as reflective of the experience of the runners participating in our study. Eligible participants were given an information sheet and signed a written informed consent document. The Human Research Ethics Committee granted ethical approval prior to recruitment.

## Study design

In a cross-sectional design, we surveyed participants between October 27<sup>th</sup>, 2021, and January 1<sup>st</sup>, 2022, at eight specialty running stores in the greater Seattle area, WA, USA. Surveys were primarily conducted on Saturdays and Sundays to align with the busiest store days. The primary investigator greeted all runners who entered the store and invited them to participate in a short survey to limit selection bias, irrespective of whether they purchased shoes or not. Salespeople were also asked to invite runners to complete the survey after their shoe selection process was complete. All salespeople working on the data collection days were invited to participate. Buyers, non-buyers, and salespeople completed similar surveys. Salespeople surveys were not tied to participating runners. Although the surveys designed for runners and salespeople were similar, they also contained questions that were specific to their respective groups. Key aspects of the surveys are presented in the following paragraphs, with the complete surveys provided as supplementary material (Supplement 1).

The research team developed the questions to surveys based on previous studies (Dhillon et al., 2020; Westerman et al., 2007; Willems et al., 2019), which were tested by runners and iterated based on their feedback. The surveys contained questions used to collect participant characteristics, including demographics, training volume, running history, and race participation. Runners were also asked if they had experienced an injury in the last six months according to the following definition: “Running related (training or competition) musculoskeletal pain in the lower limbs that causes a restriction on or stoppage of running (distance, speed, duration, or training) for at least 7 days or 3 consecutive scheduled training sessions, or that requires the runner to consult a physician or other health professional” (Yamato et al., 2015). Runners identified factors that influence their shoe choice from a comprehensive list and ranked the top three in order of

importance. Participants also identified the sources of advice and education about running shoes and ranked them according to their importance.

Runners answered where they typically shopped for new running shoes and why they visited a specialty running store that day. The survey also contained questions relating to runner's conscious behaviour during the shoe selection process (Dijksterhuis et al., 2006). Notably, runners completed a 100 mm visual analogue scale (VAS) answering: "How much did you think about making your purchase?", with 0 mm being "not at all" and 100 mm being "very much". In addition, non-buyers were asked why they did not purchase shoes in a multiple-choice selection.

Given that recommendations of salespeople considerably influence running shoe selection (Dhillon et al., 2020), runners rated if salespeople influence their shoe selection on a 100 mm visual analogue scale. The anchor points were: 0 mm "No, they did not change how I selected my running shoes", 50 mm "Neutral/Uncertain", and 100 mm "Yes, definitely". Salespeople answered a similar question that assessed how much they believed they influenced runners' shoe selection in general.

## **Data analysis**

Survey answers were entered into Qualtrics<sup>XM</sup> (SAP America) and then exported for management in Microsoft® Excel® (V 2302 Build 16.0.16130.20298). Data were grouped into buyers, non-buyers, and salespeople for comparison. The median value from the VAS scores on how much runners thought about making their purchase was used to categorise runners as conscious ( $\geq$  median) or unconscious ( $<$  median) buyers, following the approach underpinning the Unconscious Thought Theory framework (Dijksterhuis et al., 2006). In presence of missing data to select questions, all remaining available data were analysed (i.e., pairwise deletion). Five participants who agreed to the study did not complete the survey, and their data were removed.

Means with standard deviations and counts with percent values were used to describe the data. The data were analysed using IBM SPSS Statistics (version 29.0.0.0 (241)) predictive analytics software. The Shapiro-Wilk test identified that the data were not normally distributed between groups (buyers, non-buyers and salespeople). Therefore, non-parametric tests were used to compare continuous variables. Kruskal-Wallis H tests were applied when comparing variables between three groups, and Dunn's test was used for post-hoc comparisons. Mann-Whitney U tests applied when comparing two groups. Two-tailed Fisher Exact Probability tests (2x2 and 2x3) were used to determine if there were significant associations between influencing factors, sources of advice, or other nominal data between groups. The  $\alpha$  level was set a priori to 0.05.

## **Results**

A total of 139 participants completed the surveys: 85 buyers, 16 non-buyers, and 38 salespeople. Participant characteristics are reported in Table 3 and Figure 3. Buyers and non-buyers were similar in terms of age, running experience, weekly training patterns, and competitive race participation. Most buyers and non-buyers considered running as their primary sport, and 22.4% of buyers and 25% of non-buyers reported incurring a running-related injury within the last six months. Salespeople were on average 11 years younger ( $p < 0.001$ ) and raced competitively more often than runners ( $p \leq 0.035$ ). Nearly all salespeople also considered themselves runners (94.7%).

Table 3. Summary of participant characteristics and running experience reported as mean (SD).

Question	Buyers	Non-buyers	Salespeople	P value
Participant characteristics	Sample: N = 85 (43 Female, 42 Male)	Sample: N = 16 (4 Female, 11 Male, 1 No Answer)	Sample: N = 38 (11 Female, 27 Male)	Kruskal-Wallis H
	Age: 38.6 (12.3) y <sup>a</sup>	Age: 38.3 (12.1) y <sup>b</sup>	Age: 27.2 (6.9) y <sup>a,b</sup>	Dunn's Test
				Buyers vs. Non-Buyers: = 0.962
				Buyers vs. Salespeople: <0.001 Non-Buyers vs. Salespeople: =0.001
Running history	Experience: 11.2 (11.7) y	Experience: 13.6 (10.5) y	Experience selling running shoe: 4.5 (6.5) y Range: 0.1 – 32.9 y	Mann-Whitney U 95% CI Years running regularly Buyers vs. Non-Buyers: =0.146 Buyers vs. Salespeople: - Non-Buyers vs. Salespeople: -
	Weekly sessions: 3.3 (1.5)	Weekly sessions: 3.8 (1.4)	Weekly sessions: -	Mann-Whitney U 95% CI
	Weekly mileage: 16.9 (13.5)	Weekly mileage: 18.4 (11.1)	Weekly mileage: -	Average weekly sessions Buyers vs. Non-Buyers: =0.138 Buyers vs. Salespeople: - Non-Buyers vs. Salespeople: - Average weekly miles Buyers vs. Non-Buyers: =0.374 Buyers vs. Salespeople: - Non-Buyers vs. Salespeople: -
	Race competitively: 16.5% <sup>a</sup> Recently injured: 22.4%	Race competitively: 25% <sup>b</sup> Recently injured: 25%	Race competitively: 60.5% <sup>a,b</sup> Recently injured: -	Fisher's Exact Probability Test Competitive racing frequency Between groups: <0.001 Buyers vs. Non-Buyers: <0.477 Buyers vs. Salespeople: <0.001 Non-Buyers vs. Salespeople: <0.001 Recently injured Buyers vs. Non-Buyers: =1 Buyers vs. Salespeople: - Non-Buyers vs. Salespeople: -

Note. Recently injured based on in the last 6 months and following definition: running related (training or competition) musculoskeletal pain in the lower limbs that causes a restriction on or stoppage of running (distance, speed, duration, or training) for at least 7 days or 3 consecutive scheduled training sessions, or that requires the runner to consult a physician or other health professional. <sup>a</sup> Significant difference during post-hoc testing: buyers and salespeople. <sup>b</sup> Significant difference during post-hoc testing: non-buyers and salespeople.

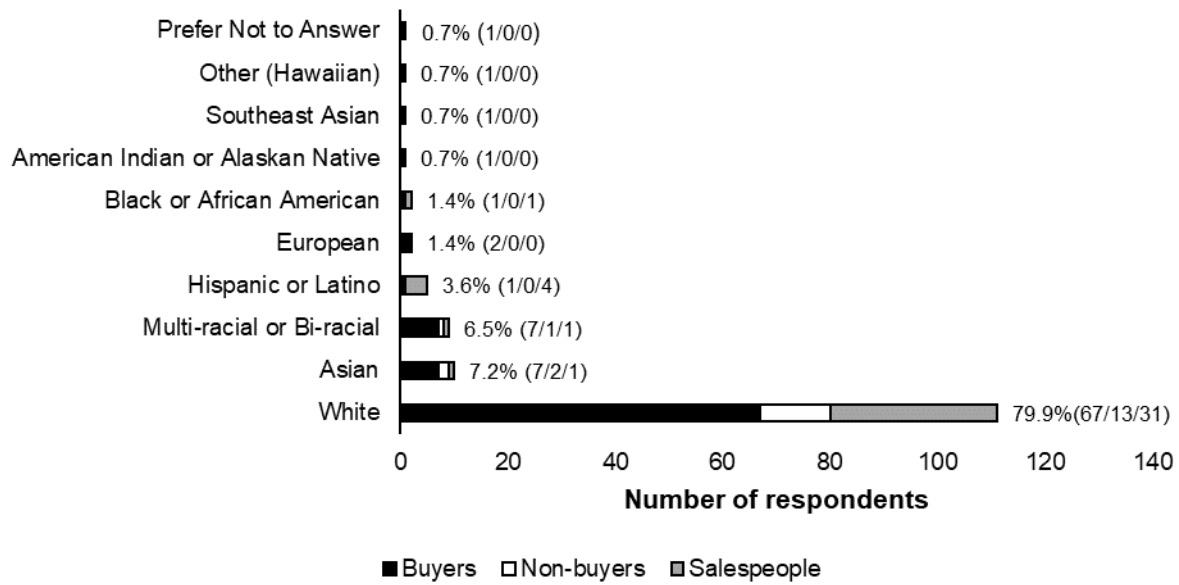


Figure 3. Ethnicity of participants by group. Runners were able to select multiple descriptions.

Conscious behaviour and sales influence: There were no significant differences between buyers and non-buyers regarding how much runners thought about their purchases, familiarity with the shoes beforehand, or the price of shoes purchased or considered for purchase (Table 4). There were statistically significant differences between salespeople and buyers when comparing the influence of the salespeople on runners' shoe selection (Dunn's Test,  $p = 0.029$ ). Salespeople believed they had a greater influence on runners' selection (mean: 80.9 mm) than buyers (67.7 mm) and non-buyers (62.6 mm).

Table 4. Summary of conscious behaviour during running shoe selection reported as mean (SD).

Question	Buyers	Non-buyers	Salespeople	P value
How expensive was it?	145.5 (33.5) USD (1 no answer)	127.5 (31.4) USD (4 no answer)	-	Mann-Whitney U Buyers vs. Non-Buyers: =0.229
Did you know the product before you went on the shopping trip?	56.5%	37.5%	-	Two-tailed Fisher's Exact Buyers vs. Non-Buyers: =0.271
How much did you think about making your purchase?	54.2 (27.0) mm	57.9 (24.2) mm	-	Mann-Whitney U Buyers vs. Non-Buyers: =0.761
How much did you think about the product between seeing it for the first time and buying it?	47.0 (26.0) mm	-	-	-

Did the sales	67.7 (28.4) mm <sup>a</sup>	62.6 (18.2) mm <sup>b</sup>	80.9 (11.8) mm <sup>a,b</sup>	Kruskal-Wallis H
associate influence				Between groups: <0.012
your shoe selection?				Dunn's Test
				Buyers vs. Non-Buyers: =0.136
				Buyers vs. Salespeople : =0.029
				Non-Buyers vs. Salespeople:
				=0.005
Why did you not	-	Just browsing:	-	-
buy shoes today?		56.3%		
		Other <sup>c</sup> : 43.8%		
		Wrong size:		
		12.5%		

Note. Price was self-reported and not checked for accuracy. <sup>a</sup> Significant differences during post-hoc tests: buyers and salespeople.

<sup>b</sup> Significant differences during post-hoc tests: non-buyers and salespeople. <sup>c</sup> Other included recently purchased and no need (12.5% each), no money, wrong colour, no right shoe (6.3% each).

Factors that influence shoe selection: On average, salespeople selected 12 factors that influence shoe choice, compared with only five factors for buyers and non-buyers (Kruskal-Wallis,  $p < 0.001$ ) Table 5). There was a significant difference between groups in terms of which factor influenced their shoe selection the most (Fisher Exact,  $p = 0.043$ ). Both buyers (36.5%) and non-buyers (43.8%) most frequently identified fit as the most important factor, while salespeople indicated that runners valued comfort most (52.6%) (Figure 4a). Following fit as the most frequently selected influential factor, comfort influenced both buyers (29.4%) and non-buyers (31.3%). Gait analysis was also identified as an important factor by both buyers (8.2%) and salespeople (10.5%). Most salespeople reported that in-store incentives did not influence shoe recommendations (81.6%), while 7.9% of salespeople were more likely to recommend incentivised product, and 10.5% were unsure.

Table 5. Summary of factors that influence running shoe selection reported as mean (SD).

Question	Buyers	Non-buyers	Salespeople	P value
Number of influencing factors	Average: 5 (2) <sup>a</sup>	Average: 5 (1) <sup>b</sup>	Average: 12 (4) <sup>a,b</sup>	Kruskal-Wallis H Between groups: <0.001 Dunn's Test Buyers vs. Non-Buyers: =0.908 Buyers vs. Salespeople: <0.001 Non-Buyers vs. Salespeople: <0.001
Most influential factor	Fit: 36.5% <sup>a</sup> Comfort: 29.4% <sup>a</sup> Based on gait analysis: 8.2%	Fit: 43.8% <sup>b</sup> Comfort: 31.3% Tie among several factors*: 6.3% each	Comfort: 52.6% <sup>a</sup> Based on gait analysis: 10.5% Fit: 7.9% <sup>a,b</sup>	Two-tailed Fisher's Exact Buyers vs. Non-Buyers vs. Salespeople Comfort: 0.043 Fit: 0.002 Gait: -

Note. \*Tie between injury prevention, performance, same model as normal, and peer-recommendation. <sup>a</sup> Significant differences during post-hoc tests: buyers and salespeople. <sup>b</sup> Significant differences during post-hoc tests: non-buyers and salespeople.

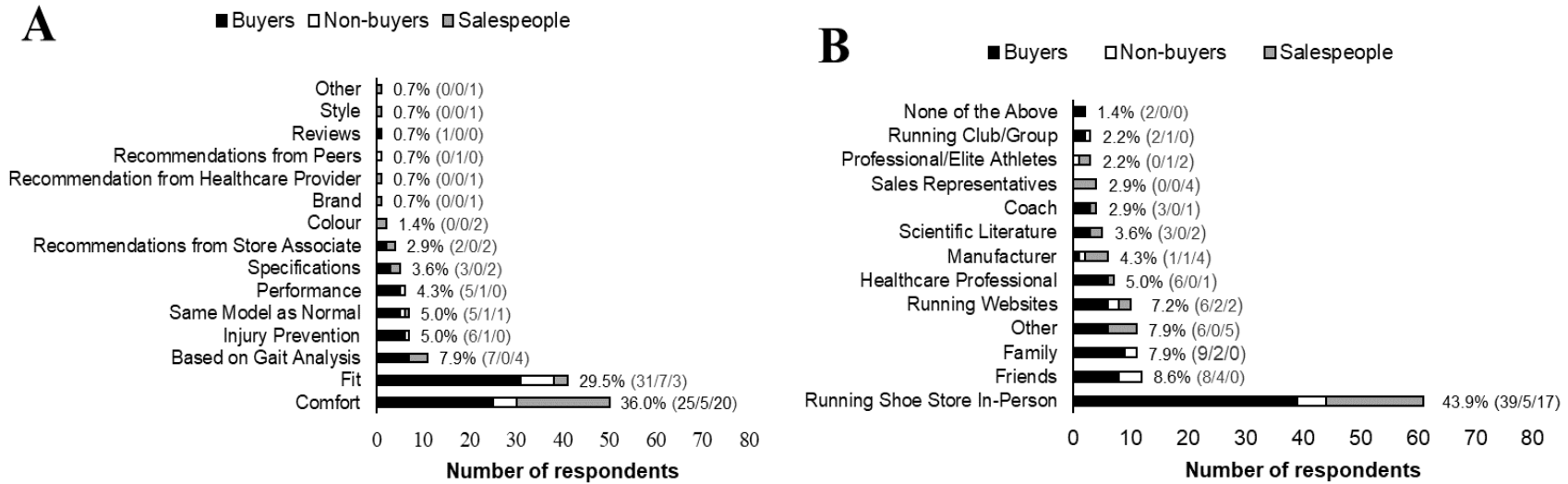


Figure 4. (A) Main criteria that influenced shoe selection by group and (B) main sources of footwear recommendations (n=139). Note that the graph represents the primary choice of individuals within each group rather than the total amount of times each factor was selected. The numbers at the end of each bar represent the number of buyers, non-buyers, and salespeople, respectively.

Sources of advice and information on running shoes: On average, salespeople selected six sources, whereas buyers and non-buyers selected three ( $< 0.001$ ) (Table 6). Each group identified salespeople as their number one source of advice and information on shoes: buyers (45.9%), non-buyers (31.3%), and salespeople (44.7%) (Figure 4b). Both buyers (9.4%) and non-buyers (25%) identified friends as a preferred source of advice, whereas no salesperson did (Fisher Exact,  $p = 0.008$ ). After colleagues, salespeople got their advice from other sources (e.g., site-specific work training or online training). The third most selected source of advice for buyers (10.6%) and non-buyers (12.5%) was family, whereas it was manufacturers (10.5%) and sales representatives (10.5%) for salespeople.

Table 6. Summary of sources of advice.

Question	Buyers	Non-buyers	Salespeople	P value
Number of advice sources	Average: 2.9 (1.2) <sup>a</sup>	Average: 3.1 (1.2) <sup>b</sup>	Average: 6.2 (2.5) <sup>ab</sup>	Kruskal-Wallis H Between groups: $<0.001$ Dunn's Test Buyers vs. Non-Buyers: $=0.698$ Buyers vs. Salespeople: $<0.001$ Non-Buyers vs. Salespeople: $<0.001$
Most influential advise source	Salespeople (45.9%) Family (10.6%) Friends (8.4%)	Salespeople (31.3%) Friends (25%) <sup>b</sup> Family (12.5%)	Salespeople (44.7%) Other (e.g., personal experience, store training) (13.2%) Tie Manufacturer/Sales Representative (10.5%)	Two-tailed Fisher's Exact Buyers vs. Non-Buyers vs. Salespeople Salespeople: $=0.231$ Friends: $=0.008$ Family: $=0.060$

<sup>a</sup> Significant differences during post-hoc tests: buyers and salespeople. <sup>b</sup> Significant differences during post-hoc tests: non-buyers and salespeople.

Specialty running stores and incentives: Runners typically purchased their shoes at specialty running stores (buyers = 78.8% and non-buyers = 62.5%, Fisher Exact,  $p = 0.366$ ). Other purchase locations included: manufacturer websites, multi-sport stores, and specialty online stores (Figure 5a). Runners reported employee expertise as the main reason for visiting specialty running stores (buyers = 75.3% and non-buyers 56.3%, Fisher Exact,  $p = 1.000$ ). Other common reasons for visiting speciality running stores were: trying on shoes, supporting the local running community, and range of selection (Figure 5b). Most salespeople (81.6%) said that financial incentives had no influence on their shoe recommendations, whereas 10.5% were unsure, and 7.9% answered that incentives did make a difference.

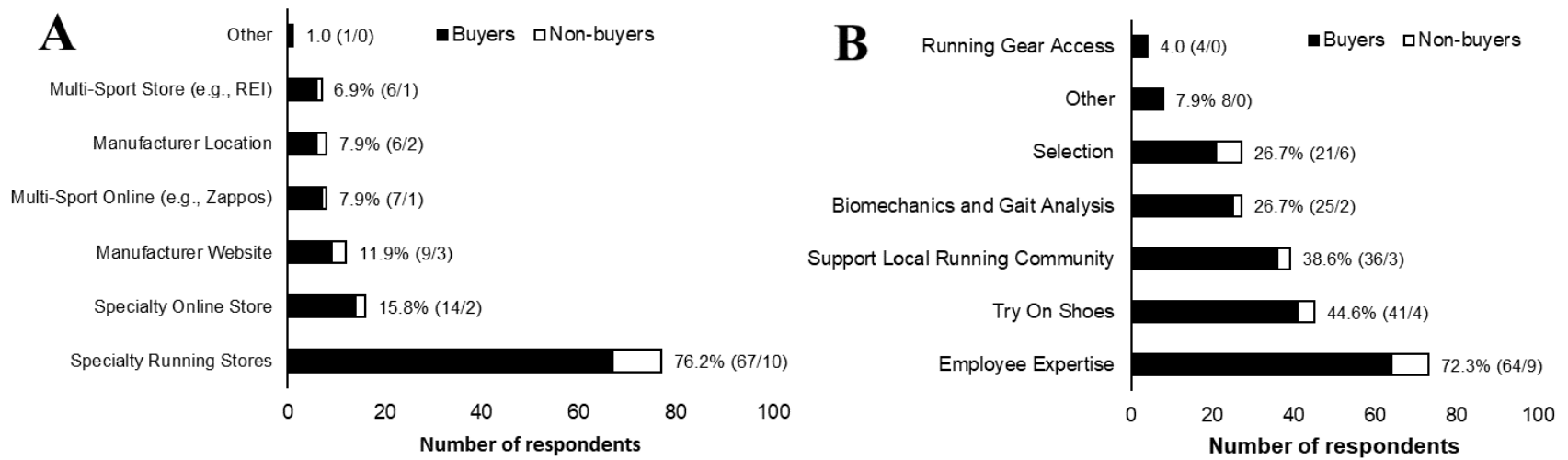


Figure 5. (A) Where runners typically buy their shoes (B) Why runners chose to shop at a specialty running store (n=101). Multiple selections were allowed for each participant.

Reasons for not buying shoes: Non-buyers selected just browsing (56.3%), unavailability of size (12.5%), or other (43.8%, e.g., wrong colour, wrong fit, or recently purchased) as reasons for not purchasing shoes. Over half of salespeople believed runners did not buy shoes due to buying online instead (57.9%), price (50%), or colour (50%).

## **Discussion**

### **In-store shoe selection and advice**

Although the present study supports that several factors influence shoe selection, it identifies fit and comfort as most important when runners select shoes in store. Dhillon et al. (2020) identified that runners prioritise comfort, performance, and injury prevention when selecting shoes from online survey responses. Similar factors also surfaced in interview data from qualitative research (Ramsey et al., 2022). In contrast to online recall surveys and interviews, runners in our study had a tangible experience in-store and a focus on immediate considerations (i.e., fit and comfort) over more abstract ones (e.g., injury prevention and performance).

Runners reported fit as the top factor influencing their shoe choice, which aligns with previous findings (Schubert et al., 2011). Fit interacts with several other factors (e.g., cushioning and material properties) and potentially protects against running-related injury (Willems et al., 2019). Fit, however, is subjective and lacks consensus definition in footwear research.

Furthermore, fit is not regularly measured or examined effectively in the existing tools that assess running shoes (Fife et al., 2023; Ramsey et al., 2023; Ramsey et al., 2019). Although both fit and comfort are identified as important in shoe selection (Fife et al., 2023; Schubert et al., 2011), comfort is most often at the forefront of literature (Nigg et al., 2015) with little attention given to fit.

Selecting shoes based on comfort may be inherently flawed given that the description of shoes can influence comfort (Chan et al., 2020). Comfort appears linked to cushioning (Kong & Bagdon, 2010) and fit (Hennig, 2011), which further complicates understanding the shoe selection process based on comfort (Fife et al., 2023). Running speed appears to influence subjective shoe comfort (Hébert-Losier et al., 2024), adding another potential confounding factor to runners choosing shoes based on comfort. Salespeople making recommendations to runners in-store may indirectly influence subjective factors, such as perceptions of comfort and fit, as they guide runners through the selection process. While there is little scientific evidence to support shoe selection based on comfort, gait analysis, and individual biomechanics or anatomy, there is no alternative consensus best practice. Agresta et al. (2022) suggest that individual characteristics of runners, like their task demands and goals, should be considered when recommending footwear. Rigorous scientific testing is still needed to determine whether this approach to footwear prescription would mitigate injury risk and enhance satisfaction.

There appears to be disagreement between runners regarding the value of in-store gait analysis. Some runners trust employees and stores that offer gait analysis more than other stores (Walton & French, 2016), while others distrust in-store gait analysis and regard it as a sales tactic without scientific validation (Ramsey et al., 2022). This dichotomy in perspective is somewhat reflected in our data wherein 37% of runners reported that gait analysis influenced their shoe selection. In contrast, 74% of salespeople believed gait analysis influenced runners' selection. Salespeople overrated the importance of gait analysis compared to runners, possibly because it is perceived as a unique in-store offering.

Runners seek advice from several sources when selecting running shoes. Both buyers and non-buyers seek advice from salespeople, family, and friends. Our findings support recent

research identifying salespeople as key advice sources (Nguyen et al., 2022). The quality of the information from each of these sources is unknown. Most buyers and non-buyers prioritise advice from salespeople, while salespeople primarily receive their advice from other salespeople, in-house training, personal experience, and sales representatives. The word-of-mouth approach to shoe recommendation is susceptible to misinformation. Running as a sport can be considered a complex system where multiple variables contribute to an outcome (Hulme & Finch, 2015). Past research and widely accepted practices may be limited by the lens of monocausality (Hulme & Finch, 2015). Salespeople have beliefs that are not supported by scientific evidence (Wolthon et al., 2020); a product of current systems. Even people often considered experts do not always agree on which shoe features are most important and how to implement recommendations (Honert et al., 2020). While runners have reported seeking advice from running websites, healthcare professionals, and scientific literature (Dhillon et al., 2020), it may be difficult for runners to easily obtain, interpret, and apply scientific information.

### **Differences between salespeople and runners**

Most runners that visited the participating specialty running stores did so specifically seeking employee expertise. Often, the salespeople recommended footwear based on some form of in-store gait analysis. Gibson (2012) was “perturbed” by his experience at a specialty running store and disagreed with the footwear recommended based on the in-store gait analysis, resulting in him doubting the process and competency of the salesperson. Salespeople sometimes recommend shoe style changes to runners that are satisfied with their current shoes, when it may be unnecessary (Wolthon et al., 2020). In our study, many runners participated in some form of gait analysis that included salespeople assessing walking, jogging, standing, squatting, and/or examining shoe wear patterns. Some salespeople used technology to assess foot pressure during

walking and running, or foot shape and volume while standing. The practice of recommending shoes based on foot type and pronation control systems to reduce injury have been challenged for over a decade (Knapik et al., 2009; Malisoux & Theisen, 2020; Richards et al., 2009), but is still common practice and widely believed (Nguyen et al., 2022).

Runners tend to trust the footwear choices of other runners with similar or higher abilities (Ramsey et al., 2022). The salespeople ran competitively more frequently than the runners in our study, which may increase the credibility of their recommendation to runners. The work experience of salespeople might also influence their credibility and confidence in their prescription practices. Most of the salespeople's expertise came from their colleagues, professional internal training, personal running experience, manufacturers, and sales representatives. The work experience of salespeople considerably varies (i.e., 5 weeks to 33 years in our study), and is generally relatively short (< 5 years). The rotating salesforce may limit the evolution of in-store shoe prescription practices due to dearth of experienced salespeople.

Salespeople also perceived they influenced runners' choices to a greater extent than runners reported. Frameworks that describe the interaction between salespeople and their customers are useful in understanding aspects of the in-store experience. Value creation and interpersonal trust is based on shared abilities, integrity, benevolence, and similarity between runners and salespeople (Baumann & Le Meunier-FitzHugh, 2014). Walton and French (2016) found that runners trust retailers over healthcare professionals in certain situations, while some runners distrust in-store processes (Gibson, 2012; Ramsey et al., 2022). Salespeople are generally confident in their beliefs and have received extensive training from their employers and manufacturers (Woltho et al., 2020), which may not be based on scientific evidence. Salespeople are usually runners, and may present a runner-centric focus during the sales process

to best help the runner they are serving due to their moral identity to help others (Itani et al., 2022).

Breakdowns in trust due to differences in running experience, technical expertise, and motives can partially explain discrepancies between how influential the salesperson was on shoe selection in the present study. Salespeople were younger by almost a decade and raced more frequently than potential shoe purchasers, which may bias their recommendations towards their personal preferences. Runners may overreport their independence of shoe selection to combat their concession of authority during the in-store interaction. Salespeople that make successful recommendations (i.e., runners bought the recommended shoe) may develop confirmation bias over time that leads to their confidence in how much they influence running shoe selection. Runners and salespeople must communicate effectively to accurately identify footwear that are specific to runners' ability and intended use (Agresta et al., 2022).

### **Buyers and non-buyers are the same population**

All runners – regardless of buying shoes or not – identified fit and comfort to be of primary importance to their shoe selection. They both valued advice from salespeople, friends, and family, and exhibited similar levels of conscious thought. Runners are either buyers or non-buyers depending on the day, as some non-buyers stated that they had made a recent running shoe purchase and came to the store to browse without the intent to purchase. Beyond replacing worn shoes, runners may select and purchase more shoes to fill a specific training need (Agresta et al., 2022), meet a colour or style preference (Fife et al., 2023), or to stockpile multiple pairs of a favourite model. Runners consider previous use when selecting shoes (Westerman et al., 2007), with some of our runners also choosing the same model as they normally wear.

## **Unconscious Thought Theory**

Based on the Unconscious Thought Theory (Dijksterhuis & Nordgren, 2006), we hypothesised that buyers and non-buyers would exhibit different levels of thought when selecting new running shoes. We predicted that buyers would think more about their purchase than non-buyers prior to visiting the store. Contrary to our hypothesis, both buyers and non-buyers thought about their purchase to a similar extent and both groups knew the running shoes they were looking for before visiting the shoe store. This finding further supports that buyers and non-buyers reflect a similar population. Specialty stores in the present study offered a variety of models from multiple manufacturers. Choosing from a large selection is more frustrating than a more limited offering, and conscious deliberation can be more upsetting than spontaneous choice (Messner & Wänke, 2011). Unconscious thinkers also benefit from high-quality information (Dijksterhuis & Strick, 2016). Runners may visit stores to gather information, which may be used consciously or unconsciously to inform their running shoe choice.

Both groups thought about their purchase a similar amount, near the median split, which makes it difficult to confidently classify runners as conscious or unconscious buyers. Research in conscious purchasing behaviour demonstrates that people are more satisfied with their purchase if they think more about simple products and less about complex ones (Dijksterhuis & Nordgren, 2006). Previous research regarding consciousness categorised shoes as simple products as chosen by the general population and included casual and general athletic shoes (Dijksterhuis et al., 2006), rather than the sport-specific models in the present study chosen by runners. Future research is needed to validate the application of Unconscious Thought Theory in runners selecting shoes by examining consciousness behaviour and its relationship to footwear satisfaction.

Whether running shoes are simple or complex may depend on the individual runner, as more experienced runners likely consider more technical aspects of shoes than less experienced runners. Many runners use multiple shoes in rotation (Malisoux et al., 2015). Experienced runners may choose specific shoes for speedwork on the track and another with higher cushioning and carbon inserts for distance racing (Kram, 2022). These considerations make the decision-making process more complex than novice runners seeking a daily training shoe. In this regard, we posit that choosing running shoes in a specialty store is a more complex experience for the modern-day runner. As unconscious shoppers benefit during complex choices (Dijksterhuis et al., 2006), it may be possible to induce a less conscious state to improve running shoe choice. Runners may be more satisfied by trusting their intuition rather than deliberating over minutiae.

### **Limitations and future directions**

One novel aspect of the present study is that runners came to specialty running shoe stores and interacted with running salespeople. Nonetheless, the selective sampling of runners visiting specialty running stores limits generalisation to runners from different geographical regions or shopping at different locations. Our results may not apply to other specialty stores, including those that do not offer similar sales strategies (e.g., gait analysis). However, we believe that collecting data from eight locations improved the generalisability of our findings. Data were collected during weekends and over a North American holiday season. As such, it is possible that the interactions between runners and salespeople differed from behaviours examined during other times of the week or year.

The research team did not standardise the in-store experience, and several factors could influence the process: footwear selection available, salesperson, and quality/quantity of gait or

foot analysis. There is no way to know how salesperson knowledge and advice varied or influenced individual runner behaviour. Runners that participated in gait analysis may perceive it as influencing their selection more than runners that did not partake in these services. Runners entering a speciality shoe store are more likely to intend to purchase shoes, which creates a potential sampling bias. Furthermore, all participants volunteered to participate, which introduced a selection bias wherein we do not know how non-participants would respond to the survey.

Future research should manipulate factors that are known to influence shoe selection (e.g., comfort) and recommendations (i.e., based on gait analysis) to better understand their value in footwear prescription. Price and product availability influence footwear comfort

(Chan et al., 2020), which may also be influenced by salespeople and in-store processes. A longitudinal investigation examining how conscious thought correlates to shoe selection and purchase satisfaction would help better understand runner's behaviours.

## **Conclusion**

Runners selecting new road running shoes at specialty stores report fit, comfort, and gait analysis as priority factors influencing their decision. Runners seek advice primarily from salespeople in specialty stores, which may limit their exposure to evidence-based information. Buyers and non-buyers did not demonstrate significantly different levels of consciousness thought or behaviours during shoe selection in-store and may represent a similar population in a geographical area. In contrast, salespeople and runners were significantly different in several ways. Salespeople believe that they have a greater influence on running shoe selection than runners report. Furthermore, salespeople primarily get their information from their peers, internal training, and brand representatives, rather than scientific sources. We caution runners to carefully consider the advice from salespeople as many employees make recommendations that are not evidence-based and may have limited experience.

## Chapter 4

### Do you need new running shoes? Motivations behind salespeople recommendations in specialty running stores.

**Prelude:** While Chapter 3 described factors that influenced shoe selection and the sources of footwear advice sought by runners who visited speciality running stores, Chapter 4 aims to more fully describe the process of running shoe selection in specialty stores by including the perspective of salespeople. Runners visiting speciality running stores to purchase road running shoes included in the previous Chapter prioritised fit and comfort, and based their decisions on the clinical gait analysis that some salespeople provided in specialty running stores. As salespeople are central to the shoe selection or recommendation process, Chapter 4 aims to describe how salespeople make their recommendations and perceive runner behaviour through a thematic analysis of interview data.

## **Introduction**

### **Running shoe research**

Runners may have different motivations for buying a new pair of running shoes. These motivators include replacing worn out shoes, adding alternate shoes into their wear rotation (Malisoux et al., 2015), or buying shoes for a specific purpose, such as long runs, racing, or speedwork. A recent systematic review summarised that recreational runners select shoes based on subjective shoe features, shoe-specific characteristics, market features, peer evaluation, and personal characteristics (Fife et al., 2023). Specialty running stores allow runners to visualise and try on shoes, and evaluate important subjective features including fit and comfort (Fife et al., 2023). Ultimately, runners seek a shoe that optimises comfort, performance, and injury prevention (Dhillon et al., 2020). Much research focuses on running-related injury and how running shoes may contribute to injury prevention (Fokkema et al., 2019; Malisoux & Theisen, 2020; Nigg et al., 2015), although the link between running shoes and injury is poorly understood. Despite this lack of evidence, many runners believe shoes influence injury incidence (Fokkema et al., 2019), which supports the need for better understanding how runners select footwear and what influences their shoe selection.

### **Running shoe recommendations and salespeople**

Runners completing online surveys reported seeking advice on shoe selection (Dhillon et al., 2020; Nguyen et al., 2022) and running injury (Fokkema et al., 2019) from running stores, which further implicate salespeople in educating runners on footwear. Some runners trust running shoe stores (Walton & French, 2016), while others are sceptical of employee advice (Ramsey et al., 2022). The foundations of advice from salespeople at running stores is unknown. In one questionnaire-based study from Sweden, salespeople primarily were educated by their

workplace on the shoe-injury interaction (Wolthon et al., 2020). This finding supports the worrying longstanding recognition that shoe advice and recommendations may not be evidence-based (Richards et al., 2009).

### **Importance of specialty running stores**

Although specialty running stores are common throughout the world, running shoe selection in-store is relatively understudied. Running shoe selection research often is lab-based or questionnaire-based relying on recall, which lack ecological validity (Fife et al., 2023). Purchasing shoes from speciality running stores allows runners to interact with the product and salespeople. Specialty running stores also serve as meeting points for group runs and often sponsor local events or runners, fostering a sense of community. That said, runners have various options for purchasing shoes, including online retailers. Internet offerings may be enticing to runners due to more options, lower price (Snipes & Pitts, 2015), and the perceived lack of sales pressure. Internet retailers may also deter runners, if there are too many options (Jiang & Zou, 2020) and no tactile experience. Consequently, runners may purchase a shoe from an online retailer and be disappointed with fit and feel upon delivery as shoe fit varies by brand and model (Jurca & Dzeroski, 2021). In contrast, specialty running stores offer a physical experience that allow runners to try on multiple different shoes before making their selection.

The in-store experience offers runners an opportunity to have a personal recommendation and access to technology and expertise (Gibson, 2012) that is harder to achieve online. Indeed, runners that choose to purchase their footwear at specialty stores are likely to interact with a trained salesperson (Wolthon et al., 2020). Understanding how salespeople experience the shoe recommendation and selection process in speciality stores will serve as a touchstone of current

practices. Therefore, we aimed to explore how salespeople make their shoe recommendations and how salespeople perceive their in-store interactions with runners.

## **Materials and methods**

This qualitative study used individual interviews to explore the in-store shoe recommendation and interaction processes and perceptions of salespeople. Ethical approval was granted from the University of Waikato for the study prior to data collection (HREC(HECS)2021#31). The 32-item Consolidated criteria for Reporting Qualitative research checklist was used to report this study (Tong et al., 2007).

### **Research team**

The primary researcher, a male PhD candidate with a background in exercise science and a former competitive runner, conducted all interviews. All other research team members are experienced runners with expertise in running footwear research and include two females and one male. One member with experience in qualitative methodology assisted with coding and quality checks.

### **Study design-theoretical approach**

Structured interviews were conducted using a ‘neo-positivist’ style described by Roulston (2010), in which the interviewer remained neutral to question responses. The neo-positivist approach was used in conjunction with development of rapport prior to conducting the interview. In practice, the interviewee is less likely to be directed or incentivised in a particular direction based on the explicit or implied direction of the interviewer. Thematic analysis was conducted on transcribed interviews of salespeople using the six phases described by Braun and Clarke (2006). The inductive approach allowed the researchers to develop themes from transcripts without a preconceived framework. Furthermore, the primary investigator implemented a recursive

approach, in which he moved back and forth between the phases of analysis to represent the data most accurately as themes were developed and revised.

### **Participant selection**

Salespeople were recruited from eight specialty running stores in and around Bellingham and Seattle, WA, USA between October 27<sup>th</sup>, 2021, and December 31<sup>st</sup>, 2021. All salespeople aged 18 years or older working on the data collection days were invited to participate through convenience sampling. No salesperson declined to participate. Thirty-eight salespeople completed single-session interviews. Salespeople participated regardless of their current or former running status (see Table 7). Eligible participants were given an information sheet and signed a written informed consent document. Participants were verbally informed of the reasons the research was being conducted prior to each interview and aware the primary investigator was collecting their responses as part of his PhD thesis on running shoe selection. The primary researcher had no formal interview training or relationships with study participants before the structured interviews.

## **Data collection**

The interviewer followed a structured, open-ended three-question interview guide. Prompts were designed to collect detailed information about in-store running shoe selection and prescription processes and their importance. Questions were pilot tested by runners and salespeople prior to conducting interviews as part of our inclusive-design process, and questions modified to increase clarity. Interviews were recorded using a Sony PX series digital voice recorder (Tokyo, Japan) and conducted in a private room or secluded area of the store. If any interruptions occurred, the interview was halted until the salesperson was completely available.

## **Data analysis**

The primary researcher read and listened to the interview recordings multiple times to become familiar with the data. Recorded interviews were uploaded to a computer, processed using OtterAi (CA, USA) transcription software, and checked manually for accuracy. Transcripts were imported into NVivo (QSR International, Release 1.7.1) for thematic analysis. Similar text segments from raw data were allocated a descriptive label (e.g., Gait analysis). Labels were grouped and categorised within themes that described key components of the in-store experience (e.g., Expertise). A second researcher experienced in qualitative research audited transcripts and verified that labels and themes suited the study aims. The themes were discussed between these two researchers initially, and agreed upon by all team members. These themes sought to encompass and describe how runners select shoes in-store, how salespeople make their recommendations, and the relative importance of the process. Quotes from interviews were selected to illustrate their respective categories and are presented in the findings.

Table 7. Summary of participant characteristics and their running experience.

Question	Salespeople
Participant characteristics	Sample: n = 38 (11 female, 27 male)
mean (SD)	Age: 27.2 (6.9) y
Ethnicity	White: n = 31
	Asian: n = 1
	Multi-racial or Bi-racial: n = 1
	Hispanic or Latino: n = 4
	European: -
	Black or African American: n = 1
	American Indian or Alaskan Native: -
	Southeast Asian: -
	Other: -
	Prefer not to answer: -
Sales experience mean (SD)	Experience selling running shoes:
	4.5 (6.5) y
	Race competitively: 60.5%

Note. Salespeople were able to participate regardless of running experience.

Thirty-eight interviews were analysed to derive the findings, although no new codes were generated after the ninth interview (Guest et al., 2006). Interviews typically were 3-10 minutes in length (Table 8). Participants did not have an opportunity to provide feedback on their interviews.

Means with standard deviations and counts with percent values were used to describe participant data.

Table 8. Characteristics of interviews presented by store. Data are counts or ranges (minimum – maximum).

Interview (counts)	Store	Interview length (min)	Gender	Age (y)	Shoe sales experience (y)
n = 3	A	2:20-4:30	2M, 1F	24.8-28.8	0.8-5.5
n = 2	B	1:31-9:16	2F	23.5-29.6	2.5-4.7
n = 5	C	2:32-3:23	2M, 3F	22.7-27.8	0.5-2.3
n = 2	D	1:38-3:09	2M	20.2-31.6	3.2-17
n = 11	E	1:10-9:31	9M, 2F	20.8-40.8	0.3-13.3
n = 11	F	1:39-7:57	9M, 2F	19-52.9	0.1-32.9
n = 3	G	1:48-3:21	3M	18.8-25.9	0.2-4.8
n = 1	H	1:45	1F	24.3	1.5

Note. Store names are coded to protect the identities of participants. Stores E and F make up most salespeople included.

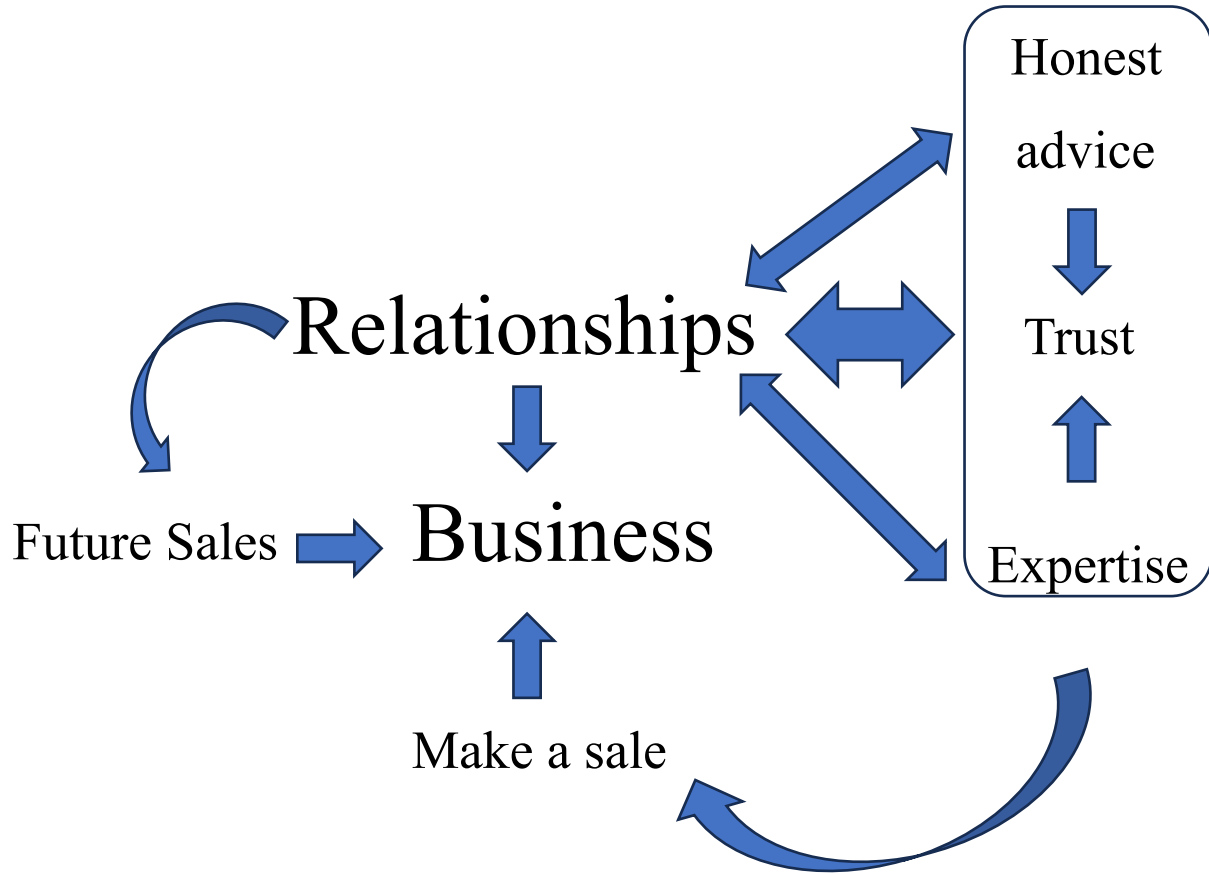
1 **Findings and discussion**

2 **Themes**

3 Two main themes were developed to describe the running shoe selection process in-store  
4 from the salesperson’s perspective: relationships and business (Figure 6). The relationship theme  
5 represents salespeople and runners co-creating a beneficial interaction and encapsulates three  
6 subthemes: trust, expertise, and honesty. Salespeople conveyed how providing runners with their  
7 honest advice and personal experiences helps them make runner-centric recommendations. The  
8 business theme emerged as salespeople explained how they used tools and training to provide a  
9 positive in-store experience and drive business. The business theme includes the subthemes of  
10 making a sale and earning future sales.

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6 Figure 6. A schematic representative of the interrelatedness of the main themes and subthemes. Larger fonts represent main  
7 themes, while smaller fonts represent subthemes. Strong relationships between salespeople and runners lead to lasting business  
8 opportunities. Relationships are built on expertise, trust, and honest advice, which increase the likelihood of making a sale and  
9 creating future sales.

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## **Theme 1: Relationships**

The relationship between the runner and the salesperson is central to the shoe selection and recommendation process, as it influences every aspect of the in-store experience.

Salespeople aim to build trust with customers by demonstrating their expertise as a runner and knowledgeable professional. They also give their honest or personal advice to help develop relationships with customers. Building trust and demonstrating expertise appear interwoven and influenced by sharing their personal experience and honest advice.

### **Building trust**

Salespeople claim listening to the runners they worked with, treating them with kindness, and finding ways to make themselves relatable. Salespeople appeared comfortable and confident recommending shoes to runners based on their in-store assessment.

P19: ‘And then I make my best recommendation. I think confidence does have a big part to do with it as the sales representative. Because I'm making a recommendation which is trying to establish trust. And, and that's carried over the customer as well, having that a little bit of authority, like you're telling them what's going to help them, but I do take a lot of their input...all their input in...in making that decision.’

Creating an environment with like-minded people who share interests in running connects to the business theme by increasing future sales opportunities. Building trust can lead to a lasting running community that extends the relationship between salespeople and runners beyond making a sale.

1 P20: 'They're also like, 'hey, do you know of any, like, running groups or anything?' And  
2 then you've got all this other information about the whole community at large around  
3 you. Yeah, you can expose people to other things beyond just running shoes.'

4 P32: 'And we want people to be happy running. We're trying to create a good running  
5 community.'

6 Runners trust running shoe salespeople (Walton & French, 2016), which may in part be  
7 due to the effort that salespeople make to establish a meaningful relationship. Trust can be  
8 challenging to gain, as runners may judge the experience and qualification of salespeople from  
9 visual appearance (Gibson, 2012). Personal characteristics, such as integrity, benevolence, and  
10 similarity, lead to interpersonal trust and salespeople work with their customers to co-create a  
11 valuable experience (Baumann & Le Meunier-FitzHugh, 2014). Most runners do not appreciate  
12 feeling like they are just a sales number (Gibson, 2012), and empathetic salespeople are likely  
13 able to perceive how the runner feels throughout the process (Mullins et al., 2014).

#### 14 **Expertise**

15 Salesperson knowledge comes from their own experience and studies, formal education,  
16 and the workplace (Wolthon et al., 2020). Salespeople in the present study rarely referenced  
17 scientific research (P5, 28), which indicates that personal experience is prioritised.

18 P28: 'Recommend a stability category, though, I'm a little bit unclear about whether  
19 there's actually science that pronation control reduces injuries. But generally, if they pronate  
20 more, I'll steer them toward more mid-stability shoes.'

1           Ultimately, salespeople want to help runners choose shoes that meet their needs.  
2 Salespeople view the selection and recommendation process from an expert lens in which they  
3 are the authority.

4           P23: ‘You know, we bring out shoes that we think work for them. And we know that will  
5 work for them, regardless of what they say about them.’

6           Although runners seek advice from several sources to inform their shoe choices (Dhillon  
7 et al., 2020), salespeople make recommendations daily. Salespeople are also runners and receive  
8 formal training at their store (P2). Their experience and specialised training lead them to feel like  
9 experts in shoe prescription, which has value due to increased customer satisfaction and  
10 subsequent loyalty (Liu & Leach, 2001). Some salespeople believe they have greater expertise in  
11 shoe prescription than the runners they help, their friends, and even medical professionals (P8,  
12 11). Others (P20) made a distinction that they are not healthcare providers and know that shoes  
13 alone may not fix the problem.

14          P8: ‘It’s like okay, well, that’s not necessarily what we’re recommending. But sure, let’s  
15 try it. And I feel like a good amount of the time they only try on with their friends,  
16 coaches, healthcare professionals want and they’re like, nothing feels good.’

17          P11: ‘The second choice would be that despite us having reasoning for a certain structure  
18 of a shoe would possibly be better or not, they will go with the word of a medical  
19 professional. Which I'm not saying they're not right or not wrong, but in my history in  
20 selling shoes, they (medical professionals) definitely are a little bit more pinpointed on  
21 certain products they like and aren't open to others.’

1            Sometimes runners and salespeople disagree about which aspects of running footwear are  
2 important (P6, 19, 23). Salespeople that build trust with their customers may be able to turn  
3 conflict into opportunity. Ideally, the interactions between runners and salespeople during shoe  
4 recommendation develop into a positive and beneficial experience for each party (Baumann &  
5 Le Meunier-FitzHugh, 2014).

## 6 **Honest advice**

7            The salespeople interviewed were also runners and used their personal experiences and  
8 goals to make their best recommendations. Salespeople have experienced discomfort and injury  
9 and want to help prevent those issues in other runners. Sharing their personal experience or  
10 honest advice can enhance the sales interaction, but biases their recommendations toward their  
11 own values and priorities.

12            P33: ‘If you ask the right questions, then the right solution presents itself and you don't  
13 really have to do much....selling as much as just trying to unearth, you know, ‘what's  
14 going to be the smartest decision, given the information that we have?’

15            P23: ‘In my personal experience with running, I've had so many injuries. I mean, not just  
16 from running but from playing sports throughout my, my entire life. And it's so, so  
17 important for me to have the right pair of shoes.’

18            Runners appreciate advice from salespeople that share their personal experience, but are  
19 sceptical when it is apparent that salespeople are only trying to make a sale (Ramsey et al.,  
20 2022). Some salespeople have the idea that they are helping runners solve problems rather than  
21 actively selling something (P19, 33). This attitude brings a personal element to the interaction  
22 and allows the salesperson to connect from their own experience. Salespeople that attribute

1 morality to their actions can collaborate better with their customers (Itani et al., 2022). They  
2 consider what is best for the runner and use their knowledge and ability to find the ideal shoe.

3         The interaction between salespeople and their customers improves when both people  
4 accurately perceive each other's feelings (Mullins et al., 2014). Runners and salespeople that do  
5 not effectively communicate and understand each other may not share the right information,  
6 which may lead to dissatisfaction of either party and a poor recommendation. Salespeople that  
7 like their job and are motivated due to a personal desire to help others are even more effective  
8 (Itani et al., 2022). Valuable interactions between salespeople and runners develop through  
9 personal connections that can lead to trust and loyalty (Baumann & Le Meunier-FitzHugh,  
10 2014).

## 11 **Theme 2: Business**

12         Salespeople also view their shoe recommendation through a business lens in which they  
13 want to make a sale and earn future sales. They acknowledge their work responsibilities and may  
14 feel pressure from their coworkers, managers, or sales representatives to reach specific sales  
15 goals. Whether or not the salesperson is intrinsically or extrinsically motivated, they aim to find  
16 shoes for runners with the end outcome being a financial transaction.

### 17 **Making a Sale**

18         Salespeople are motivated by their employer to sell shoes to maintain their employment  
19 and meet business expectations (P1-2, 12). Salespeople focus on a few key aspects to make a  
20 sale: meeting the runner's needs with appropriate shoes through gait analysis, downplaying  
21 aesthetics, and preventing injury. The relationship between salespeople and runners is crucial to  
22 an effective sales experience. Salespeople also face internal conflicts. They recognise that it is

1 their job to sell shoes, but do not always focus on ‘getting a sale’ (P5, 24) if the specific shoe  
2 offering or timing is suboptimal to the runner they are assisting.

3 P2: ‘But if no one buys a shoe, I’m out of a job.’

4 To sell shoes, the salespeople interviewed were trained in one or several of the following  
5 approaches: three dimensional (3D) foot scans and dynamic scans (P2, 3, 6, 7, 9, 10, 14, 21, 22,  
6 34), visual gait analysis (P2, 5, 10, 11, 13, 17, 18, 19, 24-25, 27-29, 32, 35), foot shape  
7 determination (P5, 7, 13, 15, 17, 19-21, 38), and insole wear pattern assessment (P27). These  
8 tools were used to get the ‘right’ shoe for runners. Many of the stores instructed runners to walk,  
9 stand on, or run across mats with pressure sensors. Some locations used 3D volumetric tools to  
10 map foot volume and foot shape. Salespeople most often used visual gait analysis methods to  
11 inform their shoe recommendations and complemented this analysis using computerised tools.

12 P13: ‘We’ll watch them walk barefoot, and kind of see if they have overpronation, or if  
13 they’re supinating, or if they’re neutral foot and trying to match their gait cycle with the  
14 shoes that we have in the back. Aside from just...they’re, whether they’re over-pronating,  
15 or under-pronating, we’ll also look at the shape of the foot. So I’ll measure them, see if  
16 they’re wide or narrow, medium width.’

17 The visual gait analysis varied between salespeople and relied heavily on personal  
18 interpretation rather than discrete measurement. For example, gait analysis was performed shod  
19 or unshod, running or walking, or with runners’ own shoes or provided ones. While an individual  
20 salesperson may be internally consistent, methodological differences decrease the validity of  
21 visual gait analysis. Many runners value visual and tool-based gait analysis in-store (Walton &  
22 French, 2016), although some consider it a gimmick (Ramsey et al., 2022). While assessing foot

1 shape and kinematics is widespread, matching these features with a motion control or stability  
2 shoe has not been shown to decrease injury risk (Relph et al., 2022).

3 In the process of recommending shoes, many salespeople described the information  
4 gathering stage (P1, 3-6, 9-10, 12-13, 14, 16, 19-25, 27-35, 37). Salespeople gather a runner's  
5 history to help narrow their recommendation. This information may also be used to develop a  
6 personal connection based on shared experiences.

7 P34: 'It starts with asking the customer a lot of questions with their running history.  
8 With...they've had, a shoe that's worked for them in the past, kind of what they've been  
9 wearing, how much are they running, are they training for races, things like that, to get an  
10 idea of where they're coming from.'

11 Salespeople worked to make their offerings more favourable than online competitors  
12 through adding value or decreasing shoe price (P1-2, 6-7, 9-14, 16-17, 24, 28-29, 33-34). The  
13 salespeople interviewed perceived online retailers as direct competitors. The main advantages of  
14 their online competitors were better pricing and greater shoe availability (P1), with supply chain  
15 difficulties (P35) reducing choices available to runners in-store. Rather than waiting for the store  
16 to make a special order, runners may be able to receive a shoe to their door more conveniently  
17 and in less time.

18 P13: 'So if they can, we'll usually match it for them, and we try to let them know, but  
19 most of the time, you can't really find our shoes for cheaper online.'

20 Specialty stores were believed to offer the benefit of personal relationships and  
21 individually tailored recommendations provided by experienced and empathetic salespeople.  
22 Some stores also offered returns within one month of running use to provide a sense of safety to

1 runners making a significant financial investment. Capitalising on trying shoes on, using them in  
2 real-time, offering returns, and creating a cultural hub for runners was thought to increase the  
3 value of local specialty running stores.

4 Intrinsically, salespeople are runners that have personally experienced injury and view it  
5 unfavourably. Salespeople know that keeping runners healthy is favourable to their sales-based  
6 economy that relies on runners replacing worn shoes. Injury interferes with that pattern, but also  
7 provides an opportunity for the salesperson to suggest a new or different shoe to avoid further  
8 injury. The idea of ‘injury prevention’ sells shoes despite the lack of evidence to support the  
9 effectiveness of shoe prescription in reducing running-related injuries (Agresta et al., 2022).  
10 Salespeople aimed to supply runners with shoes that could reduce injuries (P5, 7, 9-10, 12-14,  
11 16-17, 19, 22, 24-25, 28-36).

12 P29: ‘I think it's important that you just kind of have a shoe and there's no...I think people  
13 have an idea that there's like one shoe for everyone. I think it's more that you just have a  
14 shoe that works for you and supporting you to help with injury prevention.’

15 P27: ‘Primarily to keep them safe. To just keep healthy or as healthy as possible. And so  
16 they can extend their running career. Not career, but the running experience as long as  
17 possible. And transition into walking if we need that to occur. And we believe it helps to  
18 have appropriate footwear.’

19 Salespeople have personal experience, anecdotal evidence, and training that support their  
20 beliefs that running shoe prescription can prevent injury. This belief system has persisted for  
21 many years, although injuries are considered multifactorial (Malisoux & Theisen, 2020).

22 Salespeople may be misguided in their efforts to reduce running injury through shoe prescription

1 based on shoe features and anatomy of runners (Knapik et al., 2009; Malisoux & Theisen, 2020;  
2 Wolthon et al., 2020). Regardless, runners seem to value recommendations based on gait analysis  
3 as these are viewed as individualised recommendation (Walton & French, 2016). Choosing shoes  
4 based on comfort is hypothesised to lead to injury reduction (Nigg et al., 2015). The comfort  
5 filter theory is gaining popularity, although there is no evidence of its beneficial effects on injury  
6 prevention (Agresta et al., 2022). Salespeople believe that a comfortable shoe and natural gait  
7 reduces injuries among runners (P7, 24, 33, 36).

8 P7: ‘When you find something that fits well, gives you enough space, and is the most  
9 comfortable, you run most naturally. And more oftentimes than not people are coming in  
10 with shoes that are too small and that's where we start seeing some sort of injury or  
11 discomfort come up...’

## 12 **Future Sales**

13 Salespeople recognised the importance of fitting runners with shoes in a satisfactory  
14 manner so they return in the future (P2, 11-12, 27, 32, 36). Salespeople know the experience of  
15 runners in-store may influence where they buy shoes in the future. To them, running should be  
16 fun, increase happiness, and be beneficial from a physical, mental, and emotional perspective  
17 (P1, 5-7, 14, 18, 20, 22, 25, 32).

18 P25: ‘So that they can continue to do something that they love, something that brings  
19 them a lot of joy. For me personally, running is a huge stress reliever. Helps with, like,  
20 not only physical health, but mental health as well.’

1 P22: 'Just something that we can trust to have confidence and be happy to travel, you  
2 know, multiple miles at a time in a pair of shoes and hopefully it'll you know, reduce any  
3 sort of ailments or injuries.'

4 Salespeople believe that helping runners find a shoe that fits well and enhances their  
5 running experience can create long-term runners.

6 P12: 'You want to gain a customer and so you want to find the right shoe and if they liked  
7 that shoe, they'll come back because they know that we can fit them well.'

8 P5: 'I also find that it's important to find the right shoe for runners because it makes  
9 running more enjoyable for them. And running should be something that makes people  
10 happy. It makes me happy and I want other people to like my sport as much as I like it.'

11 Salespeople recognise that runners may not want to purchase shoes on a given day and  
12 consider the browsing customer as a future sales opportunity (P5, 10, 13, 18-20, 26). If a runner  
13 is hesitant to make a purchase, the relationship and trust that the salesperson creates with them  
14 may encourage them to return in the future.

15 P18: 'Typically, I establish, you know, good relationship with people. And then if they're  
16 hesitant, I'm like, 'Hey, well, you know where to find us' type thing, you know, just be  
17 gentle with them.'

18 P20: 'And there's so many options on the wall, that they just want to try and narrow  
19 things down and then maybe do a fitting and try something out, understand what the price  
20 is, and then come back later when you have the funds.'

1 Salespeople must balance their goals of making a sale in the short-term with the risk of  
2 losing a prospective sale. For example, nearly all salespeople aimed to dissuade runners from  
3 focusing too much on superficial characteristics, such as ‘colour.’ Rather, salespeople encouraged  
4 runners to buy the shoe they recommended even when it did not exactly match the preferences of  
5 the runner. However, this creates a scenario which may dissuade runners from being repeat  
6 customers if they continue to be dissatisfied with aspects of the purchased shoes. Salespeople  
7 that build trust and a positive relationship with runners can earn future sales by managing runner  
8 expectations and working together to prioritise what is most important.

9 P19: ‘I try to stop any kind of colour from influencing or style or anything like that. Go  
10 for fit, comfort, and functionality.’

11 Runners may wear their shoes well beyond the manufacturer recommendations of  
12 replacement or safe use (Asplund Maj & Brown Maj, 2005; Hemler et al., 2022). Beyond  
13 replacing shoes, salespeople can capitalise on runners concurrently using multiple pairs of shoes  
14 (Malisoux et al., 2015) or using shoes for specific reasons, like speed work (Agrega et al., 2022).  
15 If runners are satisfied with their in-store experience and salespeople have established trust and  
16 demonstrating expertise, runners may be more likely to return to the store as a repeat customer.

## 17 **Study Limitations**

18 The participants interviewed were runners in addition to their role as salespeople. Being  
19 runners, the salespeople often answered questions in a dual manner, as a working salesperson and  
20 as a runner. As such, it is unclear how salespeople without a running background would differ in  
21 their behaviour and recommendation practices. Another study limitation is that stores were not  
22 equally represented, and multiple participants were from the same stores. It was evident that each  
23 store received specific training that may have influenced the interview responses of participants,

1 with over-representation of certain processes and ideas. Characteristics of runners visiting stores  
2 can also influence the prescription process, which was not researched here. For example, Seattle  
3 is generally more affluent than many areas in the USA. While nearly all salespeople discussed  
4 price as a barrier to runners and sales, price may further influence the shoe selection process in  
5 certain areas. Furthermore, the primary investigator only interviewed participants on weekends  
6 as more salespeople were present. The responses therefore do not represent salespeople that only  
7 work during the week.

## 8 **Future research and conclusion**

9 This study identified how salespeople perceive the running shoe selection process and  
10 aspects of their interaction with runners. Salespeople believe that they can find the right shoe for  
11 runners to help them prevent injury and improve comfort while running, which is a commonly  
12 held belief (Honert et al., 2020). Salespeople want runners to be happy, healthy, and have an  
13 enjoyable experience. Currently, salespeople use gait analysis, foot shape, and comfort to guide  
14 their recommendation processes. These practices are not evidence-based (Agregta et al., 2022)  
15 and are driven by marketing and perceptions. Salespeople have specialised in-house training and  
16 innate desires to find the ideal shoes for themselves and others (Wolthon et al., 2020). However,  
17 healthcare professionals and runners may have different perceptions of injury risk (Dhillon et al.,  
18 2020) than salespeople, and salespeople need to deal with these competing interests.

19 There appears to be a disconnect between the effectiveness of injury reduction based on  
20 shoe prescription and the beliefs held by runners, salespeople, and healthcare professionals.  
21 Runners and salespeople may benefit from exposure to scientific literature so they can  
22 distinguish between marketing and evidence-based practices during shoe selection. Future  
23 research should examine how runners respond to high-quality evidence when selecting running

1 shoes. Researchers need to effectively communicate current understandings and hypotheses  
2 regarding shoe recommendation to the public. Runners need to be cautioned that being in the  
3 ‘right’ shoe for them may do little to reduce their injury. Socially accepted practices, such as  
4 running shoe recommendation based on market features, foot shape, and visual gait analysis,  
5 make it difficult for runners to make an informed decision about their shoe selection.

6 Acknowledgement: We thank running stores in the greater Seattle, WA area for their participation.  
7 We thank Chris Johnson, PT, for his assistance coordinating store participation. The data that  
8 support the findings of this study are available from the corresponding author upon reasonable  
9 request.

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## Section 3 – Influencing shoe choice and subjective perceptions

### Chapter 5

#### Does an educational video influence running shoe selection? A double-blind randomised controlled trial

**Prelude:** Section 1 (Chapter 2) identified and categorised factors that influence running shoe selection sourced from existing literature. Section 2 (Chapter 3 and Chapter 4) assessed how runners choose shoes in-store. Specifically, Chapter 3 incorporated findings from the review to survey runners in specialty stores and asked about shoe selection behaviour, while Chapter 4 described how salespeople build relationships with runners through developing trust and expertise to make sales and generate future business. These Chapters identified that runners do not consistently prioritise scientific literature as a source of advice when choosing shoes and that runners rely on salespeople expertise and clinical gait analyses to make their selection in store.

Section 2 focused on describing current practices and runner behaviour during footwear selection, whereas Section 3 aims to examine how interventions modify shoe selection behaviour using experimental designs. To begin Section 3, Chapter 5 aims to modify behaviour by exposing runners to an evidence-based educational video. Notably, the present Chapter evaluates shoe choices and longitudinally assesses subjective perceptions of comfort, satisfaction, and performance of runners buying new shoes. It also incorporates Unconscious Thought Theory into the experimental design to evaluate the effects of conscious decision-making processes on satisfaction.

## 1 **Introduction**

2 Runners select their shoes based on subjective and objective factors (Fife et al., 2023),  
3 including considerations linked to comfort, performance, and injury reduction (Dhillon et al.,  
4 2020). Despite the idea that running shoe prescription can prevent injury has been challenged for  
5 over a decade (Knapik et al., 2014; Richards et al., 2009), most runners and salespeople still believe  
6 that shoes have a moderate to high influence on injury (Nguyen et al., 2022; Wolthon et al., 2020).

7 Researchers have suggested that footwear comfort is important to running-related injury  
8 reduction (Nigg et al., 2015). However, footwear comfort is subjective to the individual (Kong &  
9 Bagdon, 2010) and can be influenced by physical shoe characteristics (Menz & Bonanno, 2021)  
10 and product description (Chan et al., 2020). Runners primarily seek advice from specialty running  
11 stores (Nguyen et al., 2022) and may be misinformed by unsupported beliefs (Wolthon et al.,  
12 2020). Dhillon et al. (2020) created an educational module that synthesised current research  
13 regarding running shoes that specifically addressed the shoe-injury relationship. Participants  
14 believed the module would influence their future footwear selection, although the actual effects of  
15 the educational module on footwear selection were not assessed.

16 Previous research addressing running shoe selection rely on participant recall to identify  
17 how runners make their decisions (Dhillon et al., 2020; Ramsey et al., 2022), with no research to  
18 our knowledge assessing running footwear purchasing behaviours in proximity to actual footwear  
19 purchase. How much runners think about their footwear purchase and their thought processes  
20 during footwear selection are currently unknown. The level of conscious thought implemented  
21 during the buying process can be used to classify individuals as conscious or unconscious buyers  
22 for a given decision, which may influence runners' satisfaction (Dijksterhuis et al., 2006).  
23 Unconscious Thought Theory describes how differences in thinking behaviour can influence the

1 quality of choices and subsequent satisfaction (Dijksterhuis & Van Olden, 2006). The theory  
2 postulates that complex product decisions may benefit from unconscious thought processes, and  
3 ultimately lead to increased satisfaction over time, which may apply to running shoe selection.

4         Given that no study has explicitly tested the effects of evidence-based education on  
5 footwear selection, it is currently unknown if it can positively affect perceived footwear comfort,  
6 satisfaction, and performance over time in runners who buy new shoes. We aimed to compare the  
7 effects of an educational video to a control video on how runners select road running shoes and  
8 perceive subjective comfort, satisfaction, and performance over a three-month period. We also  
9 monitored injury incidence over this time. We hypothesised that runners exposed to the educational  
10 video would experience increased comfort over time than runners that viewed the control video.  
11 We also hypothesised that runners classified as unconscious buyers regarding shoe choice would  
12 report greater satisfaction over time than conscious ones.

## 13 **Materials and methods**

### 14 **Participants**

15         Participants were recruited through online advertisements within the running community  
16 of the greater Bellingham and Seattle area (Washington, United States). Eligibility requirements  
17 included: (1) be aged 18 years or older; (2) run a minimum of once per week for at least one  
18 month (3) be willing to purchase new shoes from a participating store location within one month  
19 of enrolment; and (4) use their new shoes primarily for road running. Runners were excluded if  
20 they had experienced a running-related injury in the previous six months due to training or  
21 competition based on a consensus definition (Yamato et al., 2015). The trial was approved by the  
22 Human Research Ethics Committee of the University of Waikato (HREC(HECS)2021#31.1) and  
23 prospectively registered on Australian New Zealand Clinical Trials Registry

1 (ACTRN02622000458730). It is reported according to the CONSORT guidelines (Schulz et al.,  
2 2010).

### 3 **Trial design**

4 A double-blind parallel-group randomised controlled trial was conducted. Surveys with  
5 regards to the new shoes purchased were completed at three timepoints: at shoe purchase before  
6 first use ( $N_0$ ), one month after purchase ( $N_1$ ), and three months after purchase ( $N_3$ ). At shoe  
7 purchase, subjective ratings of old shoes (OS), initial ratings of new shoes ( $N_0$ ), demographics,  
8 and decision-making processes were collected. Given the design, outcomes of interest were  
9 compared between either three ( $N_0$ ,  $N_1$ ,  $N_3$ , all new shoe comparisons) or four (OS,  $N_0$ ,  $N_1$ ,  $N_3$ ,  
10 old shoe and new shoe comparisons) timepoints. Participants were randomly allocated using  
11 stratified sampling to either: (1) a control video about running participation; or (2) an educational  
12 video based on the latest research about running footwear.

### 13 **Randomisation and blinding**

14 A research assistant that was not involved in data collection generated randomisation lists  
15 using a random number generator (block randomisation; block sizes of 4, 6, 8). Randomisation  
16 was stratified according to gender (man/woman/other), foot strike pattern (rearfoot/non-rearfoot),  
17 and age (34 and under, 35 and over). Foot strike pattern was visually determined from recorded  
18 sagittal plane running videos provided by participants. Group allocations were concealed from  
19 the primary investigator and held by the research assistant. Upon receiving participant  
20 characteristics, the research assistant made group assignments and sent presentations to  
21 participants. Participants were blinded to their group allocation. They knew they were allocated  
22 to an educational video before buying shoes, but they did not know if they viewed the  
23 intervention or control video. They were also instructed not to reveal the content of the video to

1 the primary investigator who was the contact for participants throughout the survey process and  
2 remained blinded to group assignments until after statistical analyses. We had planned to assess  
3 participant blinding through a survey question; however, this question had to be removed due to  
4 an error in the survey skip logic.

## 5 **Interventions**

6 The intervention group viewed an evidence-based presentation that described the current  
7 state of running shoe research updated from a module published in 2020 (Dhillon et al., 2020)  
8 and is available as supplementary material. The video synthesised research relating to running  
9 biomechanics, injury, shoe prescription, and joint loads. Furthermore, literature relating to  
10 minimalist shoe construction, cushioning, and transitioning between footwear categories was  
11 included. The video prioritised the inclusion of systematic reviews and randomised controlled  
12 trials when available.

13 The control group video was designed to emulate the educational video in design, slide  
14 number, and duration. The video contained information about running participation trends world-  
15 wide based on data gathered and distributed by RunRepeat.com, which were used with  
16 permission. Statistics included worldwide running participation, race distance popularity, and  
17 demographics. The video also reported top performances across common long-distance events  
18 and an interpretation of running trends. The control video did not mention anything about  
19 running footwear.

20 After viewing their assigned video, runners were instructed to purchase new running  
21 shoes at one of the participating specialty running stores in the area. Running stores were aware  
22 that the study would bring runners into their store and offered a modest (10% or \$10 depending  
23 on store) discount to participants on any shoe purchase. Salespeople were instructed to behave

1 normally, although it is possible that runners discussed the content of the video. However,  
2 runners reported the amount of influence the video made on their purchase and were able to give  
3 additional comments about the video. No instructions were given to participants with regards to  
4 their running training. Questionnaire responses were based only on training conducted in shoes  
5 purchased for the study.

## 6 **Outcomes**

7 All data were collected using questionnaires housed on the XM Qualtrics survey system  
8 ([www.qualtrics.com](http://www.qualtrics.com)). Data on demographics and running history, such as training patterns and  
9 race participation, were collected. Primary outcomes included subjective comfort, satisfaction,  
10 and performance and were collected for both old and new shoes. Perceptions of footwear  
11 comfort were measured using 100 mm visual analogue scale (VAS) with anchors ‘extremely  
12 uncomfortable (0), neutral/uncertain (50), and extremely comfortable (100)’ that were colour-  
13 coded across questions for congruence. Perceptions of footwear satisfaction were measured using  
14 100 mm VAS with anchors ‘extremely dissatisfied (0), neutral/uncertain (50), and extremely  
15 satisfied (100)’. Perceptions of the influence of footwear on running performance were measured  
16 using 100 mm VAS with anchors ‘decreased performance (0), neutral/uncertain (50), and  
17 increased performance (100)’.

18 Factors that influenced running shoe purchase were selected from a 23-item list and  
19 ranked by importance during the first survey after shoe purchase ( $N_0$ ). Participants answered  
20 ‘yes’ or ‘no’ regarding being familiar with the shoes before shopping. Runners reported how  
21 much the assigned video influenced their shoe purchase. We collected information regarding  
22 shoes purchased including brand, model, and price. The minimalist index of shoes was calculated

1 for both the new running shoes and old running shoes of participants based on the reported brand  
2 and model (Esculier et al., 2015).

3 Injuries were self-reported at N<sub>1</sub> and N<sub>3</sub> using a detailed graphic that allowed runners to  
4 report the specific location of their injuries according to the following definition: Running  
5 related (training or competition) musculoskeletal pain in the lower limbs or low back that causes  
6 a restriction on or stoppage of running (distance, speed, duration, or training) for at least 7 days  
7 or 3 consecutive scheduled training sessions, or that requires the runner to consult a physician or  
8 other health professional (Yamato et al., 2015).

### 9 **Sample size**

10 A sample size of 112 participants (56 per group) was calculated a priori based on detecting  
11 a medium effect size difference (Cohen  $d$  0.68) in VAS achieving a power of  $\beta = 0.90$  with an  $\alpha =$   
12 0.025. This calculation was based on assumptions of similar comfort VAS means and standard  
13 deviations ( $75 \pm 15$  mm) reported elsewhere (Hébert-Losier et al., 2020), and the meaningful  
14 change set to 10 mm (Mills et al., 2010). The alpha was set to 0.025 to account for multiple VAS  
15 comparisons (i.e., two main outcomes of comfort and satisfaction).

### 16 **Statistical methods**

17 Survey data were imported into Microsoft® Excel® (V 2302 Build 16.0.16130.20298) and  
18 analysed by group (control and intervention) using IBM SPSS Statistics [version 29.0.0.0 (241)]  
19 software. Data were checked for normality and compared between groups using t-tests or non-  
20 parametric alternatives for age, training volume, number of factors that influenced running shoe  
21 selection, video influence, shoe price, and conscious behaviour. Two-tailed Fisher Exact  
22 Probability tests (2x2 and 2x3) were used to determine differences in the top three factors that  
23 influenced shoe selection, brands and models of shoes purchased, and other nominal data between

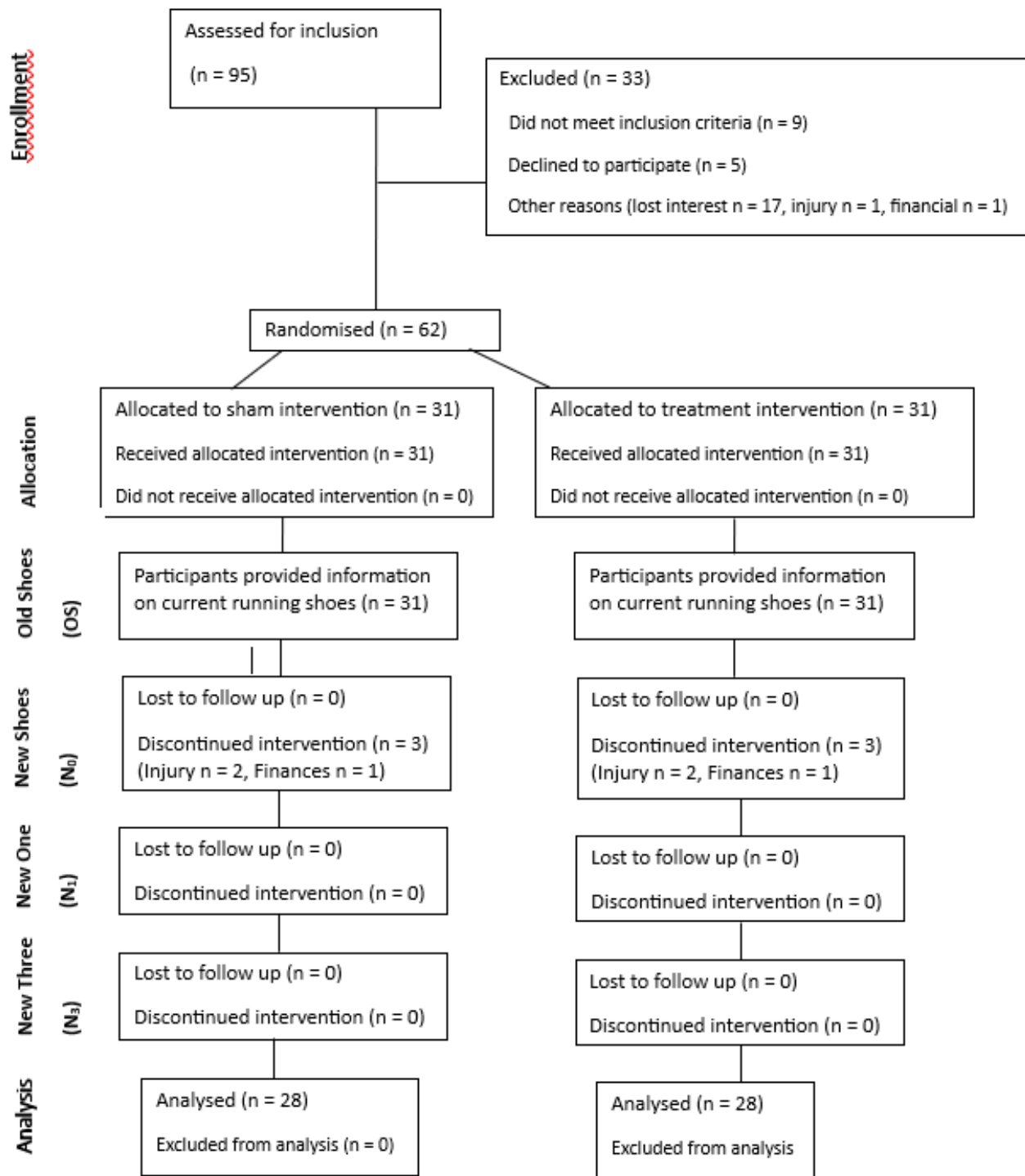
1 groups. Barnard's 2x2 tests were used for nominal data such as racing experience if group  
2 responses were zero (i.e., 400-800 m). The median value from the 100 mm VAS scores on how  
3 much runners thought about purchasing their running shoes was used to categorise runners as  
4 conscious ( $\geq$  median) or unconscious ( $<$  median) buyers, based on the approach described by the  
5 Unconscious Thought Theory framework (Dijksterhuis et al., 2006). Means with standard  
6 deviations and counts with percent values were used to describe the data. Bonferroni adjustments  
7 for multiple comparisons were used for comfort, satisfaction, and performance. P-values  $<0.050$   
8 were considered statistically significant. Effect sizes were reported using partial eta squared with  
9  $\eta_p^2$  0.01 considered small,  $\eta_p^2$  0.06 considered medium, and  $\eta_p^2$  0.14 considered large (Fritz et al.,  
10 2012). Two-way ANOVA were conducted for repeated-measures variables including subjective  
11 comfort, satisfaction, performance, running volume, and minimalist index scores. Mean  
12 differences were reported with 95% confidence intervals.

## 13 **Results**

### 14 **Participants**

15 The 112-runner sample size was not met due to recruitment challenges and resource  
16 constraints. The research team agreed to end study enrolment given that the achieved sample size  
17 would be sufficient to reach  $\beta = 0.70$  and  $\alpha = 0.05$ , rather than  $\beta = 0.90$  and  $\alpha = 0.025$ .

18 Recruitment ran from June 1<sup>st</sup>, 2022 until December 1<sup>st</sup>, 2022. Data collection was  
19 finalised on March 23<sup>rd</sup>, 2023. Eighty-five participants agreed to a phone call, met inclusion  
20 criteria, and were recruited to participate (Figure 7). Of the eligible participants, 62 (65.3 %)  
21 received a group assignment, and 56 runners completed the three-month study (90.3 %  
22 retention): 28 runners in the control group, and 28 runners in the intervention group.



1  
 2 Figure 7. Flow diagramme of participant progress through a parallel randomised trial of two groups including enrolment,  
 3 intervention allocation, follow-up, and data analysis.

4

1 Participants in both groups were similar in terms of gender, age, and ethnicity. There was  
 2 no statistically significant difference between groups in terms of running experience, weekly  
 3 training patterns, foot strike pattern, and competitive race participation (Table 9). Both groups ran  
 4 a similar amount in their shoes at each time point.

6 Table 9. Summary of participant characteristics and running experience.

	Control (n = 28)	Intervention (n = 28)	Combined (n = 56)	p value
Gender, n (%)				1.000 <sup>A</sup>
Woman	13 (46.4)	12 (42.9)	25 (44.6)	
Man	15 (53.6)	16 (57.1)	31 (55.4)	
Other	0 (0.0)	0 (0.0)	0 (0.0)	
Ethnicity, n (%)				1.000 <sup>A</sup>
White	26 (89.7)	25 (89.3)	51 (89.7)	
Hispanic or Latino	1 (3.4)	2 (7.1)	3 (5.3)	
Asian	2 (6.9)	1 (3.6)	3 (5.3)	
Age (years), mean (SD)	36.9 (12.5)	39.7 (11.4)	38.3 (12.1)	0.376 <sup>B</sup>
Foot strike pattern, n (%)				1.000 <sup>A</sup>
Non rearfoot	7 (25)	8 (28.6)	15 (26.8)	
Rearfoot	21 (75)	20 (71.4)	41 (73.2)	
Running history, n (%)				0.101 <sup>A</sup>
Between 0-3 years	3 (10.7)	9 (32.1)	12 (21.4)	
More than 3 years	25 (89.3)	19 (67.9)	44 (78.6)	
Race competitively, n (%)	17 (60.7)	12 (42.9)	29 (51.8)	0.285 <sup>A</sup>

7

Raced within the last year, n (%)				
400-800 m	3 (10.3)	0 (0)	3 (5.4)	0.099 <sup>C</sup>
1500-3200 m	6 (20.7)	2 (7.4)	8 (14.3)	0.254 <sup>A</sup>
5 km	23 (82.1)	20 (71.4)	43 (76.8)	0.528 <sup>A</sup>
8-10 km	21 (75)	18 (64.3)	39 (67.9)	0.562 <sup>A</sup>
Half-marathon	16 (55.1)	16 (57.1)	32 (57.1)	1.000 <sup>A</sup>
Marathon	5 (17.2)	6 (22.2)	11 (17.9)	0.742 <sup>A</sup>
Ultra	9 (31.0)	3 (11.1)	12 (12.5)	0.104 <sup>A</sup>
Other	5 (17.2)	1 (3.7)	6 (10.7)	0.195 <sup>A</sup>
Weekly sessions (n), mean (SD)				
N <sub>0</sub>	4.6 (2.2)	4.0 (2.0)		Time 0.699, $\eta_p^2 = 0.01$
N <sub>1</sub>	4.5 (2.3)	3.8 (1.7)		Group 0.315, $\eta_p^2 = 0.02$
N <sub>3</sub>	4.4 (1.7)	4.3 (2.5)		Interaction 0.299, $\eta_p^2 = 0.02$
$\Delta$ [95% CI]				
N <sub>1</sub> -N <sub>0</sub>	-0.1 [-0.7, 0.5]	-0.1 [-0.8, 0.5]		
N <sub>3</sub> -N <sub>0</sub>	-0.3 [-0.8, 0.3]	0.3 [-0.3, 0.9]		
Weekly distance (km), mean (SD)				
N <sub>0</sub>	46.9 (40.8)	35.1 (32.4)		Time 0.692, $\eta_p^2 = 0.01$
N <sub>1</sub>	43.7 (36.2)	34.6 (29.6)		Group 0.265, $\eta_p^2 = 0.02$
N <sub>3</sub>	45.4 (31.9)	36.9 (36.4)		Interaction 0.791, $\eta_p^2 = 0.00$
$\Delta$ [95% CI]				
N <sub>1</sub> -N <sub>0</sub>	-3.2 [-11.3, 4.9]	-0.6 [-8.7, 7.5]		
N <sub>3</sub> -N <sub>0</sub>	1.5 [-10.8, 13.8]	1.8 [-10.6, 14.1]		
Volume in new running shoes (%)				
N <sub>1</sub>	81.3 (21.3)	71.8 (25.4)		Time 0.920, $\eta_p^2 = 0.00$
N <sub>3</sub>	74.6 (31.0)	74.3 (28.2)		Group 0.097, $\eta_p^2 = 0.05$
$\Delta$ [95% CI]				
N <sub>3</sub> -N <sub>1</sub>	-6.8 [-15.7, 2.2]	2.5 [-6.5, 11.5]		Interaction 0.423, $\eta_p^2 = 0.01$

1 Note. <sup>A</sup> Fisher's Exact Probability Test, <sup>B</sup> Kruskal-Wallis, <sup>C</sup> Barnard's Test. Two-way ANOVA included three time points: new  
2 shoes (N<sub>0</sub>), one month (N<sub>1</sub>), three months (N<sub>3</sub>). The mean difference from baseline is denoted by  $\Delta$ .

3

## 1 **Comfort**

2           There was no significant main effect of time, main effect of group, or interaction when  
3 comparing comfort VAS scores over the four timepoints (Table 10).

## 4 **Satisfaction**

5           There was no main effect of time, main effect of group, or interaction when comparing  
6 satisfaction VAS scores of the new shoes across the three timepoints (Table 10).

## 7 **Performance**

8           There was a significant main effect of time on subjective shoe performance VAS scores  
9 over the four timepoints ( $p = 0.006$ ,  $\eta_p^2 = 0.083$ ) (Table 10). Post-hoc testing identified increased  
10 subjective performance of new shoes (N<sub>0</sub>) compared to OS ( $p = 0.006$ ). Subjective running  
11 performance using new shoes decreased after purchase at both one-month ( $p < 0.001$ ) and three  
12 months ( $p = 0.018$ ) post-purchase, with similar values to OS.

13

14 Table 10. Summary of footwear comfort, satisfaction, and performance ratings over time using 100 mm  
15 visual analogue scales.

	Control (n = 28)	Intervention (n = 28)	p value, $\eta_p^2$
Comfort (mm), mean (SD)			
OS	86.3 (11.4)	81.9 (20.3)	Time 0.812, $\eta_p^2 = 0.004$
N <sub>0</sub>	87.6 (12.3)	79.9 (18.0)	Groups 0.079, $\eta_p^2 = 0.056$
N <sub>1</sub>	88.1 (11.6)	83.4 (16.5)	Interaction 0.827, $\eta_p^2 = 0.005$
N <sub>3</sub>	86.3 (11.5)	83.3 (20.6)	
$\Delta$ [95% CI]			
N <sub>0</sub> -OS	1.4, [-8.9, 11.6]	-2.0 [-12.3, 8.3]	
N <sub>1</sub> -OS	1.9 [-9.7, 13.4]	1.5 [-10.1, 13.0]	
N <sub>3</sub> -OS	0.0 [-12.8, 12.8]	1.4 [-11.5, 14.2]	

Satisfaction (mm), mean (SD)			
N <sub>0</sub>	88.6 (12.5)	84.9 (16.9)	Time 0.462, $\eta_p^2 = 0.013$
N <sub>1</sub>	85.6 (13.1)	85.6 (16.7)	Groups 0.534, $\eta_p^2 = 0.007$
N <sub>3</sub>	85.7 (15.0)	82.4 (26.1)	Interaction 0.634, $\eta_p^2 = 0.007$
$\Delta$ [95% CI]			
N <sub>1</sub> -N <sub>0</sub>	-3.0 [-10.5, 4.5]	0.7 [-6.8, 8.2]	
N <sub>3</sub> -N <sub>0</sub>	-2.9 [-12.7, 6.9]	-2.6 [12.4, 7.2]	
Performance (mm), mean (SD)			
OS	68.7 (16.4)	66.4 (21.1)	Time 0.006 <sup>a</sup> , $\eta_p^2 = 0.083^m$
N <sub>0</sub>	76.8 (14.6)	74.7 (18.4)	OS-N <sub>0</sub> 0.006 <sup>b</sup>
N <sub>1</sub>	67.2 (14.7)	65.3 (19.6)	N <sub>0</sub> -N <sub>1</sub> < 0.001 <sup>c</sup>
N <sub>3</sub>	68.3 (18.2)	69.5 (19.0)	N <sub>1</sub> -N <sub>3</sub> 0.018 <sup>d</sup>
$\Delta$ [95% CI]			
N <sub>0</sub> -OS	8.1 [-3.1, 19.2]	8.3 [-2.8, 19.5]	Groups 0.710, $\eta_p^2 = 0.003$
N <sub>1</sub> -OS	-1.5 [-13.7, 10.7]	-1.1 [-13.3, 11.0]	Interaction 0.855, $\eta_p^2 = 0.004$
N <sub>3</sub> -OS	-0.4 [-12.9, 12.0]	3.1 [-9.4, 15.6]	

1 Note. Two-way ANOVA of comfort and performance included four time points: old shoes (OS), new shoes (N<sub>0</sub>), one month (N<sub>1</sub>),  
2 three months (N<sub>3</sub>). Satisfaction was compared across three time points: (N<sub>0</sub>), (N<sub>1</sub>), (N<sub>3</sub>). Main effects were further explored in  
3 post-hoc testing. <sup>a</sup> indicates main effect of time, <sup>b</sup> indicates difference from old shoes to new shoes, <sup>c</sup> indicates difference from  
4 new shoes to one month. <sup>d</sup> indicates difference from new shoes to three months. <sup>m</sup> indicates medium effect size based on common  
5 interpretation of partial eta squared ( $\eta_p^2$ ). The mean difference from baseline is denoted by  $\Delta$ .

6

## 7 Shoe selection process

8 Runners identified fit (21.4%), comfort (17.9%), and a similar model to what they  
9 normally wear (16.1%) as the three most influencing factors when selecting shoes for the present  
10 study (Table 11). There was a trend for more runners in the intervention group to purchase a new  
11 brand ( $p = 0.054$ ) and model ( $p = 0.108$ ) of shoes compared to the control group. Overall, 34  
12 runners (60.7%) purchased new shoes of the same brand, and 29 (51.8%) purchased the same  
13 model as previously worn (Table 12). There was no significant main effect of time (OS, N<sub>0</sub>), main  
14 effect of group, or interaction effect on the level of minimalism of running shoes (Table 12). The

1 intervention group reported being influenced more ( $55.4 \pm 32.7$  mm) by the educational video  
 2 than the control group ( $21.8 \pm 29.8$  mm) ( $p < 0.002$ ).

3

4 Table 11. Summary of factors that influence running shoe selection, mean (SD).

Question	Control (n = 28)	Intervention (n = 28)	Total	p value
Number of influencing factors	5.8 (2.6)	6.5 (2.7)	6.1 (2.7)	0.318 <sup>B</sup>
Video influence on shoe selection (mm)	21.8 (29.8)	55.4 (32.7)	38.6 (35.5)	0.002 <sup>B</sup>
Most influential factor, n (%)	Fit: 6 (21.4)	Fit: 6 (21.4)	12 (21.4)	1.000 <sup>A</sup>
	Similar Model: 6 (21.4)	Similar Model: 3 (10.7)	9 (16.1)	0.469 <sup>A</sup>
	Comfort: 4 (14.3)	Comfort: 6 (21.4)	10 (17.9)	0.729 <sup>A</sup>

5 Note. Video influence was rated using a visual analogue scale with anchor points as follows: 0 mm – “not at all” and 100 mm –  
 6 “very much.”<sup>A</sup> Fisher’s Exact Probability Test, <sup>B</sup> Kruskal-Wallis.

7

8 Table 12. Shoe selection behaviour based on brand and model, and shoe characteristics.

	Control (n = 28)	Intervention (n = 28)	Total (n = 56)	p value, $\eta_p^2$
Shoes purchased for the study were the same brand as old shoes, n (%)	21 (75.0)	13 (46.4)	34 (60.7)	0.054 <sup>A</sup>
Shoes purchased for the study were the same model as old shoes, n (%)	18 (64.3)	11 (39.3)	29 (51.8)	0.108 <sup>A</sup>
Minimalist Index scores (%), mean (SD)				
OS	35.2 (12.8)	34.0 (11.2)	34.6 (11.9)	Time 0.730, $\eta_p^2 = 0.002$
N <sub>0</sub>	33.8 (12.8)	36.4 (13.2)	35.1 (13.0)	Groups 0.823, $\eta_p^2 = 0.001$
$\Delta$ [95% CI]				Interaction 0.195, $\eta_p^2 = 0.031$
N <sub>0</sub> -OS				
	-1.4 [-5.5, 2.7]	2.4 [-1.7, 6.5]		
Shoe price (USD), mean (SD)				
OS	128.3 (31.5)	125.8 (31.7)	127.0 (31.3)	Time 0.206, $\eta_p^2 = 0.031$
N <sub>0</sub>	134.6 (24.9)	135.8 (22.3)	135.2 (23.3)	Groups 0.884, $\eta_p^2 = 0.000$
$\Delta$ [95% CI]				Interaction 0.770, $\eta_p^2 = 0.002$

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$N_0$ -OS	6.2 [-12.2, 24.7]	10.0 [-7.5, 27.4]
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1 Note. Shoes that were the next generation of model were considered the same as specialty stores do not typically carry multiple  
2 model years. <sup>A</sup> Fisher's Exact Probability Test, <sup>B</sup> Kruskal-Wallis. Two-way ANOVA included two time points: Old shoes (OS),  
3 new shoes ( $N_0$ ). Percentages on the Minimalist Index are ordered such that 0% indicates more maximalist shoe construction and  
4 100% indicates more minimalist construction. The mean difference from baseline is denoted by  $\Delta$ .

5

1 Responses to questions assessing conscious behaviour are reported in Table 13. The  
 2 control group was more familiar with the shoes that they selected during the study than the  
 3 intervention group prior to their purchase ( $p = 0.014$ ). Thirty-two runners (57.1%) were  
 4 classified as conscious buyers based on the median split. After categorising runners as conscious  
 5 and unconscious, there was a significant interaction effect in which unconscious buyers exhibited  
 6 increased satisfaction over time, while conscious buyers were less satisfied over time ( $p =$   
 7 0.023).

8

9 Table 13. Summary of consciousness during shoe selection.

Question	Control (n = 28)	Intervention (n = 28)	Combined (n = 56)	p value, $\eta_p^2$
Shoe familiarity (yes/no), n (%)	25 (89.3)	16 (57.1)	41 (73.2)	0.014 <sup>A</sup>
Thought about making shoe purchase (mm), mean (SD)	57.6 (32.2)	70.2 (20.3)	63.9 (20.7)	0.091
Thought about shoes from seeing to purchase (mm), mean (SD)	57.5 (30.7)	60.2 (31.8)	58.9 (31.3)	0.757
New shoe satisfaction (mm), mean (SD)	88.6 (12.2)	84.9 (16.6)	86.8 (14.9)	0.458 <sup>B</sup>
Number of 'conscious' buyers, n (%)	14 (50.0)	18 (62.3)	32 (57.1)	0.418
Satisfaction (mm), mean (SD)	Conscious	Unconscious		
N <sub>0</sub>	88.2 (14.3)	84.4 (17.1)		Time 0.681, $\eta_p^2$ 0.006
N <sub>1</sub>	84.4 (17.1)	87.3 (11.4)		Groups 0.411, $\eta_p^2$ 0.013
N <sub>3</sub>	79.8 (25.7)	89.7 (11.2)		Interaction 0.023 <sup>i</sup> , $\eta_p^2$ 0.073 <sup>m</sup>
$\Delta$ [95% CI]				
N <sub>1</sub> -N <sub>0</sub>	-3.8 [-10.7, 3.1]	2.4 [-5.6, 10.4]		
N <sub>3</sub> -N <sub>0</sub>	-8.4 [-17.1, 0.3]	4.8 [-5.3, 14.8]		

10 Note. The question "How much did you think about making your purchase?" was used to categorise runners as conscious or  
 11 unconscious shoppers. Consciousness was determined based on combined median split of 70 mm. Runners were divided as  
 12 'conscious' if they scored 70 mm or more using a 100 mm visual analogue scale. Price was self-reported and not checked for  
 13 accuracy. Anchor points for visual analogue scales were as follows: 0 mm – "not at all" and 100 mm – "very much." <sup>A</sup> Fisher's

1 Exact Probability Test, <sup>B</sup> Kruskal-Wallis. Two-way ANOVA included three time points: old shoes (OS), one month (N<sub>1</sub>), three  
2 months (N<sub>3</sub>). <sup>1</sup> indicates significant interaction effect. The mean difference from baseline is denoted by  $\Delta$ .

3

#### 4 **Injury**

5 Four runners (two from each group) were injured prior to purchasing new shoes and were  
6 excluded from the analysis. Three (5.4%) runners (two in the intervention group, one in the  
7 control group) reported an injury one month after purchasing new shoes. Injury locations  
8 included the anterior leg, ankle and foot region, and anterior hip. At three months, only one  
9 runner (1.8%) from the control group reported an injury (pain in the low back and bilaterally at  
10 the anterior leg). There were no statistically significant differences in injury rates between  
11 groups.

#### 12 **Discussion**

13 This is the first randomised controlled trial that assessed the effects of an evidence-based  
14 educational video on running shoe selection. Furthermore, this is the first study to track  
15 perceived running shoe comfort, satisfaction, and performance of new shoes over time. The  
16 intervention group reported that the video influenced shoe selection twice as much as the control  
17 group and that they were less familiar with the shoes that they purchased for the study. Despite  
18 the intervention group claiming the video influenced them more, runners in both groups  
19 purchased the same brand and model to a similar extent, although there was a statistical trend  
20 towards the intervention group buying different brand and model shoes. Familiarity influences  
21 purchasing behaviour in online shopping situations (Zaid, 2020), and appears to apply to runners  
22 in our study. Runners identified fit, comfort, and choosing a similar model as most important to  
23 their running shoe selection in-store. Choosing the same or updated shoe model may be based on  
24 familiarity with the fit and comfort of a particular shoe. Runners that find shoes that ‘work well

1 for them' are inclined to stockpile their preferred model to avoid change (Ramsey et al., 2022).  
2 Brand affinity and shoe familiarity may have superseded the educational video in importance  
3 when the time came to purchase shoes.

4 Runners tend to prefer practical over academic knowledge (Walton & French, 2016) and  
5 seek advice from running shoe retailers and websites more frequently than scientific literature  
6 (Dhillon et al., 2020). Moreover, minimalist shoes are seen as less conventional and comfortable  
7 than traditional running shoes (Walton & French, 2016). An evidence-based educational video  
8 outlining that technologies in traditional shoes do not prevent injuries, and thus, suggesting  
9 runners to consider less conventional shoes, may have been too novel for runners. As comfort is  
10 critical to running shoe choice, runners may not be willing to sacrifice traditional cushioning to  
11 experiment with an unfamiliar shoe with less cushioning.

12 Runners that viewed an educational module in previous research stated it would influence  
13 their future shoe selection (Dhillon et al., 2020). However, the educational video in our study did  
14 not appear to overtly change how runners selected their new shoes. Our educational video was  
15 designed to encourage runners in the intervention group to consider the purchase of more  
16 minimalist shoes for running, but minimalist index scores were similar between groups pre-video  
17 and post-video viewing. Minimalist shoes are generally less cushioned than traditional shoes  
18 (Esculier et al., 2015), and may be less comfortable for runners used to cushioned shoes (Kong &  
19 Bagdon, 2010), at least in the short-term. It is possible that runners who purchase more  
20 minimalist shoes may be less comfortable initially, but adapt and become more comfortable over  
21 time. The similarity in comfort between groups can most likely be attributed to participant shoe  
22 choice being relatively similar.

1 Runners consider how shoes influence performance during shoe selection (Dhillon et al.,  
2 2020; Ramsey et al., 2022; Walton & French, 2016). Indeed, both runners and non-runners alike  
3 believe that shoes have a positive effect on performance (Nguyen et al., 2022). Participants  
4 reported perceiving a significant performance improvement in their new shoes compared to old  
5 shoes (medium effect size). However, this result may not be clinically meaningful, as the  
6 difference was 8.1 mm in VAS subjective running performance and running performance was not  
7 objectively assessed. Minimally clinically important differences are set to 10.2 mm for VAS  
8 footwear comfort (Mills et al., 2010), which might extend to VAS footwear performance scores.  
9 One month after purchase, perceived performance decreased to the baseline of old shoes and  
10 remained similar at the three-month survey. It is unlikely that the change in performance is  
11 related to physical shoe degradation in such a short time (Wang et al., 2012), but rather  
12 psychological responses.

13 We also hypothesised that unconscious buyers would be more satisfied with their  
14 purchases, agreeing with our observations. Unconscious runners reported increased satisfaction  
15 over time, while conscious runners were less satisfied with their shoes. Running shoe selection  
16 can be considered a complex decision influenced by many factors such as comfort, price, and  
17 colour (Fife et al., 2023). Complex decisions are aided by unconscious thought processes  
18 (Dijksterhuis & Nordgren, 2006), which may explain the increase in satisfaction over time for  
19 the unconscious buyers. Running shoe choice in specialty stores also requires runners to select  
20 from a large assortment of options; a situation in which less conscious processing can be  
21 beneficial (Messner & Wänke, 2011). Runners may benefit from spending time and energy  
22 carefully considering shoes, then ‘sleeping on’ a decision to allow unconscious processes to  
23 guide their actions (Bos et al., 2011).

## 1 **Limitations**

2           The subjective perceptions of footwear comfort, satisfaction, and performance reported in  
3 the questionnaires may not have fully encapsulated how runners interacted with their footwear.  
4 While a more complex rating system may have captured nuanced perceptions, the questionnaires  
5 were designed to be simple and relatively short to increase the likelihood of participant  
6 compliance. Runners may have responded differently to the information in the video if it were  
7 presented in alternative format or media. It is possible that our video presentation was not as  
8 engaging or informative as needed to effect behavioral change. Reaching the planned sample size  
9 of 112 runners would have allowed us to capture smaller differences in subjective ratings between  
10 groups.

11           Unconscious Thought Theory has been established based on studies manipulating states  
12 of consciousness, with limited research examining post decision-making. The division between  
13 conscious and unconscious buyers may not fully reflect runners' thought processes. Due to an error  
14 in the digital survey skip logic, the question used to assess blinding effectiveness was removed. As  
15 such, we do not know how well participants felt they were blinded during the study.

## 16 **Conclusion**

17           An evidence-based educational video did not influence perceived running shoe comfort,  
18 satisfaction, or performance over time. Although runners believed that the video influenced their  
19 shoe selection, both groups often chose the same brand and model of shoe as previously worn. In  
20 both groups, runners prioritised fit, comfort, and getting a similar model to previously used shoe  
21 when selecting new shoes in store. Participants that were classified as unconscious buyers were  
22 more satisfied over time. Future research should seek to identify whether runners current shoe  
23 selection practices or preferences can be modified or improved in-situ.

1 **Practical implications**

- 2       • The educational video did not change how runners chose their shoes or perceptions of  
3       comfort, satisfaction, or performance.
- 4       • Runners that thought less consciously about which shoes to buy were more satisfied with  
5       their purchase.
- 6       • Runners buying shoes in specialty stores primarily choose shoes based on fit, comfort, and  
7       getting a similar model to what they are used to wearing.

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## Chapter 6

### Running shoe recommendations based on gait analysis improve perceptions of comfort, performance, and injury risk: A single-blind randomised crossover trial

**Prelude:** Chapter 5 assessed the influence of an evidence-based educational video on runners buying new shoes and longitudinally evaluated subjective perceptions commonly important to runners. Runners identified that fit, getting a similar model to what they were used to, and comfort were priorities when purchasing shoes for the study. The educational video apparently did not influence running shoe selection, although the study was limited by a reduced sample size due to resource constraints. Congruent with Unconscious Thought Theory, runners that made their choices with less conscious deliberation were more satisfied with their shoes over time. As previous Chapters have consistently identified comfort and gait analysis as being important to runners, Chapter 6 aims to determine how expert recommendation based on gait analysis influences perceptions of subjective comfort, performance, and injury prevention in runners. The methodology found in Chapter 6 is derived from an integration of results and findings from previous Chapters to replicate the in-store experience in a laboratory-controlled setting.

# 1 **Introduction**

2 Many runners consider shoes to increase comfort and reduce running-related injury  
3 incidence (Walton & French, 2016). The belief that shoes can reduce injury in part stems from  
4 marketing claims that individualised shoe prescription improves running mechanics (Knapik et  
5 al., 2009). Researchers have challenged the efficacy of shoe prescription for over a decade  
6 (Richards et al., 2009) and more recently concluded that the role of running shoe technology in  
7 injury reduction is likely overrated (Malisoux & Theisen, 2020). Despite the evolution of shoe  
8 prescription theories and paradigms over the years (i.e., pronation control, impact force  
9 modification, habitual joint path, and comfort filter), there is no sound evidence to support  
10 current running shoe prescription methods (Agrega et al., 2022).

11 Runners currently seek shoe selection advice from many sources including running  
12 stores, healthcare professionals, and experts within the running community (Dhillon et al., 2020).  
13 While runners and researchers often prioritise reducing running-related injury through shoe  
14 selection (Dhillon et al., 2020; Nigg et al., 2023), the link between running shoe technology and  
15 injury is poorly supported. Despite industry and academic experts suggesting certain shoe  
16 properties based on running level, the utility of their recommendations is unknown (Honert et al.,  
17 2020) and did not include the opinion of runners. Runners consider salespeople as experts  
18 (Walton & French, 2016), although salespeople may have beliefs that do not align with scientific  
19 evidence (Woltho et al., 2020). Runners purchasing shoes at specialty stores may undergo a gait  
20 analysis, which sometimes increases how much some runners trust salespeople expertise (Walton  
21 & French, 2016), and other times is seen as a sales tactic and gimmick (Ramsey et al., 2022). A  
22 gait analysis conducted in specialty running stores typically involves running in front of a  
23 salesperson that attempts to determine individual running biomechanics and prescribe the

1 'perfect shoe' (Gibson, 2012). It is also common practice to assess foot shape and prescribe a  
2 shoe on that basis (Knapik et al., 2009) despite the lack of an injury preventative effect.

3 Comfort is consistently prioritised during running shoe selection (Fife et al., 2023) and  
4 can be influenced by a myriad of factors including shoe construction and individual anatomy  
5 (Menz & Bonanno, 2021). Comfort is also manipulable. For example, runners rated footwear  
6 comfort differently for identical shoes based on product descriptions regarding price, market  
7 availability, and comfort (Chan et al., 2020). Thus, it seems plausible that salespeople making  
8 individualised shoe recommendations based on gait analysis can influence runners' perceived  
9 comfort.

10 To our knowledge, no study has tested how recommending a shoe based on gait analysis  
11 influences runners' footwear perceptions. Therefore, we aimed to determine the influence of  
12 expert recommendation based on gait analysis on perceptions of subjective comfort,  
13 performance, and injury prevention in runners. We hypothesised that runners would score and  
14 rank gait-matched shoes more favourably than basic shoes.

## 15 **Materials and methods**

### 16 **Sample size**

17 A sample size of 15 participants was calculated in G\*Power 3.1.9.7 a priori based on  
18 achieving a power of  $\beta = 0.80$  with an  $\alpha = 0.05$  to detect a moderate difference (Cohen's  $d =$   
19  $0.70$ , one-tail) between two dependent means. This calculation was based on the moderate  
20 difference detected in comfort scores from a study of similar design (Chan et al., 2020). To  
21 account for potential data collection issues, data from 21 participants were collected.

## 1 **Participants**

2 Participants were recruited in May 2023 through online advertisements within the  
3 running community and posters placed on the University of Waikato campus and in local running  
4 stores in the Bay of Plenty, New Zealand. Eligibility requirements included: (1) women aged 18  
5 years and older; and (2) running a minimum of once per week for at least one month. Potential  
6 participants were excluded if they were injured within the last month based on a consensus  
7 definition (Yamato et al., 2015). The Human Research Ethics Committee of the University of  
8 Waikato (HREC(HECS)2023#11) approved the trial, which was registered on the Australian  
9 New Zealand Clinical Trials Registry (ACTRN12623000516684). Participants received an  
10 information sheet detailing the participation requirements, benefits, and risks, and signed an  
11 informed consent document prior to participating.

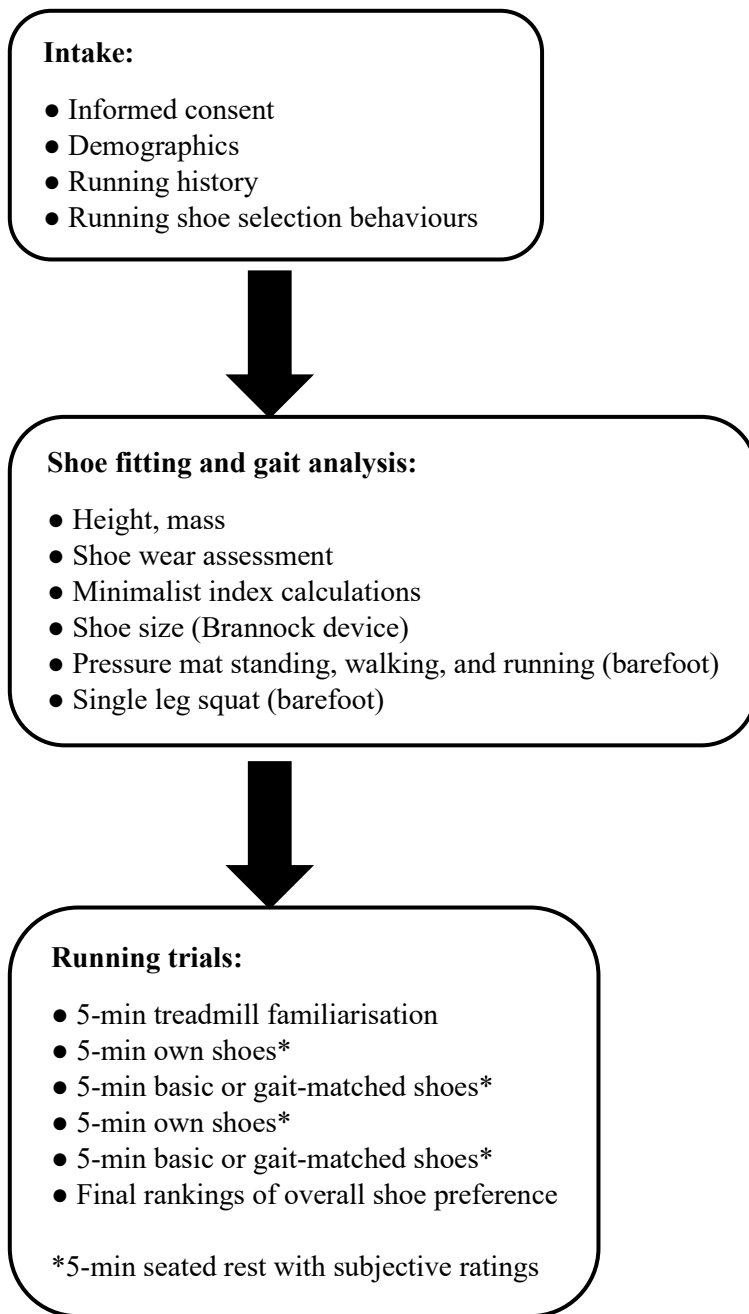
## 12 **Trial design**

13 A single-blind crossover randomised control trial was conducted (Figure 7). Evaluations  
14 were performed during a single 90-minute session and included three stages: intake, running  
15 shoe fitting with gait analysis, and running (Figure 8). During running trials, participants ran in  
16 their own shoes (OS) and two experimental shoes: 'basic' or 'gait-matched' shoes. Both  
17 experimental shoes were Brooks Anthem 5 (WA, USA) available in two colours (black and blue)  
18 and three sizes (US 7.5, 8.5, 9.5 Women). Participants were led to believe gait-matched shoes  
19 were prescribed to them based on the shoe fitting and gait analysis process, matching their foot  
20 shape and running style. The following standardised descriptions of both experimental shoes  
21 were verbally provided to runners immediately before running with them:

1           Basic: “This shoe model is quite basic. It is a generic shoe that doesn’t necessarily match  
2           your foot shape or running style. Basically, it can be used for distance running, but it is  
3           not specifically suited to you.”

4           Matched by running style: “Based on all the tests we did and the six pairs of shoes  
5           we have in the lab, this pair is the best option for you to maximise your comfort. Since  
6           this shoe matches your foot shape and running style, it will be extra comfortable when  
7           you run. We know from research that when a shoe is super comfortable and matches your  
8           body and running style, it usually leads to better performance and lower injury risk.”

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Figure 8. Flow diagram of the experimental design and study flow.

## 1 **Outcomes**

2 Primary outcomes included the running shoe comfort assessment tool (RUN-CAT)  
3 (Bishop et al., 2020) and subjective perceptions of comfort, performance, and injury reduction  
4 using 100 mm visual analogue scales (VAS). Secondary outcomes included other subjective  
5 perceptions (i.e., how much the shoe matches individual running style, running difficulty, and  
6 running pleasure) using 100 mm VAS (Matthias et al., 2021), overall shoe rankings, and  
7 biomechanical measures (i.e, flight time, contact time, cadence, duty factor, foot strike angle, and  
8 resultant acceleration of the tibia).

## 9 **Experimental protocol**

### 10 **Intake**

11 Before experimentation, data on demographics and running history were collected using  
12 an intake survey. A wall-mounted tape measure and Wedderburn WM202 scale (NSW, Australia)  
13 were used to record body height and mass of participants barefoot to the nearest 0.1 cm and 0.1  
14 kg, respectively. As part of the intake survey, runners ranked their personal running motivations  
15 from most to least important using a list adapted from the motivation of marathon scale (MOMS)  
16 (Ogles & Masters, 2003; Zach et al., 2017). Runners also ranked their running footwear priorities  
17 (i.e., comfort, injury reduction, and performance). Runners reported their sources of advice  
18 regarding running footwear and factors that influenced running shoe selection and ranked them  
19 in order of importance. Runners also reported their typical running shoe purchase locations.

### 20 **Shoe fitting with gait analysis**

21 The primary investigator (AF) conducted the shoe fitting and gait analysis for all  
22 participants to replicate practices commonly found in specialty running shoe stores (Gibson,

1 2012). This investigator had spent an extensive period in various speciality running stores  
2 observing and interacting with footwear salespeople prior to this study. The investigator also had  
3 prior experience working in sports stores as a retail consultant.

4 The shoe fitting began with AF assessing the wear and minimalist index (Esculier et al.,  
5 2015) of runners' own shoes. A Brannock device (NY, USA) was then used to measure foot size  
6 and match runners with the closest available lab-provided shoe size.

7 The gait analysis began using an AmCube pressure plate (ZA des Moulins, France) to  
8 examine runners' foot shape barefoot in standing and pressure distribution during walking and  
9 running barefoot. Following the pressure mat activities, runners performed a single-leg squat  
10 barefoot on each leg while the primary investigator watched their lower limb kinematics.  
11 Throughout these activities, no data were formally collected as the process was only performed  
12 to simulate in-store experiences and increase credibility in the gait-matched recommendations.

### 13 **Running trials**

14 Following the gait analysis, runners put their own shoes on and were instrumented with  
15 Blue Trident V2 inertial measurement unit (IMU) sensors (Vicon, Oxford, UK) on each ankle  
16 above the medial malleolus (Johnson et al., 2021; Johnson et al., 2020). All running trials were  
17 completed on a motorised treadmill (Steelflex PT10 Fitness; Steelflex Fitness, Taipei, Taiwan,  
18 China). A tablet with a high-definition camera (Apple Inc., USA) was placed 1.5 meters from the  
19 treadmill to record sagittal plane foot strike angles of the left leg in each footwear condition at  
20 240 Hz. A one-meter Optojump Next (Microgate, Bolzano, Italy) modular system with infrared  
21 light sensors was placed parallel to the treadmill and used to record spatiotemporal parameters at  
22 1000 Hz.

1           In total, four running trials were completed after an initial five minutes of running in their  
2 own shoes for familiarisation (Huang et al., 2022). During familiarisation, runners were  
3 instructed to run at a self-selected pace that they could comfortably sustain for 20 minutes  
4 (Arnold et al., 2019). The primary investigator slowly increased treadmill speed upon verbal  
5 consent from runners until the desired speed was obtained (Chan et al., 2020). The final minute  
6 of the familiarisation period was used to confirm the self-selected pace that would be used for all  
7 subsequent running trials. Throughout this process and running trials, treadmill speed was  
8 blinded to participants. Runners completed the first five-minute running trial in their own shoes  
9 immediately following familiarisation (i.e., no rest). Runners used their own shoes during the  
10 first and third running trials to act as a control and measure intra-session reliability of measures.  
11 The second and fourth running trials were randomised as either the ‘basic’ or ‘gait-matched’  
12 shoes. Experimental shoe order and colour were allocated using a random number generator.  
13 Biomechanical data (Optojump, IMU, and foot strike data) were collected for 30 s from the  
14 fourth minute of each trial. Runners rested five minutes between trials seated with footwear  
15 removed and all shoes out of sight. During this time, runners completed surveys via the XM  
16 Qualtrics software ([www.qualtrics.com](http://www.qualtrics.com)) on subjective footwear perceptions.

17           The surveys taken after each run examined subjective footwear perceptions relating to  
18 overall comfort, performance, and injury reduction, as well as how much the shoe matches  
19 individual running style, running difficulty, and running pleasure using 100 mm VAS (Hébert-  
20 Losier et al., 2024). The VAS included anchors like ‘much worse (0), neutral/uncertain (50), and  
21 much improved (100)’ – compared with runners’ own shoes – that were colour-coded across  
22 questions for congruence. Additionally, RUN-CAT was calculated based on VAS ratings of heel  
23 cushioning, forefoot cushioning, forefoot flexibility, and overall stability (Bishop et al., 2020),

1 with Goldilocks anchors like ‘heel not cushioned enough (0), ideal (50), heel cushioned too  
2 much (100)’ that were also colour-coded. Scores were converted to a final RUN-CAT score  
3 where 0 represents least ideal and 100 represents most ideal following validated and reliable  
4 methods (Bishop et al., 2020). After the last running trial, runners completed a final survey  
5 ranking their own, gait-matched, and basic in order of based on overall preference, best-matched  
6 to individual running style, performance, injury reduction, and comfort. All survey questions are  
7 provided in Supplementary Material. Participant blinding was assessed at the end of the  
8 laboratory session.

## 9 **Data processing**

10 The one-meter Optojump data were averaged across each 30-second running trial to  
11 increase representativeness of the running gait of participants (80-85 steps per trial) (Bonnaerens  
12 et al., 2021; Hébert-Losier et al., 2024). Duty factor was determined using Optojump data and  
13 the following calculations (Hébert-Losier et al., 2024):  $DF = \frac{SF \times t_c}{2} \times 100\%$ , where SF is stride  
14 frequency and  $t_c$  is contact time. Raw IMU data were filtered using a 100 Hz low-pass  
15 bidirectional 4<sup>th</sup> order Butterworth filter (Johnson et al., 2020) applied using Visual 3D  
16 V2023.01.4. Resultant tibial acceleration was calculated as  $\sqrt{x^2 + y^2 + z^2}$ . Foot strike angle was  
17 measured using Onform (CO, USA) video analysis software and foot strike pattern was visually  
18 interpreted. One foot strike from the middle of the 30 s video with a clearly defined ground  
19 contact in the middle portion of the screen was analysed.

## 20 **Statistical analysis**

21 Survey data were imported into Microsoft® Excel® (V 2302 Build 16.0.16130.20298)  
22 and analysed by shoe condition (own, basic, gait-matched) using IBM SPSS Statistics [version

1 29.0.0.0 (241)] software. Means with standard deviations and counts with percent values were  
2 used to describe the data. Reliability was assessed using subjective VAS scores and  
3 biomechanical data from runners' first and second trial using their own shoes. Intraclass  
4 correlation coefficient ( $ICC_{3,k}$ ) estimates and their 95% confidence intervals [lower, upper] were  
5 calculated using SPSS based on a mean rating, absolute-agreement, 2-way mixed-effects models  
6 and interpreted using values  $<0.50$  as poor,  $0.50-0.75$  as moderate,  $0.75-0.90$  as good, and  $>0.90$   
7 as excellent reliability (Koo & Li, 2016). The standard error of measurements (SEM) and  
8 coefficient of variation (CV) were calculated within Excel as follows,  $SEM = SD\sqrt{1 - ICC}$ , and  
9  $CV = \frac{SEM}{\text{Mean (all data)}} \times 100\%$ , and deemed acceptable when  $CV < 10\%$  (Atkinson & Nevill,  
10 1998).

11 To examine between shoe differences, one-way ANOVA with repeated measures were  
12 conducted on subjective and biomechanical measures. Both trials of runners' own shoes were  
13 averaged and compared to basic shoes and gait-matched shoes, for a total of three shoe  
14 comparisons. In presence of a main effect of shoe, post-hoc Bonferroni-adjusted pairwise  
15 comparisons were performed. Mean differences between shoe conditions were calculated with  
16 their 95% confidence intervals. Effect sizes were reported using partial eta squared with  $\eta_p^2$  0.01  
17 considered small,  $\eta_p^2$  0.06 considered medium, and  $\eta_p^2$  0.14 considered large (Fritz et al., 2012).  
18 Independent t-tests were used to compare the minimalist index of participants' own shoes to the  
19 experimental shoes. In all analyses, p-values  $< 0.05$  were considered statistically significant.

# 1 Results

## 2 Descriptive data

3 Most runners had over three years of running experience and an average self-reported 5-  
4 km race time of  $25:30 \pm 4:42$  minutes (see Table 14). Nearly all runners ( $n = 19$ , 90.5%) exhibited  
5 a rearfoot foot strike pattern using their own shoes. The minimalist index of participants' own  
6 shoes ( $31.6 \pm 11.2$ ) did not significantly differ from the experimental shoes ( $28.0 \pm 0.0$ ,  $p =$   
7  $0.156$ ) The average treadmill running speed was  $8.6 \pm 1.5$  km/h (6.1 to 11.3 km/h) (see Table 15).

8

9 Table 14. Summary of participant characteristics and running experience. Data are mean (SD) or counts.

	n = 21
Gender, n (%)	
Woman	21 (100.0)
Man	0 (0.0)
Other	0 (0.0)
Ethnicity, n (%)	
New Zealand European	17 (81.0)
European	2 (9.5)
Asian	1 (4.8)
Māori	1 (4.8)
South African	1 (4.8)
Age (years), mean (SD)	42.9 (7.5)
Running history, n (%)	
Between 0-3 years	3 (14.3)
More than 3 years	18 (85.7)

Combined years, mean (SD) 12.3 (9.1)

Race competitively, n (%) 7 (33.3)

5 km race time, mean (SD) 25:30 (4:42)

Weekly sessions, mean (SD) 3.4 (1.4)

Weekly distance (km), mean (SD) 46.1 (26.9)

1 Note. SD, standard deviation.

2

3 Table 15. Foot strike pattern, footwear characteristics of runners, and treadmill speed. Data are mean (SD)  
4 or counts.

---

	n = 21
Foot-strike pattern, n (%)	
Rearfoot	19 (90.5)
Midfoot	1 (4.8)
Forefoot	1 (4.8)
Minimalist index (%), mean (SD)	
Experimental shoes	28.0 (0.0)
Own shoes	31.6 (11.2)
Shoe size, n (%)	
US 7.5	10 (47.6)
US 8.5	7 (33.3)
US 9.5	4 (19.0)
Treadmill speed (km/h), mean (SD)	8.6 (1.5)

5 Note. SD, standard deviation.

6

1           A summary of running shoe selection behaviours of participants is presented in Tables 15-  
2 16. When choosing running shoes, runners most frequently prioritised comfort (23.8%), gait  
3 analysis findings (19.0%), and shoe specifications and technologies (19.0%) (Figure 9a). To  
4 inform their shoe selection, runners most frequently prioritised advice from running shoe stores  
5 in-person (42.9%), friends (19.0%), and coaches (14.3%, Figure 9b). Primary motivations for  
6 running included enjoyment (38.1%), general health (28.6%), and team affiliation (14.3%, Figure  
7 10a). Regarding footwear design, injury reduction (52.4%) was most important to runners,  
8 followed by comfort (38.1%) and performance (9.5%, Figure 10b). Runners most often  
9 purchased their shoes in specialty running stores (47.6%, Figure 11).

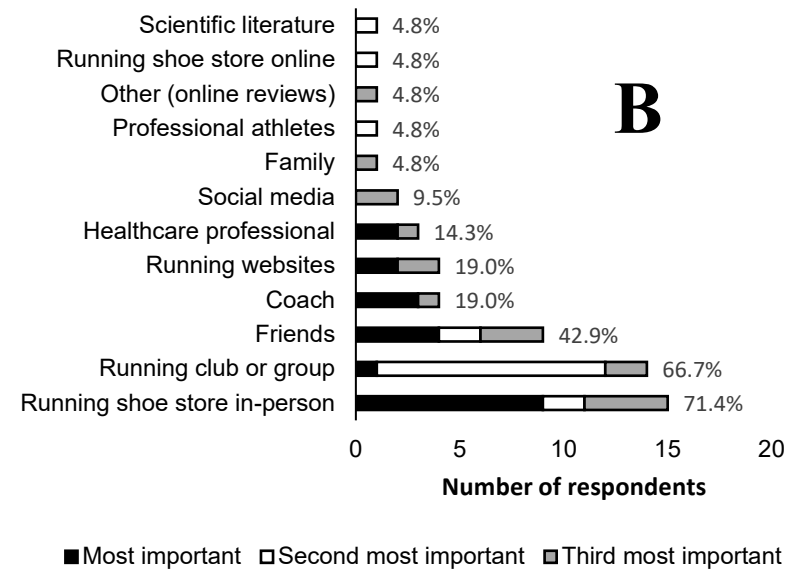
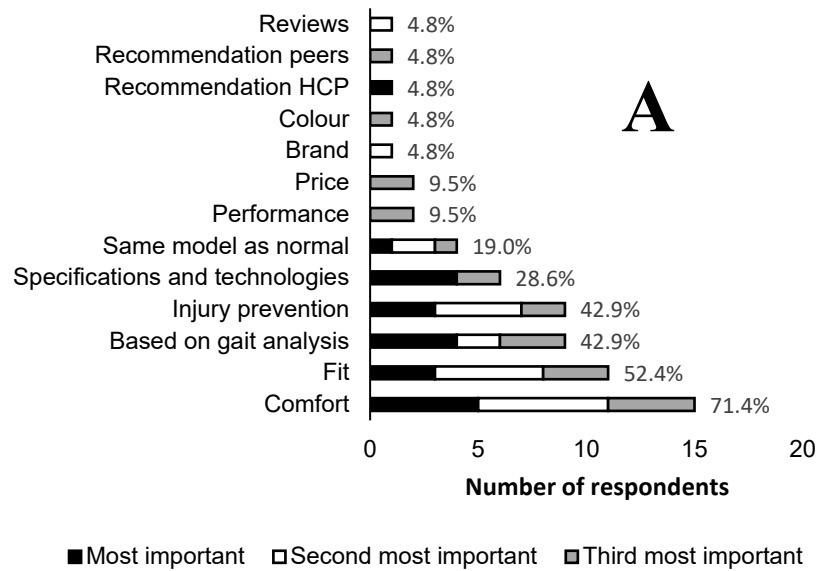


Figure 9. (A) Main criteria that influenced shoe selection (B) main sources of footwear recommendations (n = 21). Participants selected and ranked factors and sources of advice in order of importance. Percentages represent the number of runners that ranked a specific factor in their top three criteria. HCP, healthcare provider.

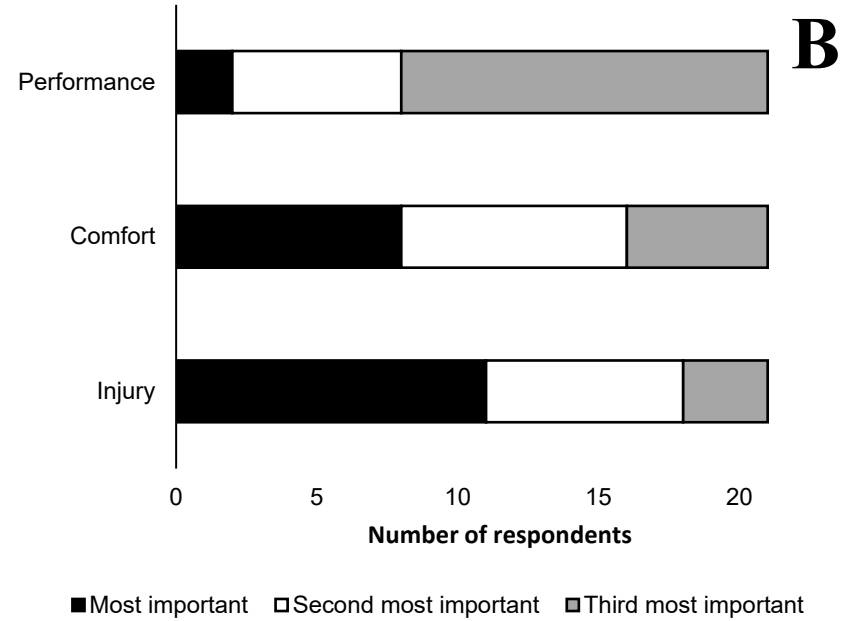
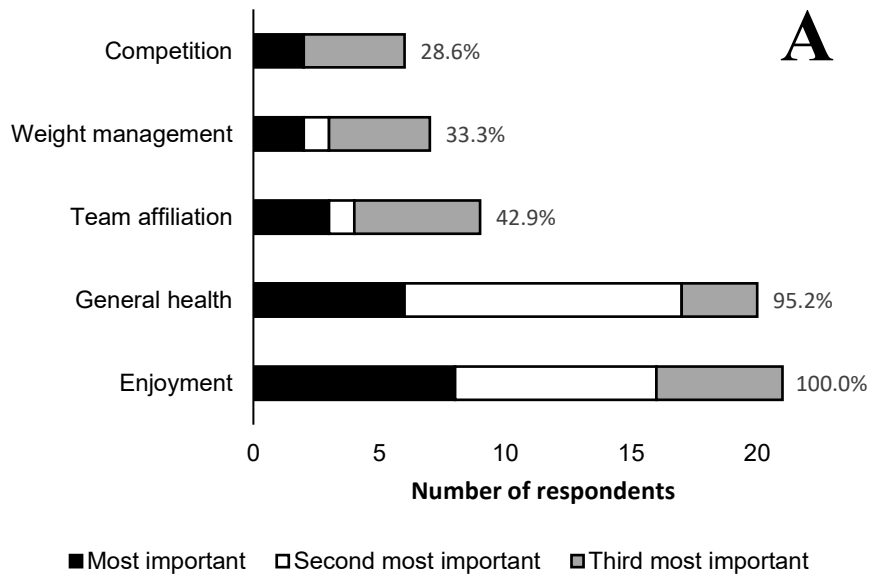


Figure 10. (A) Main motivation for participation in running as a sport, (B) relative importance of shoe design priorities (n = 21). Participants ranked motivations (Zach et al., 2017) and shoe design priorities in order of importance.

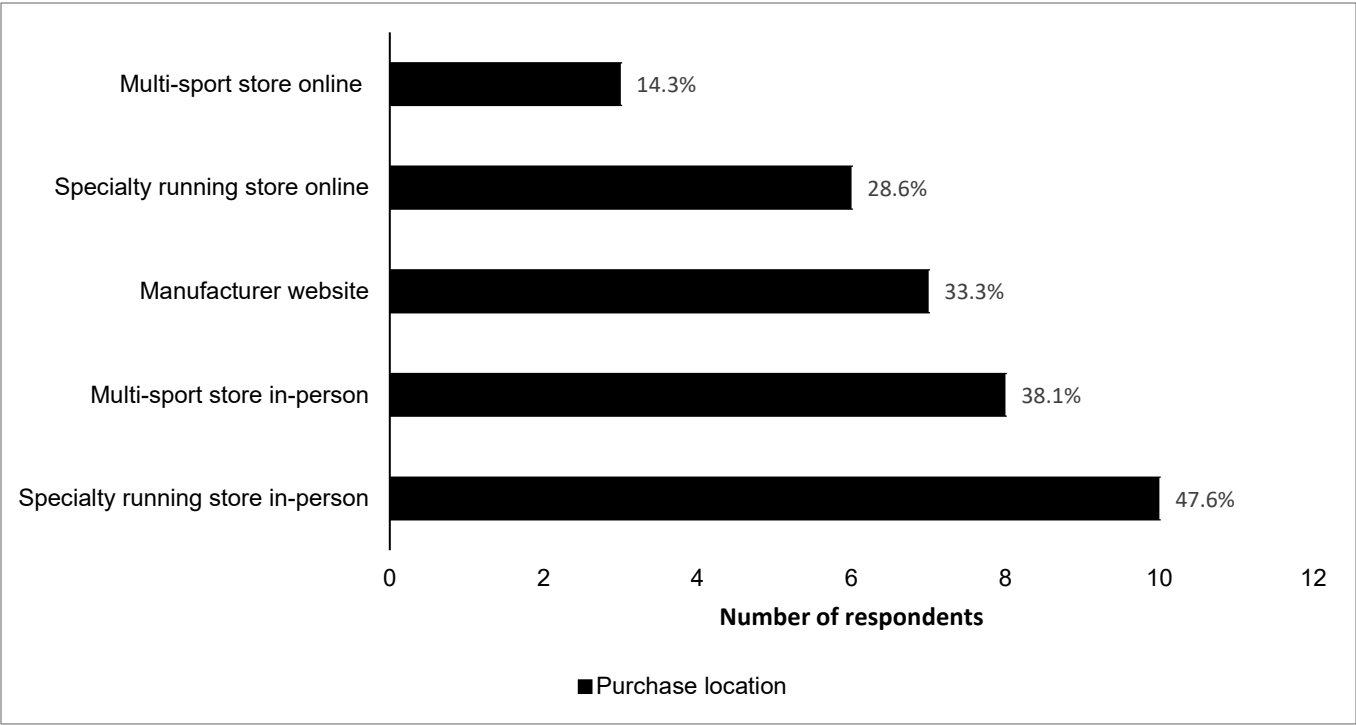


Figure 11. Runners identified locations from which they typically purchased their running shoe. Percentages are based on n = 21, although participants were able to select more than one option.

## Reliability

Of the subjective measures collected, VAS scores for RUN-CAT, performance, injury reduction, how much the shoe matches individual running style, and running pleasure demonstrated good reliability (Table 16). Overall comfort and perceived running difficulty demonstrated moderate reliability. Most subjective measures exhibited acceptable errors ( $CV \leq 9.8\%$ ,  $SEM \leq 7.2$  mm), with higher errors for injury risk reduction and difficulty ( $CV$  15.4 to 17%,  $SEM = 11.0$  mm). All biomechanical measures showed excellent reliability and acceptable levels of errors ( $CV \leq 9.2\%$ ), except for resultant tibial acceleration where reliability was good ( $ICC = 0.824$ ,  $CV$  11.5%).

Table 16. Reliability of subjective perceptions and spatiotemporal running data. Data are mean (SD) or estimates with 95% confidence intervals [lower, upper].

Item	Own shoes 1 mean (SD)	Own shoes 2 mean (SD)	$\Delta$ mean mean (SD)	ICC [95% CI]	SEM [95% CI]	CV (%) [95% CI]
Subjective VAS scores (100 mm scale)						
RUN-CAT	82.7 (14.3)	79.9 (16.7)	2.8 (0.2)	0.877 [0.696, 0.951]	5.4 [3.4, 8.5]	6.9 [4.4, 10.9]
Overall comfort	85.9 (7.3)	81.7 (11.1)	4.2 (8.5)	0.700, [0.273, 0.877]	5.2 [3.3, 8.1]	6.2 [4.0, 9.6]
Performance	67.6 (15.4)	64.7 (18.3)	2.9 (11.8)	0.861 [0.663, 0.943]	6.3 [4.0, 9.7]	9.5 [6.1, 14.7]
Injury risk reduction	64.1 (19.6)	65.0 (24.4)	-0.9 (20.2)	0.747 [0.366, 0.898]	11.0 [7.0, 17.4]	17.0 [10.8, 26.9]
Matches running style	72.1 (17.3)	75.0 (17.5)	-2.8 (13.4)	0.826 [0.577, 0.929]	7.2 [4.6, 11.2]	9.8 [6.3, 15.3]
Difficulty	70.6 (18.7)	71.5 (17.5)	-0.9 (19.1)	0.624 [0.050, 0.849]	11.0 [6.9, 17.4]	15.4 [9.8, 24.5]
Pleasure	85.1 (10.5)	81.4 (12.7)	3.7 (8.2)	0.842 [0.599, 0.937]	4.6 [2.9, 7.4]	5.6 [3.5, 8.9]
Biomechanical measures						
Flight time (ms)	56.0 (22.9)	53.3 (23.9)	2.6 (9.3)	0.954 [0.885, 0.981]	5.0 [3.2, 8.0]	9.2 [8.9, 14.6]
Contact time (ms)	314.5 (36.1)	317.0 (37.6)	-2.5 (9.6)	0.982 [0.955, 0.992]	4.9 [3.3, 7.8]	1.6 [1.0, 2.5]
Cadence (steps/min)	166.0 (9.5)	165.0 (9.1)	0.0 (1.7)	0.991 [0.978, 0.997]	0.9 [0.5, 1.4]	0.5 [0.3, 0.8]
Duty factor (%)	0.4 (0.0)	0.4 (0.0)	0.0 (0.0)	0.962 [0.909, 0.985]	0.0 [0.0, 0.0]	1.6 [1.0, 2.4]
Foot strike angle (°)	10.4 (7.8)	10.5 (7.7)	-0.1 (2.1)	0.982 [0.955, 0.993]	1.0 [0.6, 1.6]	8.3 [5.2, 13.1]
Tibial resultant acceleration (g)	9.0 (2.3)	8.9 (2.3)	0.1 (0.7)	0.824 [0.541, 0.933]	1.0 [0.6, 1.7]	11.5 [7.1, 18.5]

Note. Means with standard deviations are given for both trials using runners' own shoes, as well as the between trial mean difference ( $\Delta$ mean). Intra-class correlation coefficients (ICC) with their 95% confidence intervals (CI) (lower, upper), standard error of measurement (SEM), and coefficient of variation (CV) are also provided. SD, standard deviation. RUN-CAT, the running shoe comfort assessment tool. VAS, visual analogue scale.

## Subjective measures

There was a significant ( $p \leq 0.001$ ) and large ( $\eta_p^2$  0.362 to 0.565) main effect of shoe on all subjective perception measures (Table 17). Post-hoc testing identified runners were overall more comfortable and found running more pleasant in their own shoes followed by the gait-matched shoes, and rated basic shoes the lowest. There were no significant differences in the remaining subjective measures (i.e., performance, injury reduction, match to running style, and difficulty) between own and gait-matched shoes, with significantly lower scores for the basic shoes.

Table 17. Summary of subjective perceptions and biomechanical measures and between shoe differences. Data are mean (SD) or mean differences with 95% confidence intervals [lower, upper].

	Mean (SD)	p value, $\eta_p^2$
Subjective VAS scores (100 mm scale)		
RUN-CAT (mm)		
	n = 20	
OS	81.3 (14.7)	Shoe $<0.001^a$ , $\eta_p^2 = 0.371^1$
N <sub>b</sub>	61.2 (18.3)	OS-N <sub>b</sub> 0.005 <sup>b</sup>
N <sub>m</sub>	76.9 (14.7)	OS-N <sub>m</sub> 0.800
$\Delta$ [95% CI]		N <sub>b</sub> -N <sub>m</sub> 0.002 <sup>d</sup>
N <sub>b</sub> -OS	-20.0 [-34.4, -5.7]	
N <sub>m</sub> -OS	-4.4 [-14.6, 5.7]	
N <sub>b</sub> -N <sub>m</sub>	-15.6 [-25.5, -5.7]	

Overall comfort (mm)	n = 21	
OS	83.8 (8.3)	Shoe <0.001 <sup>a</sup> , $\eta_p^2 = 0.530^1$
N <sub>b</sub>	49.0 (24.1)	OS-N <sub>b</sub> <0.001 <sup>b</sup>
N <sub>m</sub>	66.1 (21.5)	OS-N <sub>m</sub> 0.003 <sup>c</sup>
$\Delta$ [95% CI]		N <sub>b</sub> -N <sub>m</sub> 0.024 <sup>d</sup>
N <sub>b</sub> -OS	-34.8 [-48.2, -21.4]	
N <sub>m</sub> -OS	-17.7 [-29.6, -5.8]	
N <sub>b</sub> -N <sub>m</sub>	-17.1 [-32.2, -2.0]	
Performance (mm)	n = 21	
OS	66.1 (15.9)	Shoe <0.001 <sup>a</sup> , $\eta_p^2 = 0.413^1$
N <sub>b</sub>	37.9 (21.0)	OS-N <sub>b</sub> <0.001 <sup>b</sup>
N <sub>m</sub>	55.0 (18.6)	OS-N <sub>m</sub> 0.148
$\Delta$ [95% CI]		N <sub>b</sub> -N <sub>m</sub> 0.003 <sup>d</sup>
N <sub>b</sub> -OS	-28.3 [-44.5, -12.1]	
N <sub>m</sub> -OS	-11.2 [-25.2, 2.8]	
N <sub>b</sub> -N <sub>m</sub>	-17.1 [-28.6, -5.6]	
Injury reduction (mm)	n = 21	
OS	64.6 (19.7)	Shoe <0.001 <sup>a</sup> , $\eta_p^2 = 0.362^1$
N <sub>b</sub>	34.5 (23.5)	OS-N <sub>b</sub> <0.004 <sup>b</sup>
N <sub>m</sub>	54.6 (20.5)	OS-N <sub>m</sub> 0.402
$\Delta$ [95% CI]		N <sub>b</sub> -N <sub>m</sub> <0.001 <sup>d</sup>
N <sub>b</sub> -OS	-30.1 [-51.2, -8.9]	
N <sub>m</sub> -OS	-10.0 [-26.7, 6.7]	
N <sub>b</sub> -N <sub>m</sub>	-20.1 [-31.1, -9.1]	
Matches running style (mm)	n = 21	
OS	73.6 (16.1)	Shoe <0.001 <sup>a</sup> , $\eta_p^2 = 0.551^1$
N <sub>b</sub>	37.0 (18.2)	OS-N <sub>b</sub> <0.001 <sup>b</sup>
N <sub>m</sub>	65.9 (19.4)	OS-N <sub>m</sub> 0.440

$\Delta$ [95% CI]		$N_b-N_m < 0.001^d$
$N_b-OS$	-36.6 [-53.2, -20.0]	
$N_m-OS$	-7.6 [-20.9, 5.6]	
$N_b-N_m$	-29.0 [-42.1, -15.8]	
<hr/>		
Difficulty (mm)	n = 21	
OS	71.0 (15.4)	Shoe 0.001 <sup>a</sup> , $\eta_p^2 = 0.394^1$
$N_b$	43.3 (18.9)	$OS-N_b < 0.001^b$
$N_m$	57.3 (19.2)	$OS-N_m 0.061$
$\Delta$ [95% CI]		$N_b-N_m 0.033^d$
$N_b-OS$	-27.7 [-42.9, -12.5]	
$N_m-OS$	-13.7 [-28.0, 0.5]	
$N_b-N_m$	-14.0 [-27.0, -0.9]	
<hr/>		
Pleasure (mm)	n = 21	
OS	82.3 (10.9)	Shoe 0.001 <sup>a</sup> , $\eta_p^2 = 0.565^1$
$N_b$	44.7 (20.7)	$OS-N_b 0.001^b$
$N_m$	65.8 (21.6)	$OS-N_m 0.009^c$
$\Delta$ [95% CI]		$N_b-N_m 0.004^d$
$N_b-OS$	-38.5 [-52.1, -25.0]	
$N_m-OS$	-17.4 [-31.0, -3.9]	
$N_b-N_m$	-21.1 [-35.9, -6.3]	

Biomechanical measures		
<hr/>		
Tibial resultant acceleration	n = 19	
(g)	9.0 (2.7)	Shoe 0.009 <sup>a</sup> , $\eta_p^2 = 0.232^1$
OS	9.8 (3.3)	OS-N <sub>b</sub> 0.052
N <sub>b</sub>	9.9 (3.3)	OS-N <sub>m</sub> 0.011 <sup>c</sup>
N <sub>m</sub>		N <sub>b</sub> -N <sub>m</sub> 1.000
$\Delta$ [95% CI]	-0.8, [-1.6, 0.0]	
N <sub>b</sub> -OS	-1.0 [-1.7, -0.2]	
N <sub>m</sub> -OS	-0.2 [-1.1, 0.7]	
N <sub>b</sub> -N <sub>m</sub>		
<hr/>		
Flight time (ms)	n = 20	
OS	52.0 (25.8)	Shoe 0.421, $\eta_p^2 = 0.042$
N <sub>b</sub>	50.0 (29.5)	
N <sub>m</sub>	49.7 (26.4)	
$\Delta$ [95% CI]		
N <sub>b</sub> -OS	-2.0 [-7.7, 3.6]	
N <sub>m</sub> -OS	-2.4 [-7.3, 2.6]	
N <sub>b</sub> -N <sub>m</sub>	0.3 [-4.0, 4.6]	
<hr/>		
Contact time (ms)	n = 21	
OS	315.7 (37.4)	Shoe 0.623, $\eta_p^2 = 0.023$
N <sub>b</sub>	315.3 (39.4)	
N <sub>m</sub>	317.1 (38.4)	
$\Delta$ [95% CI]		
N <sub>b</sub> -OS	-0.4 [-6.0, 5.2]	
N <sub>m</sub> -OS	1.4 [-4.0, 6.8]	
N <sub>b</sub> -N <sub>m</sub>	-1.8 [-5.6, 2.0]	
<hr/>		

Cadence (steps/min)	n = 20	
OS	165.0 (9.5)	Shoe 0.157, $\eta_p^2 = 0.093^m$
N <sub>b</sub>	165.9 (9.0)	
N <sub>m</sub>	165.4 (8.2)	
$\Delta$ [95% CI]		
N <sub>b</sub> -OS	0.9 [-0.2, 1.9]	
N <sub>m</sub> -OS	0.4 [-0.9, 1.6]	
N <sub>b</sub> -N <sub>m</sub>	0.5 [-0.7, 1.7]	
Duty factor (mm)	n = 21	
OS	0.4 (0.0)	Shoe 0.524, $\eta_p^2 = 0.032$
N <sub>b</sub>	0.4 (0.0)	
N <sub>m</sub>	0.4 (0.0)	
$\Delta$ [95% CI]		
N <sub>b</sub> -OS	0.0 [0.0, 0.0]	
N <sub>m</sub> -OS	0.0 [0.0, 0.0]	
N <sub>b</sub> -N <sub>m</sub>	0.0 [0.0, 0.0]	
Foot strike angle (°)	n = 21	
OS	10.5 (7.6)	Shoe <0.001 <sup>a</sup> , $\eta_p^2 = 0.356^l$
N <sub>b</sub>	12.6 (8.2)	OS-N <sub>b</sub> <0.001 <sup>b</sup>
N <sub>m</sub>	11.9 (9.1)	OS-N <sub>m</sub> 0.055
$\Delta$ [95% CI]		N <sub>b</sub> -N <sub>m</sub> 0.182
N <sub>b</sub> -OS	2.1 [0.9, 3.3]	
N <sub>m</sub> -OS	1.4 [0.0, 2.8]	
N <sub>b</sub> -N <sub>m</sub>	0.7 [-0.2, 1.7]	

Note. One-way ANOVA of included three shoe conditions: own shoes (OS), 'basic' shoes (N<sub>b</sub>), and shoes 'matched' to the runner (N<sub>m</sub>). Main effects were further explored in post-hoc testing. <sup>a</sup> indicates main effect of time, <sup>b</sup> indicates difference from old shoes to basic shoes (N<sub>b</sub>), <sup>c</sup> indicates difference from old shoes to 'matched' shoes (N<sub>m</sub>). <sup>d</sup> indicates difference from basic shoes to matched shoes. <sup>l</sup> and <sup>m</sup> indicate large and medium effect sizes respectively, based on common interpretation of partial eta squared ( $\eta_p^2$ ).  $\Delta$ , mean difference from baseline. CI, confidence intervals. RUN-CAT, the running shoe comfort assessment tool. SD, standard deviation. VAS, visual analogue scale.

### **Biomechanical measures**

There was a significant and large ( $\eta_p^2$  0.232 to 0.356) main effect of shoe on resultant tibial acceleration ( $p = 0.009$ ) and foot strike angle ( $p < 0.001$ ). Post-hoc testing identified that runners exhibited lower acceleration in their own shoes compared to the gait-matched condition, and lower foot strike angles using their own shoes than basic shoes. There were no other significant differences between shoes for biomechanical measures (Table 17).

### **Overall shoe preferences**

When ranking shoe preferences, runners consistently preferred their own shoes followed by the gait-matched shoes across all subjective categories (i.e., overall, comfort, performance, injury reduction, and matched to individual running style), while basic shoes were the least preferred (Figure 12). For overall shoe preference, fifteen (71.4%) runners preferred their own shoes, five (23.8%) the gait-matched shoes, and one (4.8%) the basic shoes. No participant indicated that they believed the experimental shoes to be identical when assessed for blinding effectiveness.

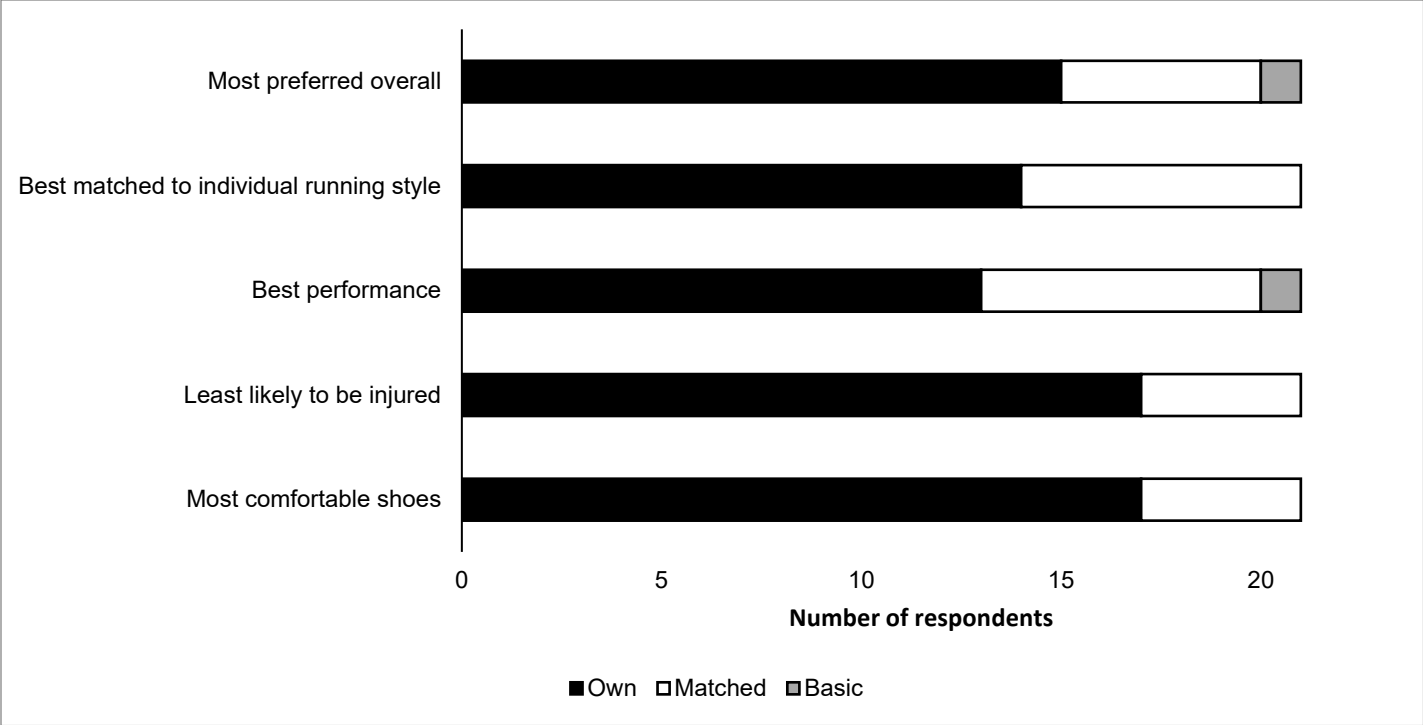


Figure 12. Head-to-head shoe rankings. Runners ranked their own shoes, the gait-matched shoes (Nm), and the basic shoes (Nb) against each other.

## Discussion

This is the first study that assessed how deceptive shoe descriptions influence subjective perceptions of comfort, performance, and injury reduction. Our hypothesis that runners would rate shoes matched to their gait more favourably than basic shoes was supported. Runners rated gait-matched shoes significantly higher than basic shoes in every subjective measure, and similarly to their own shoes in all measures except for overall comfort and running pleasure. Gait-matched shoes were consistently rated over 10 mm higher than basic shoes on VAS, indicating a clinically meaningful difference (Mills et al., 2010). Indeed, all VAS differences between the experimental shoes (range 14.0 to 29.0 mm) exceeded the SEM values (range 4.6 to 11.0 mm) we identified in our reliability analysis, with the largest difference being the VAS of how well the shoe matched an individual's running style.

The preference of our runners for the deceptively described gait-matched shoes over the basic shoes further support the idea that comfort can be influenced through psychological means. Previous research has demonstrated that participants informed about mass differences between basketball shoes jump higher and shuffle cut better compared to blinded counterparts (Lam et al., 2022). Furthermore, shoes from popular brands with favourable public images are preferred over generic counterparts (Hennig & Schulz, 2011). Even description of running shoes based on price, material, and market availability can influence perceived comfort (Chan et al., 2020). It appears that runners are highly trusting of salespeople and marketing.

The subjective preferences for the gait-matched shoes were not associated with significant changes in running biomechanics. While there was a statistically significant difference in resultant tibial acceleration between own and gait-matched shoes ( $p = 0.011$ ) and trend towards significance between own and basic shoes ( $p = 0.052$ ), this difference may have

been due to the significant (albeit only  $\leq 2.1^\circ$ ) changes in foot strike angles between shoes, indicative of larger rearfoot angles in the experimental shoes. Furthermore, the 1 g difference between shoes is equal to the 1 g SEM derived from our reliability analysis; hence, may not be clinically meaningful. Altogether, the lack of statistically significant and clinically meaningful differences in running biomechanics between gait-matched and basic shoes suggest that, similar to previous research (move Chan et al., 2020 here), subjective shoe preferences can be influenced without large differences in biomechanics (Chan et al., 2020).

Nearly a quarter of participants ranked the gait-matched shoes above their own, indicating that they were effectively persuaded by the recommendation provided using gait analysis and favourable product description. A novelty effect of the experimental shoes may have also been present, with the cushioning of runners' own shoes potentially degraded due to previous wear (Wang et al., 2010). While diminished shoe cushioning can be difficult to detect longitudinally (Cornwall & McPoil, 2017), novel shoes with fresh cushioning may be perceived as more comfortable when directly comparing between shoes (Pisciotta & Shorten, 2018). The gait-matched shoe was almost universally preferred to the basic shoe, supporting the VAS ratings for individual shoes, but both were ranked behind runners' own shoes. Runners sometimes demonstrate brand affinity and prefer to use familiar footwear (Ramsey et al., 2022), which may explain runners' preference for their own shoes. Previous research found moderate agreement between VAS ratings and a head-to-head preference simultaneously wearing different shoes on each foot (Kong et al., 2015). In our study, runners compared shoes at the end of testing, which may better simulate shoe selection in running stores (Gibson, 2012).

Runners in the present study identified that running shoe stores in-person, running clubs or groups, and friends were the most common sources of advice that informed their running shoe

selection. These sources of advice agree with previous research (Dhillon et al., 2020; Nguyen et al., 2022; Ramsey et al., 2022), with a preference for interpersonal interaction. Comfort was key to running shoe selection, consistent with past surveys (Dhillon et al., 2020) and current recommendations (Honert et al., 2020), despite being manipulable based on shoe description.

While comfort was the most influential factor when choosing shoes, runners ranked injury reduction as more important to footwear design. The importance of comfort and injury as priorities for runners is likely connected to the ideology of the ‘comfort filter,’ in which comfortable shoes are posited to reduce injury incidence (Nigg et al., 2015), despite little evidence supporting its effectiveness (Agresta et al., 2022). Participants’ motivation to run was primarily based on enjoyment and health, which may explain why runners want comfortable and safe shoes, rather than prioritising performance.

## **Limitations**

Some participants may have suspected that both shoes were the same without stating their honest thoughts in the surveys. However, this may reflect real-world practices in which runners may not want to disagree with salespeople. Furthermore, runners were not blinded to the branding of the experimental shoe conditions, which also may have influenced their perceptions based on brand image. Due to resource constraints, only three sizes of experimental shoes were available, and participants between shoe sizes used the closest available size, which may have affected comfort measures.

The reliability of subjective perception data between runners’ own shoe trials may have been influenced by an experimental condition occurring between trial one and trial. Data from the ‘own’ shoe conditions were averaged across both trials, and data missing from Accelerometer, Optojump, and VAS ratings reduced the number of data points available for

averages and final analysis from 21 to 20 or 19 participants. It is possible that missing Accelerometer data may have affected results, although it is unlikely that other outcomes were affected.

## **Conclusion**

Deceptive footwear descriptions based on a sham ‘clinical gait analysis’ affected perceptions of comfort, performance, and injury risk. Compared with shoes described as ‘basic,’ runners rated the same shoe described as ‘matched by running style’ as more comfortable, higher performing, and less likely to cause injury. In many cases runners rated the gait-matched shoe like their own shoes. Since it is apparent that subjective perceptions can be manipulated based on product description, we caution runners to consider the value of choosing shoes solely based on comfort. However, there is no clear indication that choosing shoes based on subjective perceptions is harmful, and may even create a positive running experience in the short-term.

## Chapter 7

### **General summary**

The purpose of this Thesis was to fill gaps in the academic literature and increase the understanding of the running shoe selection process, with a particular focus on runner's behaviours in specialty running stores and subjective perceptions of running footwear, like comfort. Firstly, a systematic review summarised existing research regarding factors that influenced road running shoe selection. Next, an observational study investigated runner behaviour in-store through paper-based surveys. A thematic analysis of interviewed salespeople addressed the runner-salesperson interaction and runner behaviour from the salesperson's perspective. An online intervention study explored the effects of an evidence-based educational video on running shoe selection, conscious behaviour, and subjective perceptions over time (e.g., comfort, satisfaction, and performance). Finally, a laboratory-based intervention study investigated the effects of shoe recommendation using deceptive product descriptions and gait analysis on subjective perceptions (e.g., comfort, performance, injury risk, and match to running style) and biomechanical measures (e.g., resultant acceleration of the tibia, flight time, and cadence).

This Thesis was comprised of studies with novel methodologies and results that add key information to the body of knowledge regarding running shoe selection. Chapters 3 and 4 described runner behaviour in specialty running shoe stores, which had not previously occurred in-situ. Furthermore, no study had previously thematically analysed how salespeople perceive runner behaviour (Chapter 4), despite salespeople being central to running shoe choice. Runners in Chapters 3 and 5 were assessed for conscious behaviour regarding decision-making processes,

underpinned by Unconscious Thought Theory in a multidisciplinary study design. Unconscious Thought Theory has not previously been examined in running footwear selection. Chapter 5 includes the first study to assess the influence of a novel evidence-based educational video on actual running shoe selection. While Chapter 6 shares some methodological similarities to previous work (Chan et al., 2020), it is the first study to emulate the in-store shoe selection process that many runners experience and report on its effect on subjective perceptions of runners.

## **Literature review (Chapter 2)**

To identify opportunities for knowledge translation and key areas of improvement, factors that influence the running shoe selection processes must first be understood. Therefore, a systematic literature review was conducted to summarise and critically evaluate research regarding the factors that influence road running shoe selection.

Forty factors that influenced shoe choice were identified across seven studies. Running shoe selection is influenced by a variety of factors that can be categorised as subjective (e.g., comfort, fit, injury reduction, performance), shoe-specific characteristic (e.g., cushioning, mass), market features (e.g., price, colour, style), peer evaluation (e.g., recommendations from peers), and runner characteristic (e.g., ethnicity, gender, previous use).

Chapter 2 identified some issues regarding running shoe selection research. Many of the 40 factors (62.5%) were only referenced a single time. Dhillon et al. (2020) captured some of the most important factors that influence running shoe selection through a large online survey, which was the most robust study included in the literature review. The other studies in the review insufficiently captured which factors are important to runners because their designs generally did not include a broad selection of influencing factors. Most of the studies included were not

designed to specifically address the breadth of possible influencing factors, but rather focused on a limited number of factors related to the individual study aims and design.

Furthermore, certain factors reported to influence road running shoe selection may appear to be more important than they really are if based purely on how frequently they presented in literature. For example, although market features such as price, colour, and style appear across several articles, runners in the other Chapters included in this Thesis did not prioritise them over subjective perceptions, such as comfort and fit. The runners in this Thesis generally reported the same influencing factors as found in the large online survey published by Dhillon et al. (2020), although with an increased focus on factors that were likely more evident and tangible in-store, such as fit and comfort. Conversely to the runners' responses, salespeople in Chapter 4 considered price and aesthetics to be quite important to runners, although typically as a reason not to buy a shoe rather than the driving force in selection.

The systematic literature review of Chapter 2 specifically identified there was a lack of in-store research and methodologies that directly addressed how runners make their shoe selection. The literature review was used to create a more comprehensive list of potential influencing factors that runners and salespeople could select and rank during subsequent study participation. The subsequent Chapters in this Thesis are foundational pieces of scientific literature that more comprehensively describe and explore the specialty running store experience.

### **Running shoe selection in-store (Chapters 3 and 4)**

None of the studies identified in the literature review (Chapter 2) were conducted in-store, which indicated the need for ecologically valid research to evaluate runner shoe selection processes in specialty stores. Previous research identified that running shoe stores are central to the shoe selection process (Dhillon et al., 2020). Therefore, exploring in the in-store selection

process from the perspectives of both runners and salespeople is perceived as useful to understanding the typical running shoe selection process. Chapter 3 investigated how runners choose running shoes in-store, while Chapter 4 investigated the in-store recommendation process from the perspective of shoe salespeople.

Runners that shopped at specialty running stores were similar in demographics and running experience regardless of whether they bought shoes or not on the day they were surveyed, whereas salespeople raced more and were younger than their customers. Differences in training and age between runners and salespeople may impact shoe recommendations based on salesperson bias, as experts in the footwear industry recommend different footwear priorities based on running level (Honert et al., 2020). There was a discrepancy between runners and salespeople regarding how much they perceived the salesperson influenced the running shoe selection of runners (Chapter 3). However, salespeople that accurately perceive their relationship with consumers are also more profitable according to prior research (Mullins et al., 2014). Runners rated the salesperson's influence on their selection as significantly lower than salespeople. These results suggest that runners and salespeople need to work together to overcome communication barriers, which could potentially improve shoe selection. Furthermore, involving clinicians and manufacturers in the conversation may further inform runners.

Runners considered multiple factors when buying new shoes, with an emphasis on tangible experiences that occur in-store, such as fit, comfort, and gait analysis. Runners also seek advice from running shoe salespeople, family, and friends, while salespeople get their information from peers. These results confirm that the salesperson is central to the in-store shoe selection process, despite having a lesser influence on the shoe selection of runners than they perceive. Runners go to specialty stores to try on shoes and find one that is comfortable and has a

good fit, and many runners appreciate the in-store expertise and gait analysis offered by salespeople.

The nexus of sport science and marketing makes running shoe research unique. Research aims to elucidate the validity of marketing claims and their influence on behaviour. Salespeople primarily advised by peers may not be exposed to current findings in scientific literature, but rather stuck in an echo-chamber of anecdote and in-house training (Wolthon et al., 2020), with manufacturers at the source of the information provided to salespeople. As a result, a salesperson's advice may be based more on marketing claims rather than critically evaluated and scientifically examined reasons. Runners do not always interact with the few salespeople that use scientific research to guide their recommendations (Dhillon et al., 2020). Therefore, the salesperson's advice and expertise or the tools used in speciality running stores, such as gait analysis, may not necessarily be beneficial to runners. However, it is unknown whether current practices are more harmful than alternatives. Runners should consider that the effects of alternative shoe prescription paradigms are also unknown, and therefore are not inherently better than current shoe recommendations (Napier & Willy, 2018).

Findings from the salespeople's interview data indicate that aspects of current shoe recommendation practices are not necessarily based on scientific evidence, but rather socially accepted practices. Wolthon et al. (2020) identified that salespeople can be both confident and wrong about the link between running shoes and injury; and therefore, it is essential to be able to shift salesperson's practices if needed. Thematic analysis of salespeople's interviews revealed two inter-connected themes; namely fostering runners-salespeople relationships and behaviours that drive business (Chapter 4). Salespeople approach runners making recommendations from a relatable standpoint and as experts with experience to guide shoe selection. In agreement with

the survey-based data from runners, most salespeople value gait analysis and use it as a tool to inform shoe prescription. Shoe recommendations from salespeople are based on finding the right shoe for runners to reduce running-related injury and maximise comfort.

Chapter 4 has not yet been published in a peer-reviewed scientific journal. Feedback from journals focused on sport and health psychology believed the paper belonged to sports science, and a qualitative sports science journal suggested it would be better suited to sports marketing. The relationship between multiple fields of study regarding running shoes and shoe selection indicates that a more holistic approach to the topic is necessary to make effective assessments and move the field forward. Prior to publication, Chapter 3 faced a similar criticism of being too marketing focus for publication consideration from a sports science journal. While these viewpoints are reasonable based on the salesperson population and the themes derived from the interviews, the methodology and writing were focused on selecting running shoes as sporting equipment and their implications on the health of the runner pertaining to injury prevention. Furthermore, the research explores the perceptions of salespeople and their interactions with runners, not aiming to find better marketing or manners to increase shoe sales. Despite the apparent value to manufacturers or businesses, the aim of the study was to explore how salespeople make their shoe recommendations and their perceptions of runners' behaviour in their stores, hence the target of journals in sport, health, and psychology over marketing.

The primary benefit of publishing a description of the in-store experience from both the runner and the salesperson perspective is to provide researchers and clinicians a common reference point and understanding of current practices. Chapter 3, which identified factors important to running shoe selection in-store from the runner's perspective, was also initially rejected for publication from a footwear-related journal with the same marketing concern. The

other half of the in-store experience is also crucial as there is a need to better understand the knowledge, beliefs, practices, and perceptions of salespeople to impact footwear prescription practices.

Since salespeople play a crucial role in advising and recommending shoes to runners (Dhillon et al., 2020; Fife et al., 2024), increasing salesperson knowledge and influencing their behaviours represent a key opportunity to improve the running shoe selection process. Chapter 4 solidifies the importance of the advisor-advisee relationship between salespeople and runners found in Chapter 3 and previous literature (Dhillon et al., 2020). Interviewed salespeople believed that they knew more than both runners and healthcare professionals about which shoes to choose. Runners generally trust salespeople over academic knowledge (Walton & French, 2016) and tend to trust the opinions of more experienced runners (Ramsey et al., 2022). As the salespeople in Chapter 4 typically raced more frequently than the runners they advise, the dual-role of salesperson-runner creates compelling credibility in their shoe recommendations as perceivably both a footwear and running expert.

Salespeople can also function as social enablers that introduce runners to the greater running community. The specialty running stores that participated in this Thesis advertised local races, hosted community group runs, and acted as rendezvous points for running groups. Salespeople in Chapter 4 worked to build relationships and trust with the runners they advise. The social connections offered by salespeople to runners may create a confounding effect in which runners follow shoe recommendations based on social parameters rather than solely on logical or evidence-based information.

Current shoe prescription practices involving either salespeople or healthcare professionals are potentially subject to groupthink, which can occur within healthcare

professional teams providing patient care (DiPierro et al., 2022). Applied to running shoe selection, the desire to achieve consensus between runner, salesperson, and/or other interested parties may lead to less effective outcomes. Regardless, salespeople present a key opportunity for systematic improvement in the shoe prescription process. Helping salespeople become aware of and implement current scientific frameworks may be more efficient than targeting runners directly based on the findings of previous literature and this Thesis.

## **Effects of an educational video on shoe selection and subjective perceptions**

### **(Chapter 5)**

The largest study included in the systematic literature review (Chapter 2) described an educational module designed to disseminate current literature to inform runners regarding the relationship between footwear and injury (Dhillon et al., 2020). Runners and healthcare professionals stated that the module would influence how they chose their next pair of shoes, however, no follow up study was conducted (Dhillon et al., 2020). Therefore, the double-blinded randomised controlled trial conducted in Chapter 5 of this Thesis used an educational video based on the original module, albeit with updated references and a narrated presentation. It sought to explore whether footwear selection was indeed influenced by an educational module, and how it influenced subjective perceptions of the selected footwear over time. There was a trend towards choosing shoes differently between the control group and intervention group, despite the intervention group perceiving they were influenced significantly more by the video than the control group when selecting their shoes (Chapter 5).

Subjective comfort and satisfaction did not differ between the intervention and control groups or over time. Both groups rated subjective performance in new shoes higher than their old shoes, although ratings returned to baseline after a month (Chapter 5). Shoe degradation does not

account for such rapid changes in construction, nor can runners easily identify changes in cushioning, so this effect appears to be psychological (Cornwall & McPoil, 2017). Other examples of potential psychological effects include lighter shoes increasing vertical jump height in basketball players only when aware of shoe mass differences (Mohr et al., 2016). Furthermore, running economy in marathon racing shoes may also be influenced by placebo (Hunter et al., 2019). The runners in Chapter 5 only reported subjective performance without any quantitative measures. So although it is unknown whether running performance actually increased, differences in subjective perceptions may have come from expectations of increased performance (Mohr et al., 2016) that diminished over time with further use of the novel footwear.

The results of this Thesis provide a foundation for the importance of focusing on salespeople, and specifically increasing their exposure to scientific evidence. The salespeople in this Thesis were primarily educated using in-store training programmes and relied on their peers for information. As a result, salespeople likely develop an inherent bias from manufacturer-based marketing materials designed to sell more shoes. As presenting education directly to runners did not significantly influence shoe choice and subjective perceptions, and the salesperson is central to running shoe choice in-store as determined in Chapters 3 and 4, focusing knowledge translation efforts on salespeople may be the optimal way to ultimately inform the runner. Targeting knowledge translation efforts on footwear advisors (e.g., salespeople, healthcare professionals, etc.) may reduce the spread of misinformation regarding the link between injury and running shoe prescription (Agrega et al., 2022; Malisoux & Theisen, 2020). Salespeople and clinicians that rely on scientific evidence can then share findings in an understandable manner with runners and empower runners to make informed decisions themselves. Shifting more

responsibility to runners during shoe selection once informed may lead to runners making more cautious and considered decisions.

Runners prioritised fit, comfort, and choosing a similar model to what they normally wear when choosing running shoes for the study; factors that agree with previous research (Dhillon et al., 2020) and highlight that runners seek familiarity when they trust a given product and are satisfied (Zaid, 2020). The educational video that the experimental group watched presented content that encouraged runners to consider more minimalist shoes (Esculier et al., 2015). Although the module was biased toward runners potentially choosing more minimalist shoes, many runners in Chapter 5 prioritised choosing a similar model to what they normally wear. Runners in Chapter 3 reported similar sentiments, and salespeople in Chapter 4 reported asking runners to identify shoes that have worked well in the past. Runners that find shoes that work well for them appear to stick with what they know (Ramsey et al., 2022), which further supports runners inclination for practical knowledge and lived experiences (Walton & French, 2016).

Chapter 5 further implemented aspects of Unconscious Thought Theory introduced in Chapter 3 by comparing post-choice satisfaction between runners categorised as conscious or unconscious (Dijksterhuis et al., 2006). Chapter 3 identified that there was no difference between buyers and non-buyers regarding conscious behaviour, which indicates that runners might be more conscious or unconscious in their shoe selection processes regardless of whether they make a purchase. Runners visiting stores to gather information may consciously or unconsciously process this information prior to selection. Running shoes in the present study were considered a complex product due to considerations of material, geometry, use, market features, and range of choices.

Unconscious decisions regarding complex products are tied to increased post-choice satisfaction (Dijksterhuis & Strick, 2016). Runners in Chapter 5 classified as unconscious reported significantly greater satisfaction with their new shoes over time than those classified as conscious, which agrees with the theory. Several factors moderate the unconscious thought effect, including the number of available products and complexity of the product (Strick et al., 2011), which runners consistently experience in specialty stores. If running shoe satisfaction is most important to runners, choosing shoes based on a gut feeling or ‘sleeping on it’ may be an ideal solution (Bos et al., 2011). As no current shoe recommendation strategy based on injury reduction appears to be based on scientific evidence, being satisfied with running shoes post-purchase may be a worthwhile aim.

## **Effects of shoe recommendation and gait analysis on subjective perceptions**

### **(Chapter 6)**

Although salespeople are central to the running shoe selection process, there is a disconnect between how runners and salespeople perceive the same interactions as described in previous Chapters. Since runners selected shoes in stores focus on subjective perceptions of fit and comfort, it may help runners to consider that their perceptions may be subject to manipulation. Runners and salespeople throughout the Thesis identified subjective factors, such as comfort, as important to shoe selection, which agrees with current recommendations (Honert et al., 2020) and prevailing ideologies that shoe comfort should guide selection (Nigg et al., 2015). However, researchers have recently acknowledged that more evidence is needed to determine the efficacy of choosing shoes based on comfort (Agresta et al., 2022; Nigg et al., 2023), and shown that subjective comfort of running footwear can be influenced experimentally

(Chan et al., 2020). Furthermore, as identified in Chapters 3 and 4, the salesperson is central to running shoe selection, and many runners value gait analysis available in speciality stores.

Runners believe that they make their decisions more independently, while salespeople think that they have a large influence on runners' shoe selections, which demonstrates inaccurate perceptions between the two groups (Mullins et al., 2014). Furthermore, salespeople believe that runners' shoe selection is influenced by more factors than runners report, and describe influencing factors that were not captured through runner surveys. For example, runners did not prioritise colour during shoe selection, but salespeople think that having the wrong colour is a strong deterrent to purchase (Chapter 4). It may also be the case that colour is not one of the most important factors to shoe selection itself, but a preference that still holds weight in the decision-making process (Ramsey et al., 2022).

Salespeople also described potential friction between runners, healthcare professionals, and specialty stores. While some salespeople described positive and mutually beneficial relationships with clinicians, others were frustrated when runners trusted healthcare professionals more than their recommendations (Chapter 4). On average, runners appear to seek advice from salespeople more frequently than healthcare professionals (Dhillon et al., 2020; Walton & French, 2016), although individuals may preferentially trust healthcare professionals, especially related to previous injury (Ramsey et al., 2022). Healthcare professionals do not necessarily have evidence-based beliefs (Wolthon et al., 2020), which may reduce the utility of their recommendations as well.

Chapter 6 replicated the typical in-store recommendation process using clinical gait analysis and product descriptions to manipulate subjective perceptions of runners using novel shoes and compare them to runners' own shoes. Shoe construction was identical between novel

shoes, but product descriptions differed. One shoe was described as ‘matched’ to their gait and running style, and the other shoe was described as ‘basic’. Subjective measures, including the composite comfort score (RUN-CAT), performance, and injury risk reduction ratings, were similar between runner’s own shoes and the gait-matched shoes, but gait-matched shoes were more ideal, higher performing, and perceived to reduce injury more than basic shoes.

Biomechanics remained similar across running conditions. Runners ranked their own shoes highest overall, but almost universally preferred the gait-matched shoes to the basic pair. The preference for runners’ own shoes is further supported by runners choosing shoes based on familiarity in Chapter 5. With regards to the two novel shoes, the results indicate that shoe descriptions combined with apparent expert recommendation can effectively influence subjective perceptions of running footwear, which agrees with previous research findings (Chan et al., 2020).

In Chapter 6, participants had the opportunity to identify whether they recognised the deception between the shoe models used in the laboratory-based study. No runner openly suggested that the shoes were the same, but this finding may be due to the setting of a one-on-one recorded interview after an hour-long session building the expert-runner relationship and self-censorship (Güner Gültekin, 2024). In a similar study design, only one of 18 runners noticed researchers had added mass to identical shoes (Hoogkamer et al., 2016), but it is possible that runners felt uncomfortable to honestly share their opinions.

Additionally, there is no alternative best practice to choosing shoes based solely on comfort, or evidence to suggest negative effects of comfort-based selection. The results from Chapter 6 suggest that runners may find expertly recommended shoes more comfortable simply because of the recommendation, although it is unknown how long acute changes in comfort may

last. Although there may be little evidence to support choosing shoes based solely on comfort (Agresta et al., 2022), runners in this Thesis often prioritised comfort in accordance to popular shoe selection ideologies focused on injury reduction (Nigg et al., 2015).

Despite a paucity of evidence regarding comfort and running-related injury reduction, researchers who are uncertain of best practices still recommend finding comfortable shoes (Malisoux & Theisen, 2020). Runners that find shoes more comfortable through manipulated means may still benefit from having an overall running positive experience, with no known negative acute or chronic effects (Chan et al., 2020). Prior research identified shoe inserts increased subjective comfort and running speed in runners without a significant effect on running-related injury incidence (Fortune et al., 2022), while rugby players using a tailored footwear programme (i.e., player education, footwear prescription, and footwear use rotation) were more comfortable and injured less frequently (Kinchington et al., 2011). In both these cases, there are many confounding factors that make it difficult to directly identify the role comfort plays in injury incidence.

Regardless of potential physical benefits of selecting the right shoe for runners, salespeople and runners must build relationships (Baumann & Le Meunier-FitzHugh, 2014) to reduce the opportunity of unmet expectations and associated negative outcomes (Curwen & Park, 2014). Additionally, acutely increased subjective comfort may influence footwear choice away from a selection that may be more beneficial to a runner. Acute comfort in women's general use footwear can diminish after the initial try-on period, which can lead to pain and negative emotions, such as self-doubt, anger, remorse, and disappointment (Curwen & Park, 2014). Thus, unmet expectations from changes in acute subjective perceptions (i.e., a reduction in artificially enhanced subjective perceptions) may have psychological and physical effects. The

potential for negative experiences may be higher in running shoes due to the performance and injury protective expectations runners place on their footwear.

Anecdotally, some stores offered bonuses or commissions to salespeople when they sold specific brands or models of shoes. Few salespeople in Chapter 3 reported that their footwear recommendation may be influenced by shoe commissions or bonuses offered from selling specific footwear. In the case where salespeople are financially incentivised, runners may be unknowingly guided towards the incentivised product based on a system that benefits salespeople over runner-centric approaches. Although salespeople may not feel their recommendations are influenced by commissions or bonuses, they may be unconsciously biased or unwilling to disclose their actual practices. Similarly, clinicians may be biased after receiving free footwear or other benefits from manufacturers (Dunn, 1980), and may not disclose their potential biases to runners when making shoe recommendations.

Despite potential for biases in salespeople or clinicians, it seems reasonable that experts generally try to make recommendations focused on individual running use and ability (Honert et al., 2020). The role and benefit of gait analyses in this process remains unclear for uninjured individuals. Salespeople in Chapter 4 were runners themselves and recognised their dual roles as experienced runners making recommendations while simultaneously focusing on making sales. Again, it is important to recognise that the role of running shoes is potentially overrated in relation to injury incidence (Malisoux & Theisen, 2020). There may not be an inherent long-term negative effect of any recommendation strategy, even one based primarily on incentivised product. However, many runners currently trust salespeople and believe them to be making evidence-based shoe recommendations (Ramsey et al., 2022; Walton & French, 2016). Runners that hold salespeople in this regard may feel frustrated or deceived if they discover that their shoe

recommendation was less individually tailored than they believed. Runners may be better served if they understand that current shoe prescription practices are currently based more on ‘art’ than ‘science’ (Richards et al., 2009).

The experiment in Chapter 6 occurred in New Zealand, where runners prioritised comfort, gait analysis, and shoe specifications/technologies when selecting shoes and sought advice preferentially from salespeople in-store, friends, and coaches. The factors and advice that influenced shoe selection in these runners related to their primary footwear design priorities where injury reduction was most important, followed by comfort and then performance. Runners appear to have as main goal of running without injury, which aligns with their primary motivations for participation (i.e., enjoyment, general health, and being part of a team).

Runners in Spain also run for enjoyment and health reasons in addition to fulfilling personal goals, competition, and being proud and confident (Parra-Camacho et al., 2019). Intuitively, running for sport is an ancient practice occurring within communities across time and geography. Considering the globalisation of running brands and the influence of international media, it is possible that many runners share common goals and participation despite potential cultural differences. Furthermore, runners and other athletes may have inherent similarities that draw them to participation with homogenous ideologies. However, differences in motivation do exist between different types of runners. Marathoners are driven by health, fitness, and social factors, while ultramarathons are motivated by self-esteem and personal discovery (Partyka & Waśkiewicz, 2024). Thus, although findings from Chapter 6 are likely generalisable across most recreational road runners, confounding factors may be present.

The influencing factors and sources of advice found in Chapter 6 performed in New Zealand generally agree with those from the other Chapters, noting that Chapters 3, 4, and 5

were all conducted in the United States. Given these similarities, the results within this Thesis are most likely generalisable across modern Westernised civilisations. Researchers using similar populations may develop research based on the findings of this Thesis, while others should account for potential differences between countries and cultures during running shoe selection. Cultural and economic differences may lead to different selection priorities and patterns. For example, it is possible that less affluent communities may prioritise price over comfort or fit. Brand loyalty derived from celebrity endorsement may become more important to runners than comfort or performance, especially in the region from which the star athlete is from. Furthermore, the running footwear company Brooks is local to the Seattle area, which was the studied USA region in this Thesis. After Hoka, Brooks was the second most popular brand purchased during the experiment in Chapter 5, which may be due in part to locality. Likewise, Nike may be a more popular brand of footwear in Oregon, USA, due to the presence of its headquarters. Researchers should consider potential confounding factors that may influence shoe selection outside of generic factors and further explore how social factors affect shoe choice.

## **Strengths**

The key strengths and limitations of each Chapter in this Thesis and of the overall Thesis are enumerated in Table 18. One of the overall strengths of the Thesis was the breadth of study designs implemented, which included a comprehensive systematic review (Chapter 2), an in-store observational cross-sectional study (Chapter 3), an in-store qualitative thematic analysis (Chapter 4), an online double-blind randomised controlled trial (Chapter 5), and a single-blind laboratory-based randomised controlled trial with repeated measures (Chapter 6). The studies comprising this Thesis have contributed to advancing knowledge in the field of running shoe selection through novel methodologies and incorporating ecologically valid settings.

Indeed, a strength of the included studies is based on the novelty of in-store research, which increases generalisability for specialty store shoe shoppers. The in-store survey of runners conducted in Chapter 3 and thematic analysis of salespeople in Chapter 4 contributed to a robust understanding of current running shoe selection behaviours, particularly given that the interaction between runners and salespeople has been relatively underexplored. Exploring the perceptions and motivations of salespeople recommending shoes to runners is foundational to identifying key opportunities for systematic improvement. For example, the difference between how much runners think salespeople influenced their running shoe choice and how much salespeople believed they influence shoe choice is indicative of a communication barrier between parties.

Furthermore, the use of an educational video to influence runner behaviour and subjective perceptions simulated knowledge translation and followed up on previous research (Dhillon et al., 2020). The development of tools used to educate the general running population, healthcare professionals, and salespeople should increase access to scientific knowledge and better inform shoe choice. The use of novel outcome measures addressing runner consciousness and satisfaction during their shoe selection processes brings a cross-disciplinary theory into footwear science. Implementing UTT into running research is preliminary to creating evidence-based recommendations regarding the conscious behaviour of shoe choice to improve decision quality and post-choice satisfaction. Furthermore, the using UTT creates a link between marketing, psychology, and sports science that needs further exploration and appreciation in science.

The recruitment of women for the laboratory-based experiment improved women representation in sports science research (Cowley et al., 2021; Langley et al., 2023; Martínez-

Rosales et al., 2021), and specifically running research. The methodologies used in this Thesis included in-person and online participation, as well as occurred across two countries, which allowed the opportunity to make comparisons as appropriate by method or country. The methodologies were based in part on filling gaps in the literature, and the literature review in Chapter 2 helped develop a robust list of factors influencing shoe selection. Subsequent studies benefitted by providing a more comprehensive selection of criteria for runners to identify than existed prior to this Thesis.

## **Limitations**

There were few consistent limitations throughout the Thesis, as each component approached the research question using different methodologies. Limitations include reduced sample sizes due to recruitment difficulty, resource constraints, and instrument data drop-out. One of the main limitations of the systematic review (Chapter 2) was the low number of included studies based on strict inclusion criteria. It is possible that a broader inclusion criterion may have led to a more robust understanding of factors that influenced running shoe selection generally. The systematic review was foundational to the development of the thesis structure (Figure 1) and excluded studies may have influenced research directions. Furthermore, few studies included in the review directly addressed the research question, representing a gap in the literature, but also limiting their inferential utility. Logistical difficulties derived from the international Covid-19 pandemic created challenges with study design and implementation. Due to travel restrictions in 2019, studies occurred earlier in the Thesis in the United States and later in the Thesis in New Zealand. Due to international relocation and time zone differences and resource constraints, the online RCT found in Chapter 5 had a reduced sample size. Only Chapter 6 was conducted in

New Zealand, which makes for a heterogenous demographic across the Thesis that should be considered when interpreting results, albeit indications of generalisability indicated above.

In Chapters 3 and 4, a survey of runners in specialty running stores identified typical shoe selection behaviours, while salespeople were interviewed regarding the shoe selection process. Data were collected during weekends and during a holiday season in the USA, which may have influenced any or all aspects of shoe selection or the salesperson-runner interaction. The primary investigator conducted all data collections, and was only present in one store a time, so the convenience sampling is limited to the store visited on those specific days. While all runners that visited running stores were invited to participate, many declined, and we do not know how they would have responded to surveys. Interviewed salespeople may have become aware of research content and may have adjusted their behaviour as a result. Although many stores participated, most salespeople and runners included in the research came from a limited number of stores.

In Chapter 5, recruitment difficulties and time constraints reduced the sample size from the original study design. The reduction in sample size may have reduced the ability to identify subtle yet meaningful differences in outcome measures. The evidence-based educational video was created specifically for the study, although it is unknown if other forms of media would have been more effective for knowledge translation and influencing behaviours.

Chapter 6 replicated the typical in-store running shoe selection process in which an expert uses clinical gait analysis and recommends a specific shoe to runners. In our study, running shoes were masked by colour only, and some runners may have suspected that experimental shoes were identical. While runners were assessed for blinding effectiveness, it is possible that they were unwilling to share their suspicions due to the relationship dynamic within

the research setting. Runners that suspected or accurately recognised the deception may have responded differently to surveys compared to truly blinded participants.

Table 18. Strengths and limitations of each Chapter and of the Thesis.

Thesis	Strengths	Limitations
<p style="text-align: center;">Chapter 2</p> <p>How do road runners select their shoes: A systematic review</p>	<ul style="list-style-type: none"> <li>• Comprehensive systematic review of factors that influence road running shoe selection.</li> <li>• Identified methodological opportunities for future research directly addressing shoe selection.</li> <li>• Adhered to the structure and reporting guidelines of PRISMA.</li> </ul>	<ul style="list-style-type: none"> <li>• Did not identify the relative importance of influencing factors.</li> <li>• Inclusion criteria of original research may have removed editorials or reviews describing other influencing factors.</li> </ul>
<p style="text-align: center;">Chapter 3</p> <p>Quantitative analysis of in-store runner behaviour during shoe selection</p>	<ul style="list-style-type: none"> <li>• In-person study design in specialty running stores increased ecological validity.</li> <li>• First study that assessed consciousness in runners.</li> <li>• Foundational study that addressed in-store running shoe selection processes including importance of gait analysis.</li> </ul>	<ul style="list-style-type: none"> <li>• Convenience sampling may reduce generalisability of results.</li> <li>• Differences in runner and salesperson interaction may have led to varied outcomes.</li> <li>• The cross-sectional study design precludes longitudinal understanding of changes in perceptions and behaviours.</li> </ul>

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## Chapter 4

Qualitative description of in-store salesperson perspective on shoe selection

- In-person study design captured nuanced details during interviews.
- Identified how salespeople and runners interact along with the salesperson's perspective of runner behaviour.
- Explored the motivations of salespeople in specialty running shoe stores from both personal and business perspectives.
- All the interviewed salespeople were runners, and salespeople without a running background may behave differently.
- Store-specific training influences salesperson patterns, making it difficult to generalise all findings.
- Structured interviews may have prevented narrowed participant perspectives too much.

Followed COREQ reporting guidelines.

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## Chapter 5

Double-blind RCT using educational video to influence running shoe selection, comfort, and satisfaction

- First randomised controlled trial that assesses the effects of education on runner shoe choice and subjective measures.
  - Tracked subjective shoe perceptions longitudinally over three months.
  - First study that assessed how consciousness influences satisfaction regarding running shoes and UTT.
  - Followed CONSORT reporting guidelines.
  - Subjective perceptions may not have fully captured how runners interacted with footwear and the educational video.
  - Educational video may not have been presented effectively enough to elicit behavioural change.
  - The reduced sample size may have led to less accurate results.
  - Blinding was not assessed due to an error in survey design.
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## Chapter 6

Running shoe recommendations based on gait analysis improve perceptions of comfort, performance, and injury risk: A single-blind randomised crossover trial

- First study that addressed the importance of gait analysis in shoe recommendation.
  - Effectively demonstrated that subjective perceptions can be manipulated.
  - Identified factors that influenced running shoe selection, sources of advice, and shoe design priorities for New Zealand runners.
  - All participants were female, which is a traditionally under-represented group in running research.
  - Runners may have suspected deception without being confident enough to voice their suspicions.
  - Reliability of experimental shoe conditions is unknown.
  - Limited resources meant that some runners had to use the closest available size when they did not match lab-provided shoes.
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## Overall Thesis

An investigation of factors that influence running footwear selection and subjective perceptions

- Comprised of a breadth of methodologies including a systematic review, quantitative survey, qualitative thematic analysis, online double-blind RCT, in-person single-blind RCT.
  - Diverse study designs examined the research question from different viewpoints.
  - Studies were conducted in the USA and NZ, which allowed for an international representation.
  - The Thesis focused on the specialty running store experience and runner behaviour in-person rather than retrospectively.
  - The Thesis included studies that sought to influence running shoe selection and subjective perceptions through novel means.
  - Each study built on previous study findings and current literature.
  - The Thesis focused on recreational runners rather than elite athletes, which made the results more generalisable.
  - The studies in the USA took place during the global Covid-19 pandemic, while NZ research occurred as restrictions were ended. These restrictions and social changes influenced study recruitment, personal interaction, and study design. Runners and salespeople across both the USA and NZ may have acted differently than normal due to pandemic influence.
  - Most studies took place in the USA due to travel restrictions, which somewhat reduced population homogeneity across the Thesis as the last study was conducted in NZ.
  - There was limited exploration between how NZ and USA runners and salespeople differ in beliefs and typical practices regarding running shoe selection.
  - Shoe availability differed between NZ and USA, which may have influenced how runners experience shoe selection and which factors they prioritise.
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CONSORT= Consolidated standards of reporting trials, COREQ= Consolidated criteria for reporting qualitative research, PRISMA = Preferred Reporting Items for Systematic Reviews and Meta-Analyses, UTT= Unconscious Thought Theory

## Practical applications

This Thesis analysed the in-store shoe selection process from both runners' and salespeople's perspectives, and explored ways to alter shoe selection and subjective perceptions of comfort, satisfaction, and performance. This holistic approach to examining running shoe selection is ultimately aimed at helping runners make evidence-based decisions by describing current shoe selection practices and runner expectations. Based on the findings of this Thesis, the following practical applications may be beneficial for runners, salespeople, researchers, and healthcare professionals to consider in regard to shoe selection:

- Runners currently choose shoes with the goal of injury reduction through prioritising fit and comfort when shopping for new shoes and rely on salespeople in specialty shoe stores for advice. Runners should consider that the link between shoe choice and injury is poorly understood and that salespeople may not make evidence-based recommendations. Specifically, salespeople primarily receive training from their peers and in-store programmes, which is likely to derive from manufacturers and brand representatives rather than scientific evidence.
- Runners can benefit from implementing aspects of Unconscious Thought Theory into their running shoe selection. Runners should consciously seek high quality information on shoe selection from accurate sources, but should make their shoe selection less consciously to increase long-term satisfaction. Runners can 'sleep on' their shoe choice to unconsciously process the complexities of running shoe factors and make better choices.

- Subjective perceptions can be manipulated by product descriptions and expert recommendation. Runners should be cautious when choosing shoes solely based on subjective factors such as comfort, performance, and injury risk in the presence of external recommendations.
- Runners, salespeople, healthcare professionals, and researchers should work closely together to openly discuss what runners want from running shoes. Currently, there is a discrepancy between runners and salespeople regarding how much salespeople influence the shoe selection of runners, although the importance of the discrepancy is unknown. Runners and salespeople should be aware that there is little, if any, evidence to support common marketing claims that shoes can effectively improve specific aspects of the running experience in uninjured runners outside of performance.
- The effort to educate runners using digestible scientific evidence should continue. It is important for researchers to find how to communicate with runners, salespeople, and healthcare professionals in an understandable manner. Since runners primarily seek footwear advice from salespeople and friends/other runners, efforts made to educate and influence the practices and beliefs of salespeople may be most effective in knowledge translation.

## **Future research**

Considering the findings, strengths, and limitations of this Thesis, the following future research directions are recommended to assess and improve knowledge related to running shoe selection:

- Future research should examine if different types of educational media (e.g., more interactive modules versus passive ones) influence running shoe selection using experimental designs. The runners in this Thesis reported that the educational video did influence how they chose their shoes, but their purchasing behaviours were not significantly different from runners that viewed a control video. It is possible that educational videos are ineffective in shoe selection behavioural modification, although other forms of media than the video presentation could be more influential. Furthermore, testing different types of media may lead to the development of better tools to positively influence runners, salespeople, and others involved in running shoe selection.
- Future research could implement experimental designs with different populations, such as male runners, elite runners, trail runners, injured runners, master runners, and in other countries. As running shoe selection can be influenced by many factors, continued research on how different types of runners select shoes can increase the evidence base to inform recommendation strategies for specific populations.
- Future research should focus on specialty running store salespeople and influencing their beliefs and practices. As salespeople are the most common source of advice for runners, they may be the key to informing the general running population. Testing educational material or shoe recommendation practices may lead to more satisfied and less injured runners with realistic expectations of what shoes can and cannot do. Helping specialty shoe store salespeople better align their beliefs with current scientific evidence should help runners avoid unmet expectations and holistically improve their running experience.

- Future research should examine the longitudinal effects of manipulative product descriptions. While subjective perceptions of comfort, performance, and injury can be influenced acutely, the long-term effects of product description and shoe recommendation on perceptions and injury are unknown. Furthermore, whether the effects of manipulating perceptions lead to positive or negative outcomes is unknown, and could be examined by tracking runners over several months or the life of the shoe.
- Future research can expand on findings related to the importance of factors influencing shoe selection. Runners in this Thesis ranked shoe construction priorities from highest to lowest as follows: reducing injury risk, enhancing comfort, and increasing performance. Further qualitative examination is warranted to better understand how runners perceive the connection between shoe construction and injury, comfort, and performance to better inform the development of knowledge translation tools.
- Future research could seek to implement more aspects of Unconscious Thought Theory into experimental components of running shoe choice. Given that unconscious shoppers are more satisfied and make better decisions when purchasing complex products such as running shoes, future research should focus on creating unconscious conditions during shoe choice. Previous UTT experiments have created unconscious conditions through introducing distracting tasks during decisions. The introduction of a distracting task during shoe selection may also create a less conscious state and influence the quality of shoe choice and subsequent satisfaction.

- It is also possible that the complexity of running shoe choice may be influenced by running level, in which novice runners consider less aspects than more experienced runners. Given that most research in this Thesis focused on recreational runners, the level of consciousness exhibited by elite runners during shoe selection remains unknown. If novices choose shoes in a more simplistic manner, they may benefit from increased consciousness during shoe selection. In contrast, if elite runners consider more aspects of shoes and subsequently experience a more complex decision condition, they may benefit from a less conscious state. As such, evaluating how UTT is mediated by running experience could be used to recommend beneficial behaviours regarding conscious choice.

## **Conclusion**

This Thesis contributes to scientific literature pertaining to running shoe selection processes and subjective perceptions related to running shoe choice. This Thesis described runners' experience in specialty running stores and analysed the shoe selection process from the perspectives of both runners and salesperson. Overall, runners consistently value fit, comfort, and gait analysis when considering new shoes and seek advice from salespeople and other runners rather than seeking out scientific research. Runners that are presented with scientific evidence believe that it influences their choices, but do not significantly change their shoe selection behaviour. Runners should also consider that their subjective perceptions can be influenced acutely through product description and recommendations from salespeople that may or may not be based on evidence.

## References

- Agresta, C., Giacomazzi, C., Harrast, M., & Zandler, J. (2022). Running injury paradigms and their influence on footwear design features and runner assessment methods: A focused review to advance evidence-based practice for running medicine clinicians. *Frontiers in Sports and Active Living*, 4, 815675. <https://doi.org/10.3389/fspor.2022.815675>
- Arnold, B. J., Weeks, B. K., & Horan, S. A. (2019). An examination of treadmill running familiarisation in barefoot and shod conditions in healthy men. *Journal of Sports Sciences*, 37(1), 5-12. <https://doi.org/10.1080/02640414.2018.1479533>
- Asplund Maj, C. A., & Brown Maj, D. L. (2005). The running shoe prescription. *The Physician and Sportsmedicine*, 33(1), 17-24. <https://doi.org/10.3810/psm.2005.01.33>
- Atkinson, G., & Nevill, A. M. (1998). Statistical methods for assessing measurement error (reliability) in variables relevant to sports medicine. *Sports Medicine*, 26(4), 217-238. <https://doi.org/10.2165/00007256-199826040-00002>
- Barff, R., & Austen, J. (1993). 'It's gotta be da shoes': Domestic manufacturing, international subcontracting, and the production of athletic footwear. *Environment and Planning A*, 25(8), 1103-1114. <https://doi.org/10.1068/a251103>
- Barwick, A. L., Hurn, S. E., van Netten, J. J., Reed, L. F., & Lazzarini, P. A. (2019). Factors associated with wearing inadequate outdoor footwear in populations at risk of foot ulceration: A cross-sectional study. *PloS One*, 14(2), e0211140. <https://doi.org/10.1371/journal.pone.0211140>
- Baumann, J., & Le Meunier-FitzHugh, K. (2014). Trust as a facilitator of co-creation in customer-salesperson interaction—an imperative for the realization of episodic and

- relational value? *AMS Review*, 4, 5-20. <https://doi.org/https://doi.org/10.1007/s13162-013-0039-8>
- Besomi, M., Leppe, J., Di Silvestre, M. C., & Setchell, J. (2018). SeRUN® study: Development of running profiles using a mixed methods analysis. *PloS One*, 13(7), e0200389. <https://doi.org/10.1371/journal.pone.0200389>
- Bishop, C., Buckley, J. D., Esterman, A. E., & Arnold, J. B. (2020). The running shoe comfort assessment tool (RUN-CAT): Development and evaluation of a new multi-item assessment tool for evaluating the comfort of running footwear. *Journal of Sports Sciences*, 38(18), 2100-2107. <https://doi.org/10.1080/02640414.2020.1773613>
- Blazey, P., Michie, T. V., & Napier, C. (2021). A narrative review of running wearable measurement system accuracy and reliability: Can we make running shoe prescription objective? *Footwear Science*, 13(2), 117-131. <https://doi.org/10.1080/19424280.2021.1878287>
- Bonnaerens, S., Fiers, P., Galle, S., Derie, R., Aerts, P., Frederick, E., Kaneko, Y., Derave, W., Clercq, D. D., & Segers, V. (2021). Relationship between duty factor and external forces in slow recreational runners. *BMJ Open Sport & Exercise Medicine*, 7(1), e000996. <https://doi.org/10.1136/bmjsem-2020-000996>
- Bos, M. W., Dijksterhuis, A., & van Baaren, R. B. (2011). The benefits of “sleeping on things”: Unconscious thought leads to automatic weighting. *Journal of Consumer Psychology*, 21(1), 4-8. <https://doi.org/https://doi.org/10.1016/j.jcps.2010.09.002>
- Braun, V., & Clarke, V. (2006). Using thematic analysis in psychology. *Qualitative Research in Psychology*, 3(2), 77-101. <https://doi.org/10.1191/1478088706qp063oa>
- Brooks. (2020, 1/27/2022). When to replace your running shoes. *Running Tips*.

- Chan, Z. Y., Au, I. P., Zhang, J. H., Ferber, R., Shum, G., An, W. W., & Cheung, R. T. (2020). Effects of deceptive footwear condition on subjective comfort and running biomechanics. *Translational Sports Medicine*, 3(3), 256-262. <https://doi.org/https://doi.org/10.1002/tsm2.135>
- Cornwall, M. W., & McPoil, T. G. (2017). Can runners perceive changes in heel cushioning as the shoe ages with increased mileage? *International Journal of Sports Physical Therapy*, 12(4), 616-624.
- Cowley, E. S., Olenick, A. A., McNulty, K. L., & Ross, E. Z. (2021). “Invisible sportswomen”: The sex data gap in sport and exercise science research. *Women in Sport and Physical Activity Journal*, 29(2), 146-151. <https://doi.org/10.1123/wspaj.2021-0028>
- Curwen, L., & Park, J. (2014). When the shoe doesn't fit: Female consumers' negative emotions. *Journal of Fashion Marketing and Management*, 18(3), 338-356. <https://doi.org/http://dx.doi.org/10.1108/JFMM-12-2012-0078>
- Davis, I. S. (2014). The re-emergence of the minimal running shoe. *Journal of Orthopaedic & Sports Physical Therapy*, 44(10), 775-784. <https://doi.org/https://www.jospt.org/doi/10.2519/jospt.2014.5521>
- Delattre, N., & Cariou, A. (2018). Women perception of shoe cushioning as a function of mechanical properties of footwear using a sensory trained panel method. *Footwear Science*, 10(1), 11-19. <https://doi.org/https://doi.org/10.1080/19424280.2017.1403973>
- Dhillon, G. K., Hunt, M. A., Reid, A. L., & Esculier, J. F. (2020). What are the perceptions of runners and healthcare professionals on footwear and running injury risk? *BMJ Open Sport & Exercise Medicine*, 6(1), e000767. <https://doi.org/10.1136/bmjsem-2020-000767>

Dijksterhuis, A., Bos, M. W., Nordgren, L. F., & Van Baaren, R. B. (2006). On making the right choice: The deliberation-without-attention effect. *Science*, *311*(5763), 1005-1007.

<https://doi.org/https://doi.org/10.1126/science.1121629>

Dijksterhuis, A., & Nordgren, L. F. (2006). A theory of unconscious thought. *Perspectives on Psychological Science*, *1*(2), 95-109. <https://doi.org/https://doi.org/10.1111/j.1745-6916.2006.00007.x>

Dijksterhuis, A., & Strick, M. (2016). A case for thinking without consciousness. *Perspectives on Psychological Science*, *11*(1), 117-132.

<https://doi.org/https://doi.org/10.1177/1745691615615317>

Dijksterhuis, A., & Van Olden, Z. (2006). On the benefits of thinking unconsciously: Unconscious thought can increase post-choice satisfaction. *Journal of Experimental Social Psychology*, *42*(5), 627-631.

<https://doi.org/https://doi.org/10.1016/j.jesp.2005.10.008>

Dinato, R. C., Ribeiro, A. P., Butugan, M. K., Pereira, I. L., Onodera, A. N., & Sacco, I. C. (2015). Biomechanical variables and perception of comfort in running shoes with different cushioning technologies. *Journal of Science and Medicine in Sport*, *18*(1), 93-97. <https://doi.org/https://doi.org/10.1016/j.jsams.2013.12.003>

DiPierro, K., Lee, H., Pain, K. J., Durning, S. J., & Choi, J. J. (2022). Groupthink among health professional teams in patient care: A scoping review. *Medical Teacher*, *44*(3), 309-318.

<https://doi.org/10.1080/0142159X.2021.1987404>

Dorsch, T. E., King, M. Q., Dunn, C. R., Osai, K. V., & Tulane, S. (2017). The impact of evidence-based parent education in organized youth sport: A pilot study. *Journal of*

- Applied Sport Psychology*, 29(2), 199-214.  
<https://doi.org/10.1080/10413200.2016.1194909>
- Dunn, K. (1980). Choosing a running shoe: Science or subjectivity? *The Physician and Sportsmedicine*, 8(12), 85-86. <https://doi.org/10.1080/00913847.1980.11948670>
- Dyer, B. (2020). A pragmatic approach to resolving technological unfairness: The case of Nike's Vaporfly and Alphafly running footwear. *Sports medicine - open*, 6(1), 21.  
<https://doi.org/10.1186/s40798-020-00250-1>
- Esculier, J.-F., Dubois, B., Dionne, C. E., Leblond, J., & Roy, J.-S. (2015). A consensus definition and rating scale for minimalist shoes. *Journal of Foot and Ankle Research*, 8(1), 42. <https://doi.org/10.1186/s13047-015-0094-5>
- Farndon, L., Robinson, V., Nicholls, E., & Vernon, W. (2016). If the shoe fits: Development of an on-line tool to aid practitioner/patient discussions about 'healthy footwear'. *Journal of Foot and Ankle Research*, 9(1), 17. <https://doi.org/10.1186/s13047-016-0149-2>
- Fife, A., Ramsey, C., Esculier, J.-F., & Hébert-Losier, K. (2023). How do road runners select their shoes? A systematic review. *Footwear Science*, 15(2), 103-112.  
<https://doi.org/https://doi.org/10.1080/19424280.2023.2180543>
- Fife, A., Ramsey, C., Esculier, J. F., & Hébert-Losier, K. (2024). How do runners select their shoes? An in-store experience. *Footwear Science*, 1-9.  
<https://doi.org/10.1080/19424280.2024.2353597>
- Fokkema, T., Vos, R.-J. d., Bierma-Zeinstra, S. M. A., & Middelkoop, M. v. (2019). Opinions, barriers, and facilitators of injury prevention in recreational runners. *Journal of Orthopaedic & Sports Physical Therapy*, 49(10), 736-742.  
<https://doi.org/10.2519/jospt.2019.9029>

- Fortune, A. E., Sims, J. M. G., Rhodes, S. J., & Ampat, G. (2022). Does orthotics use improve comfort, speed and injury rate during running? Preliminary analysis of a randomised control trial. *World Journal of Orthopedics*, *13*(7), 652-661.  
<https://doi.org/10.5312/wjo.v13.i7.652>
- Foundation, O. (2021). *2021 Outdoor participation trends report*. <https://outdoorindustry.org/wp-content/uploads/2015/03/2021-Outdoor-Participation-Trends-Report.pdf>
- Fredette, A., Roy, J.-S., Perreault, K., Dupuis, F., Napier, C., & Esculier, J.-F. (2022). The association between running injuries and training parameters: A systematic review. *Journal of Athletic Training*, *57*(7), 650-671. <https://doi.org/https://doi.org/10.4085/1062-6050-0195.21>
- Fritz, C. O., Morris, P. E., & Richler, J. J. (2012). Effect size estimates: Current use, calculations, and interpretation. *Journal of Experimental Psychology: General*, *141*(1), 2.  
<https://doi.org/> <https://doi.org/10.1037/a0024338>
- Galic, B. (2021, 11/03/2021). *126 Running statistics that you need to know*. Retrieved 12/15/2021 from <https://www.livestrong.com/article/13730338-running-statistics/>
- Gibson, K. (2012). Knight's children: Techno-science, consumerism and running shoes. *Qualitative Research in Sport, Exercise and Health*, *4*(3), 341-361.  
<https://doi.org/10.1080/2159676X.2012.693530>
- Goonetilleke, R. S. (2013). *The science of footwear*. Taylor & Francis Group, LLC.
- Greensword, M., Aghazadeh, F., & Al-Qaisi, S. (2012). Modified track shoes and their effect on the EMG activity of calf muscles. *Work*, *41*(Supplement 1), 1763-1770. <https://doi.org/10.3233/WOR-2012-0382-1763>

- Griffiths, M. A., Armour, K. M., & Cushion, C. J. (2018). 'Trying to get our message across': Successes and challenges in an evidence-based professional development programme for sport coaches. *Sport, Education and Society*, 23(3), 283-295.  
<https://doi.org/10.1080/13573322.2016.1182014>
- Guest, G., Bunce, A., & Johnson, L. (2006). How many interviews are enough? An experiment with data saturation and variability. *Field Methods*, 18(1), 59-82.  
<https://doi.org/https://doi.org/10.1177/1525822x05279903>
- Güner Gültekin, D. (2024). Groupthink in contemporary decision making: A failure to dissent. In *Overcoming cognitive biases in strategic management and decision making* (pp. 91-106). IGI Global yayınevi.
- Hassouna, A. (2023). Sample size calculation. In A. Hassouna (Ed.), *Statistics for clinicians: How much should a doctor know?* (pp. 339-419). Springer International Publishing.  
[https://doi.org/10.1007/978-3-031-20758-7\\_4](https://doi.org/10.1007/978-3-031-20758-7_4)
- Hébert-Losier, K., Finlayson, S. J., Driller, M. W., Dubois, B., Esculier, J.-F., & Beaven, C. M. (2020). Metabolic and performance responses of male runners wearing 3 types of footwear: Nike Vaporfly 4%, Saucony Endorphin racing flats, and their own shoes. *Journal of Sport and Health Science*, 11(3), 275-284.  
<https://doi.org/https://doi.org/10.1016/j.jshs.2020.11.012>
- Hébert-Losier, K., Knighton, H., Finlayson, S. J., Dubois, B., Esculier, J.-F., & Beaven, C. M. (2024). Biomechanics and subjective measures of recreational male runners in three shoes running outdoors: A randomised crossover study. *Footwear Science*, 16(1), 13-23.  
<https://doi.org/10.1080/19424280.2023.2283460>

- Hemler, S. L., Pliner, E. M., Redfern, M. S., Haight, J. M., & Beschoner, K. E. (2022). Effects of natural shoe wear on traction performance: A longitudinal study. *Footwear Science*, *14*(1), 1-12. <https://doi.org/10.1080/19424280.2021.1994022>
- Hennig, E., & Schulz, J. (2011). Subjective evaluation of biomechanical shoe properties during blinded and non-blinded running. *Footwear Science*, *3*(sup1), S75-S76. <https://doi.org/10.1080/19424280.2011.575802>
- Hennig, E. M. (2011). Eighteen years of running shoe testing in Germany – a series of biomechanical studies. *Footwear Science*, *3*(2), 71-81. <https://doi.org/10.1080/19424280.2011.616536>
- Hoerzer, S., Trudeau, M. B., Edwards, W. B., & Nigg, B. M. (2016). Intra-rater reliability of footwear-related comfort assessments. *Footwear Science*, *8*(3), 155-163. <https://doi.org/10.1080/19424280.2016.1195451>
- Honert, E. C., Mohr, M., Lam, W.-K., & Nigg, S. (2020). Shoe feature recommendations for different running levels: A Delphi study. *PloS One*, *15*(7), e0236047. <https://doi.org/https://doi.org/10.1371/journal.pone.0236047>
- Hoogkamer, W., Kipp, S., Spiering, B. A., & Kram, R. (2016). Altered running economy directly translates to altered distance-running performance. *Medicine and Science in Sports and Exercise*, *48*(11), 2175-2180. <https://doi.org/10.1249/MSS.0000000000001012>
- Huang, M., Mo, S., Pak-Kwan Chan, P., Chan, Z. Y. S., Zhang-Lea, J. H., & Cheung, R. T. H. (2022). The influence of running shoes on familiarization time for treadmill running biomechanics evaluation. *Sports Biomechanics*, 1-14. <https://doi.org/10.1080/14763141.2022.2046144>

- Hulme, A., & Finch, C. F. (2015). From monocausality to systems thinking: A complementary and alternative conceptual approach for better understanding the development and prevention of sports injury. *Injury Epidemiology*, 2(1), 31.  
<https://doi.org/10.1186/s40621-015-0064-1>
- Hunter, I., McLeod, A., Valentine, D., Low, T., Ward, J., & Hager, R. (2019). Running economy, mechanics, and marathon racing shoes. *Journal of Sports Sciences*, 37(20), 2367-2373.  
<https://doi.org/10.1080/02640414.2019.1633837>
- Itani, O. S., Chonko, L., & Agnihotri, R. (2022). Salesperson moral identity and value co-creation. *European Journal of Marketing*, 56(2), 500-531.  
<https://doi.org/https://doi.org/10.1108/ejm-06-2020-0431>
- Iyengar, S. S., & Lepper, M. R. (2000). When choice is demotivating: Can one desire too much of a good thing? *Journal of Personality and Social Psychology*, 79(6), 995.  
<https://doi.org/10.1037//0022-3514.79.6.995>
- Jiang, B., & Zou, T. (2020). Consumer search and filtering on online retail platforms. *Journal of Marketing Research*, 57(5), 900-916. <https://doi.org/10.1177/0022243720928367>
- Johnson, C. D., Outerleys, J., & Davis, I. S. (2021). Relationships between tibial acceleration and ground reaction force measures in the medial-lateral and anterior-posterior planes. *Journal of Biomechanics*, 117, 110250.  
<https://doi.org/https://doi.org/10.1016/j.jbiomech.2021.110250>
- Johnson, C. D., Outerleys, J., Jamison, S. T., Tenforde, A. S., Ruder, M., & Davis, I. S. (2020). Comparison of tibial shock during treadmill and real-world running. *Medicine and Science in Sports and Exercise*, 52(7), 1557-1562.  
<https://doi.org/https://doi.org/10.1249/mss.0000000000002288>

- Jurca, A., & Dzeroski, S. (2021). Fit consistency of men's running shoes. *Footwear Science*, 13(sup1), S63-S65. <https://doi.org/10.1080/19424280.2021.1917683>
- Kinchington, M. A., Ball, K. A., & Naughton, G. (2011). Effects of footwear on comfort and injury in professional rugby league. *Journal of Sports Sciences*, 29(13), 1407-1415. <https://doi.org/10.1080/02640414.2011.593041>
- Knapik, J. J., Pope, R., Orr, R., & Grier, T. (2015). Injuries and footwear (part 1): Athletic shoe history and injuries in relation to foot arch height and training in boots. *Journal of Special Operations Medicine: A Peer Reviewed Journal for SOF Medical Professionals*, 15(4), 102-108. <https://doi.org/10.55460/ktp0-xu4q>
- Knapik, J. J., Swedler, D. I., Grier, T. L., Hauret, K. G., Bullock, S. H., Williams, K. W., Darakjy, S. S., Lester, M. E., Tobler, S. K., & Jones, B. H. (2009). Injury reduction effectiveness of selecting running shoes based on plantar shape. *Journal of Strength & Conditioning Research*, 23(3), 685-697. <https://doi.org/10.1519/JSC.0b013e3181a0fc63>
- Knapik, J. J., Trone, D. W., Tchandja, J., & Jones, B. H. (2014). Injury-reduction effectiveness of prescribing running shoes on the basis of foot arch height: Summary of military investigations. *Journal of Orthopaedic & Sports Physical Therapy*, 44(10), 805-812. <https://doi.org/10.2519/jospt.2014.5342>
- Kong, P., & Bagdon, M. (2010). Shoe preference based on subjective comfort for walking and running. *Journal of the American Podiatric Medical Association*, 100(6), 456-462. <https://doi.org/10.7547/1000456>
- Kong, P., Lim, C., Ding, R., & Sterzing, T. (2015). Subjective evaluation of running footwear depends on country and assessment method: A bi-national study. *Ergonomics*, 58(9), 1589-1604. <https://doi.org/10.1080/00140139.2015.1018957>

- Koo, T. K., & Li, M. Y. (2016). A guideline of selecting and reporting intraclass correlation coefficients for reliability research. *Journal of Chiropractic Medicine, 15*(2), 155-163.  
<https://doi.org/10.1016/j.jcm.2016.02.012>
- Kram, R. (2022). Ergogenic distance running shoes: How do we think they work and how can we understand them better? *Footwear Science, 14*(3), 139-146.
- Lam, W. K., Kan, W. H., Chia, J. S., & Kong, P. W. (2022). Effect of shoe modifications on biomechanical changes in basketball: A systematic review. *Sports Biomechanics, 21*(5), 577-603. <https://doi.org/https://doi.org/10.1080/14763141.2019.1656770>
- Langley, J. O., Branthwaite, H., Chockalingam, N., & Forsyth, J. J. (2023). Determining the effect and magnitude of advanced footwear technology on female distance running performance. *Footwear Science, 15*, 161 - 169.  
<https://doi.org/https://doi.org/10.1080/19424280.2023.2219651>
- Lindorfer, J., Kröll, J., & Schwameder, H. (2019). Comfort assessment of running footwear: Does assessment type affect inter-session reliability? *European Journal of Sport Science, 19*(2), 177-185. <https://doi.org/10.1080/17461391.2018.1502358>
- Liu, A. H., & Leach, M. P. (2001). Developing loyal customers with a value-adding sales force: Examining customer satisfaction and the perceived credibility of consultative salespeople. *Journal of Personal Selling & Sales Management, 21*(2), 147-156.  
<https://doi.org/10.1080/08853134.2001.10754265>
- Malisoux, L., Delattre, N., Gette, P., Urhausen, A., & Theisen, D. (2021). The effect of shoe cushioning on injury risk, landing impact forces and spatiotemporal parameters during running: Results from a randomised trial including 800+ recreational runners. *Footwear*

*Science*, 13(sup1), S55-S56.

<https://doi.org/https://doi.org/10.1080/19424280.2021.1917679>

Malisoux, L., Ramesh, J., Mann, R., Seil, R., Urhausen, A., & Theisen, D. (2015). Can parallel use of different running shoes decrease running-related injury risk? *Scandinavian Journal of Medicine & Science in Sports*, 25(1), 110-115.

<https://doi.org/https://doi.org/10.1111/sms.12154>

Malisoux, L., & Theisen, D. (2020). Can the “appropriate” footwear prevent injury in leisure-time running? Evidence versus beliefs. *Journal of Athletic Training*, 55(12), 1215-1223.

<https://doi.org/10.4085/1062-6050-523-19>

Martínez-Rosales, E., Hernández-Martínez, A., Sola-Rodríguez, S., Esteban-Cornejo, I., & Soriano-Maldonado, A. (2021). Representation of women in sport sciences research, publications, and editorial leadership positions: are we moving forward? *Journal of Science and Medicine in Sport*, 24(11), 1093-1097.

<https://doi.org/10.1016/j.jsams.2021.04.010>

Matthias, E. C., Banwell, H. A., & Arnold, J. B. (2021). Methods for assessing footwear comfort: A systematic review. *Footwear Science*, 13(3), 255-274.

<https://doi.org/10.1080/19424280.2021.1961879>

McLeod, A. R., Bruening, D., Johnson, A. W., Ward, J., & Hunter, I. (2020). Improving running economy through altered shoe bending stiffness across speeds. *Footwear Science*, 12(2),

79-89. <https://doi.org/https://doi.org/10.1080/19424280.2020.1734870>

Menz, H. B., & Bonanno, D. R. (2021). Footwear comfort: A systematic search and narrative synthesis of the literature. *Journal of Foot and Ankle Research*, 14(1), 63.

<https://doi.org/10.1186/s13047-021-00500-9>

- Messner, C., & Wänke, M. (2011). Unconscious information processing reduces information overload and increases product satisfaction. *Journal of Consumer Psychology, 21*(1), 9-13. <https://doi.org/https://doi.org/10.1016/j.jcps.2010.09.010>
- Miller, J. E., Nigg, B. M., Liu, W., Stefanyshyn, D. J., & Nurse, M. A. (2000). Influence of foot, leg and shoe characteristics on subjective comfort. *Foot & Ankle International, 21*(9), 759-767. <https://doi.org/https://doi.org/10.1177/107110070002100908>
- Mills, K., Blanch, P., & Vicenzino, B. (2010). Identifying clinically meaningful tools for measuring comfort perception of footwear. *Medicine and Science in Sports and Exercise, 42*(10), 1966-1971. <https://doi.org/10.1249/MSS.0b013e3181dbacc8>
- Mills, K. A. G., Collins, N. J., & Vicenzino, B. (2018). The relationship between immediate comfort and plantar foot sensitivity during running in cushioned versus minimal shoes. *Footwear Science, 10*(1), 21-27. <https://doi.org/10.1080/19424280.2017.1403972>
- Moher, D., Liberati, A., Tetzlaff, J., Altman, D. G., & Group, P. (2010). Preferred reporting items for systematic reviews and meta-analyses: The PRISMA statement. *International Journal of Surgery, 8*(5), 336-341. <https://doi.org/https://doi.org/10.1371/journal.pmed.1000097>
- Mohr, M., Trudeau, M. B., Nigg, S. R., & Nigg, B. M. (2016). Increased athletic performance in lighter basketball shoes: Shoe or psychology effect? *International Journal of Sports Physiology and Performance, 11*(1), 74-79. <https://doi.org/https://doi.org/10.1123/ijsp.2014-0538>
- Moschis, G. P., Ferguson, J. L., & Zhu, M. (2011). Mature consumers' selection of apparel and footwear brands and department stores. *International Journal of Retail & Distribution Management, 39*(10), 785-801. <https://doi.org/10.1108/09590551111162266>

- Mousavi, S. H., Hijmans, J. M., Minoonejad, H., Rajabi, R., & Zwerver, J. (2021). Factors associated with lower limb injuries in recreational runners: A cross-sectional survey including mental aspects and sleep quality. *Journal of Sports Science & Medicine*, 20(2), 204. <https://doi.org/https://doi.org/10.52082/jssm.2021.204>
- Mullins, R. R., Ahearne, M., Lam, S. K., Hall, Z. R., & Boichuk, J. P. (2014). Know your customer: How salesperson perceptions of customer relationship quality form and influence account profitability. *Journal of Marketing*, 78(6), 38-58. <https://doi.org/https://doi.org/10.1509/jm.13.0300>
- Muniz-Pardos, B., Sutehall, S., Angeloudis, K., Guppy, F. M., Bosch, A., & Pitsiladis, Y. (2021). Recent improvements in marathon run times are likely technological, not physiological. *Sports Medicine*, 51(3), 371-378. <https://doi.org/https://doi.org/10.1007/s40279-020-01420-7>
- Napier, C., & Willy, R. W. (2018). Logical fallacies in the running shoe debate: Let the evidence guide prescription. *British Journal of Sports Medicine*. <https://doi.org/https://doi.org/10.1136/bjsports-2018-100117>
- Nguyen, A. P., Gillain, L., Delieux, L., Detrembleur, C., Mahaudens, P., & Esculier, J.-F. (2022). Opinions about running shoes in runners and non-runners. *Footwear Science*, 1-12. <https://doi.org/https://doi.org/10.1080/19424280.2022.2144468>
- Nigg, B. M., Baltich, J., Hoerzer, S., & Enders, H. (2015). Running shoes and running injuries: Mythbusting and a proposal for two new paradigms: 'Preferred movement path' and 'comfort filter'. *British Journal of Sports Medicine*, 49(20), 1290-1294. <https://doi.org/10.1136/bjsports-2015-095054>

- Nigg, B. M., Cigoja, S., & Nigg, S. R. (2020). Effects of running shoe construction on performance in long distance running. *Footwear Science*, 12(3), 133-138.  
<https://doi.org/https://doi.org/10.1080/19424280.2020.1778799>
- Nigg, B. M., Nigg, S., Hoitz, F., Subramaniam, A., Vienneau, J., Wannop, J. W., Khassetarash, A., Alizadeh, S., Matijevich, E., Honert, E. C., Edwards, W. B., & Mohr, M. (2023). Highlighting the present state of biomechanics in shoe research (2000–2023). *Footwear Science*, 1-11. <https://doi.org/10.1080/19424280.2023.2209044>
- Ogles, B. M., & Masters, K. S. (2003). A typology of marathon runners based on cluster analysis of motivations. *Journal of Sport Behavior*, 26(1).  
<https://doi.org/DOI:10.1080/02701367.1993.10608790>
- Page, M. J., McKenzie, J. E., Bossuyt, P. M., Boutron, I., Hoffmann, T. C., Mulrow, C. D., Shamseer, L., Tetzlaff, J. M., Akl, E. A., & Brennan, S. E. (2021). The PRISMA 2020 statement: An updated guideline for reporting systematic reviews. *International Journal of Surgery*, 88, 105906. <https://doi.org/https://doi.org/10.1016/j.jclinepi.2021.02.003>
- Parra-Camacho, D., González-Serrano, M. H., González-García, R. J., & Calabuig Moreno, F. (2019). Sporting habits of urban runners: Classification according to their motivation. *International Journal of Environmental Research and Public Health*, 16(24), 4990.  
<https://doi.org/https://doi.org/10.3390/ijerph16244990>
- Partyka, A., & Waśkiewicz, Z. (2024). Motivation of marathon and ultra-marathon runners. A narrative review. *Psychology Research and Behavior Management*, 17, 2519-2531.  
<https://doi.org/10.2147/PRBM.S464053>
- Pedisic, Z., Shrestha, N., Kovalchik, S., Stamatakis, E., Liangruenrom, N., Grgic, J., Titze, S., Biddle, S. J., Bauman, A. E., & Oja, P. (2020). Is running associated with a lower risk of

all-cause, cardiovascular and cancer mortality, and is the more the better? A systematic review and meta-analysis. *British Journal of Sports Medicine*, 54(15), 898-905.

<https://doi.org/https://doi.org/10.1136/bjsports-2018-100493>

Pisciotta, E., & Shorten, M. (2018). Perception of running shoe cushioning: Wear test vs. controlled experiment. *Footwear Science*, 10(2), 69-75.

<https://doi.org/10.1080/19424280.2018.1486462>

Ramsey, C., Peterson, B., & Hebert-Losier, K. (2023). Measurement and reporting of footwear characteristics in running biomechanics: A systematic search and narrative synthesis of contemporary research methods. *Sports Biomechanics*, 22(3), 351-387.

<https://doi.org/https://doi.org/10.1080/14763141.2022.2125431>

Ramsey, C. A., Lamb, P., Kaur, M., Baxter, G. D., & Ribeiro, D. C. (2019). How are running shoes assessed? A systematic review of characteristics and measurement tools used to describe running footwear. *Journal of Sports Sciences*, 37(14), 1617-1629.

<https://doi.org/10.1080/02640414.2019.1578449>

Ramsey, C. A., Lamb, P., & Ribeiro, D. C. (2022). Factors influencing runner's choices of footwear. *Frontiers in Sports and Active Living*, 4.

<https://doi.org/https://doi.org/10.3389/fspor.2022.829514>

Relph, N., Greaves, H., Armstrong, R., Prior, T. D., Spencer, S., Griffiths, I. B., Dey, P., & Langley, B. (2022). Running shoes for preventing lower limb running injuries in adults. *Cochrane Database of Systematic Reviews*(8).

<https://doi.org/https://doi.org/10.1002/14651858.CD013368.pub2>

- Richards, C., Magin, P., & Callister, R. (2009). Is your prescription of distance running shoes evidence-based? *British Journal of Sports Medicine*, *43*(3), 159-162.  
<https://doi.org/https://doi.org/10.1136/bjism.2008.046680>
- Roulston, K. (2010). Considering quality in qualitative interviewing. *Qualitative Research*, *10*(2), 199-228. <https://doi.org/10.1177/1468794109356739>
- Saragiotto, B. T., Yamato, T. P., & Lopes, A. D. (2014). What do recreational runners think about risk factors for running injuries? A descriptive study of their beliefs and opinions. *Journal of Orthopaedic & Sports Physical Therapy*, *44*(10), 733-738.  
<https://doi.org/10.2519/jospt.2014.5710>
- Schubert, C., Oriwol, D., & Sterzing, T. (2011). Gender and age related requirements of running shoes: a questionnaire on 4501 runners. *Footwear Science*, *3*(sup1), S148-S150.  
<https://doi.org/10.1080/19424280.2011.575850>
- Schulz, K. F., Altman, D. G., & Moher, D. (2010). CONSORT 2010 Statement: Updated guidelines for reporting parallel group randomised trials. *BMC Medicine*, *8*, 18.  
<https://doi.org/10.1186/1741-7015-8-18>
- Sherman, R. A., Rauthmann, J. F., Brown, N. A., Serfass, D. G., & Jones, A. B. (2015). The independent effects of personality and situations on real-time expressions of behavior and emotion. *Journal of Personality and Social Psychology*, *109*(5), 872.  
<https://doi.org/10.1037/pspp0000036>
- Snipes, R. L., & Pitts, J. (2015). Running with the big dogs (part a): A competitive forces and strategic analysis of the running specialty store industry. *Journal of the International Academy for Case Studies*, *21*(3), 37-42.

- Sterzing, T., Schweiger, V., Ding, R., Cheung, J. T.-M., & Brauner, T. (2013). Influence of rearfoot and forefoot midsole hardness on biomechanical and perception variables during heel-toe running. *Footwear Science*, 5(2), 71-79.  
<https://doi.org/10.1080/19424280.2012.757810>
- Strick, M., Dijksterhuis, A., Bos, M. W., Sjoerdsma, A., Van Baaren, R. B., & Nordgren, L. F. (2011). A meta-analysis on unconscious thought effects. *Social Cognition*, 29(6), 738-762. <https://doi.org/https://doi.org/10.1521/soco.2011.29.6.738>
- Sun, X., Lam, W.-K., Zhang, X., Wang, J., & Fu, W. (2020). Systematic review of the role of footwear constructions in running biomechanics: Implications for running-related injury and performance. *Journal of Sports Science & Medicine*, 19(1), 20-37.  
<https://pubmed.ncbi.nlm.nih.gov/32132824>
- Tay, C. S., Sterzing, T., Lim, C. Y., Ding, R., & Kong, P. W. (2017). Overall preference of running shoes can be predicted by suitable perception factors using a multiple regression model. *Human Factors*, 59(3), 432-441. <https://doi.org/10.1177/0018720816681147>
- Thompson, F. M., & Coughlin, M. J. (1994). The high price of high-fashion footwear. *The Journal of Bone & Joint Surgery*, 76(10), 1586-1593.  
<https://doi.org/https://doi.org/10.2106/00004623-199410000-00022>
- Tong, A., Sainsbury, P., & Craig, J. (2007). Consolidated criteria for reporting qualitative research (COREQ): A 32-item checklist for interviews and focus groups. *International Journal for Quality in Health Care*, 19(6), 349-357.  
<https://doi.org/10.1093/intqhc/mzm042>

- Tunprasert, T., Langley, B., & Morrison, S. C. (2021). A scoping review on methods for assessing product comfort: Considerations for footwear comfort. *Footwear Science*, *13*(sup1), S95-S97. <https://doi.org/10.1080/19424280.2021.1917700>
- van der Worp, M., ten Haaf, D., van Cingel, R., de Wijer, A., Nijhuis-van der Sanden, M., & Staal, J. (2015). Injuries in runners; a systematic review on risk factors and sex differences. *PLoS One*, *10*(2), e0114937. <https://doi.org/10.1371/journal.pone.0114937>
- Van Gent, R., Siem, D., van Middelkoop, M., Van Os, A., Bierma-Zeinstra, S., & Koes, B. (2007). Incidence and determinants of lower extremity running injuries in long distance runners: A systematic review. *British Journal of Sports Medicine*, *41*(8), 469-480. <https://doi.org/https://doi.org/10.1136/bjism.2006.033548>
- Vink, P., & Hallbeck, S. (2012). Comfort and discomfort studies demonstrate the need for a new model. *Applied Ergonomics*, *43*(2), 271-276. <https://doi.org/doi:10.1016/j.apergo.2011.06.001>
- Walton, P. D., & French, D. P. (2016). What do people think about running barefoot/with minimalist footwear? A thematic analysis. *British Journal of Health Psychology*, *21*(2), 451-468. <https://doi.org/10.1111/bjhp.12180>
- Wang, L., Hong, Y., & Li, J. X. (2012). Durability of running shoes with ethylene vinyl acetate or polyurethane midsoles. *Journal of Sports Sciences*, *30*(16), 1787-1792. <https://doi.org/https://doi.org/10.1080/02640414.2012.723819>
- Wang, L., Xian Li, J., Hong, Y., & He Zhou, J. (2010). Changes in heel cushioning characteristics of running shoes with running mileage. *Footwear Science*, *2*(3), 141-147. <https://doi.org/10.1080/19424280.2010.519348>

- Warne, J. P., Gruber, A. H., Cheung, R., & Bonacci, J. (2021). Training and technique choices predict self-reported running injuries: An international study. *Physical Therapy in Sport*, 48, 83-90. <https://doi.org/10.1016/j.ptsp.2020.12.017>
- Westerman, S. J., Tuck, G. C., Booth, S. A., & Khakzar, K. (2007). Consumer decision support systems: Internet versus in-store application. *Computers in Human Behavior*, 23(6), 2928-2944. <https://doi.org/10.1016/j.chb.2006.06.006>
- Willems, T. M., De Ridder, R., & Roosen, P. (2019). Is consumer behaviour towards footwear predisposing for lower extremity injuries in runners and walkers? A prospective study. *Journal of Foot and Ankle Research*, 12(1), 43. <https://doi.org/10.1186/s13047-019-0354-x>
- Woltho, A., Nielsen, R. O., Willy, R. W., Taylor-Haas, J. A., & Paquette, M. R. (2020). Running shoes, pronation, and injuries: Do beliefs of injury risk factors among running shoe salespersons and physiotherapy students align with current aetiology frameworks? *Footwear Science*, 12(2), 101-111. <https://doi.org/10.1080/19424280.2020.1734869>
- Yamato, T. P., Saragiotto, B. T., & Lopes, A. D. (2015). A consensus definition of running-related injury in recreational runners: A modified Delphi approach. *Journal of Orthopaedic & Sports Physical Therapy*, 45(5), 375-380. <https://doi.org/https://doi.org/10.2519/jospt.2015.5741>
- Zach, S., Xia, Y., Zeev, A., Arnon, M., Choresh, N., & Tenenbaum, G. (2017). Motivation dimensions for running a marathon: A new model emerging from the motivation of marathon scale (MOMS). *Journal of Sport and Health Science*, 6(3), 302-310. <https://doi.org/https://doi.org/10.1016/j.jshs.2015.10.003>

Zaid, S. (2020). The role of familiarity in increasing repurchase intentions in online shopping.

*Journal of Economics, Business, & Accountancy Ventura*, 23(1), 12-18.

<https://doi.org/10.14414/jebav.v23i1.2132>

## Supplementary files for Chapter 2

Search syntax implemented for each database

### **PubMed®:**

((("running"[MeSH Terms] OR "running"[All Fields] OR "runnings"[All Fields] OR "run"[All Fields]) AND ("footwear"[All Fields] OR "shoe\*"[All Fields]) AND ("select\*"[All Fields] OR "purchas\*"[All Fields] OR "choice\*"[All Fields] OR "choos\*"[All Fields] OR "prefer\*"[All Fields] OR "buy"[All Fields] OR "bought"[All Fields])) AND (english[Filter]))

### **Scopus®:**

TITLE-ABS-KEY ( ( running OR run\* ) AND ( footwear OR shoe\* ) AND ( select\* OR purchas\* OR choice\* OR choos\* OR prefer\* OR buy\* OR bought ) ) AND ( LIMIT-TO ( DOCTYPE , "ar" ) ) AND ( LIMIT-TO ( LANGUAGE , "English" ) )

### **Web of Science®:**

TS= ((Running OR run\*) AND (footwear OR shoe\*) AND (select\* OR purchas\* OR choice\* OR choos\* OR prefer\* OR buy\* OR bought)) and Articles (Document Types) and Articles (Document Types) and English (Languages)

### **SPORTDiscus™:**

(Running OR run\*) AND (footwear OR shoe\*) AND (select\* OR purchas\* OR choice\* OR choos\* OR prefer\* OR buy\* OR bought)

Limiters - Publication Type: Academic Journal

Expanders - Apply equivalent subjects

Narrow by Language: - English

Search modes - Boolean/Phrase

## Supplementary files for Chapter 3

Survey for buyers

# In-store Purchase - 2nd draft

---

**Start of Block: Default Question Block**

Q27 How old are you (years)?

---

Q2 What is your gender?

Woman (1)

Man (2)

Non-binary (3)

Other (please specify) (4) \_\_\_\_\_

Prefer not to say (5)

---

Q3 Which of the following best describes you?

- Asian (1)
  - Black or African American (2)
  - European (3)
  - Hispanic or Latino (4)
  - American Indian or Alaska Native (5)
  - White (6)
  - Multiracial or Biracial (7)
  - Southeast Asian (8)
  - Other (please specify) (9) \_\_\_\_\_
  - Prefer not to answer (10)
- 

Q4 How many years have you been running regularly (at least once per week)?

\_\_\_\_\_

---

Q5 What is your average weekly training over the last month?

Sessions per week:

\_\_\_\_\_

---

Q6 What is your average weekly training over the last month?

Miles per week:

---

---

Q9 Do you race competitively?

Yes (1)

No (2)

---

Q17 Do you consider running as your main sport-related activity?

Yes (1)

No (2)

---

Q18 Where do you get advice or information on running shoes?

- Friends (1)
  - Family (2)
  - Running club/group (3)
  - Professional of elite athletes (4)
  - Coach (5)
  - Running shoe store online (7)
  - Running shoe store in-person (8)
  - Healthcare Professional (9)
  - Scientific literature (10)
  - Advertisements (11)
  - Running websites (12)
  - Manufacturer (13)
  - Social media (14)
  - Other (please specify) (15)
- 
- None of the above (16)

*Carry Forward Selected Choices from "Where do you get advice or information on running shoes?"*



Q19 Based on your answer above, rank the top three in order of importance

(1 being the most important factor)

- \_\_\_\_\_ Friends (1)
  - \_\_\_\_\_ Family (2)
  - \_\_\_\_\_ Running club/group (3)
  - \_\_\_\_\_ Professional of elite athletes (4)
  - \_\_\_\_\_ Coach (5)
  - \_\_\_\_\_ Running shoe store online (6)
  - \_\_\_\_\_ Running shoe store in-person (7)
  - \_\_\_\_\_ Healthcare Professional (8)
  - \_\_\_\_\_ Scientific literature (9)
  - \_\_\_\_\_ Advertisements (10)
  - \_\_\_\_\_ Running websites (11)
  - \_\_\_\_\_ Manufacturer (12)
  - \_\_\_\_\_ Social media (13)
  - \_\_\_\_\_ Other (please specify) (14)
  - \_\_\_\_\_ None of the above (15)
-

Q15 What factors influenced you when buying your running shoes? (Check all that apply).

- Based on gait analysis, running mechanics (20)
- Brand (2)
- Color (1)
- Comfort (8)
- Fit (7)
- Injury prevention (9)
- Performance (10)
- Price (4)
- Recommendation from coach (14)
- Recommendation from healthcare provider (15)
- Recommendation from peers (12)
- Recommendations from store associate (13)
- Reviews (16)
- Same model that you normally wear (5)
- Scientific literature (17)
- Specifications and technologies (i.e heel-toe drop, heel height, mass, neutral, stability, motion control etc.) (6)
- Style (3)

Other (Please specify) (18)

---

None of the above (19)

---

*Carry Forward Selected Choices from "What factors influenced you when buying your running shoes? (Check all that apply)."*



Q24 Based on your answer above, rank the top three in order of importance.

(1 being the most important factor).

- \_\_\_\_\_ Based on gait analysis, running mechanics (1)
  - \_\_\_\_\_ Brand (2)
  - \_\_\_\_\_ Color (3)
  - \_\_\_\_\_ Comfort (4)
  - \_\_\_\_\_ Fit (5)
  - \_\_\_\_\_ Injury prevention (6)
  - \_\_\_\_\_ Performance (7)
  - \_\_\_\_\_ Price (8)
  - \_\_\_\_\_ Recommendation from coach (9)
  - \_\_\_\_\_ Recommendation from healthcare provider (10)
  - \_\_\_\_\_ Recommendation from peers (11)
  - \_\_\_\_\_ Recommendations from store associate (12)
  - \_\_\_\_\_ Reviews (13)
  - \_\_\_\_\_ Same model that you normally wear (14)
  - \_\_\_\_\_ Scientific literature (15)
  - \_\_\_\_\_ Specifications and technologies (i.e heel-toe drop, heel height, mass, neutral, stability, motion control etc.) (16)
  - \_\_\_\_\_ Style (17)
  - \_\_\_\_\_ Other (Please specify) (18)
  - \_\_\_\_\_ None of the above (19)
-

Q25 Did you buy your shoes today based on the factors that you selected in question 10?

Yes (1)

No (2)

If no, please explain (3) \_\_\_\_\_

---

Q12 Did the sales associate influence your shoe selection?

No, they did not change how I selected my running shoes    Neutral/Uncertain    Yes, definitely

0   10   20   30   40   50   60   70   80   90   100

Please move slider ()



Q26 Where do you typically purchase your running shoes?

- Manufacturer physical location (1)
  - Manufacturer website (Nike, Adidas, Brooks) (2)
  - Multi-sport online store (Zappos, DSW, etc.) (3)
  - Multi-sport store (i.e. Scheels, REI, Big 5, etc.) (4)
  - Running event (5)
  - Specialty online running store (6)
  - Specialty running store (7)
  - Other (please specify) (8) \_\_\_\_\_
- 

Q27 Why did you come to a specialty running store instead of going elsewhere to buy shoes?

- Access to other running gear (1)
  - Biomechanical or gait analysis (2)
  - Employee expertise (3)
  - Selection (4)
  - Support local running community (5)
  - Try on shoes (6)
  - Other (7) \_\_\_\_\_
-

Q28 In your experience, why is it important to find the right running shoe?

---

Q29 Have you experienced a running-related injury in the last 6 months based on the following definition? Running related (training or competition) musculoskeletal pain in the lower limbs that causes a restriction on or stoppage of running (distance, speed, duration, or training) for at least 7 days or 3 consecutive scheduled training sessions, or that requires the runner to consult a physician or other health professional.

Yes (1)

No (2)

Q30 If yes, indicate the location of the injury. Please select all that apply.

Foot (1)

Ankle (2)

Lower leg (3)

Knee (4)

Thigh (5)

Hip (6)

Pelvis (7)

Low Back (8)

Other (9) \_\_\_\_\_

Q34 What did you buy?

---

Q33 How expensive was it?

---

Q32 Did you know the product before you went on the shopping trip?

Yes (1)

No (2)

Q14 How much did you think about the product between seeing it for the first time and buying it?

Not at all      Neutral amount      Very Much  
0   10   20   30   40   50   60   70   80   90   100

Please move slider ()	
-----------------------	--

Q36 How much did you think about making your purchase?

Not at all      Neutral amount      Very Much  
0   10   20   30   40   50   60   70   80   90   100

---

Please move slider ()



---

Page Break

**End of Block: Default Question Block**

---

Survey for non-buyers

# In-store No Purchase

---

**Start of Block: Default Question Block**

Page Break

---

Q26 How old are you (years)?

---

Q2 What is your gender?

Woman (1)

Man (2)

Non-binary (3)

Other (please specify) (4) \_\_\_\_\_

Prefer not to say (5)

---

Q3 Which of the following best describes you?

- Asian (1)
  - Black or African American (2)
  - European (3)
  - Hispanic or Latino (4)
  - American Indian or Alaska Native (5)
  - White (6)
  - Multiracial or Biracial (7)
  - Southeast Asian (8)
  - Other (please specify) (9) \_\_\_\_\_
  - Prefer not to answer (10)
- 

Q4 How many years have you been running regularly (at least once per week)?

\_\_\_\_\_

---

Q5 What is your average weekly training over the last month?

Sessions per week:

\_\_\_\_\_

---

Q6 What is your average weekly training over the last month?

Miles per week:

---

---

Q9 Do you race competitively?

Yes (1)

No (2)

---

Q17 Do you consider running as your main sport-related activity?

Yes (1)

No (2)

---

Q18 Where do you get advice or information on running shoes?

- Friends (1)
  - Family (2)
  - Running club/group (3)
  - Professional of elite athletes (4)
  - Coach (5)
  - Running shoe store online (7)
  - Running shoe store in-person (8)
  - Healthcare Professional (9)
  - Scientific literature (10)
  - Advertisements (11)
  - Running websites (12)
  - Manufacturer (13)
  - Social media (14)
  - Other (please specify) (15)
- 
- None of the above (16)

*Carry Forward Selected Choices from "Where do you get advice or information on running shoes?"*



Q19 Based on your answer above, rank the top three in order of importance

(1 being the most important factor)

- \_\_\_\_\_ Friends (1)
  - \_\_\_\_\_ Family (2)
  - \_\_\_\_\_ Running club/group (3)
  - \_\_\_\_\_ Professional of elite athletes (4)
  - \_\_\_\_\_ Coach (5)
  - \_\_\_\_\_ Running shoe store online (6)
  - \_\_\_\_\_ Running shoe store in-person (7)
  - \_\_\_\_\_ Healthcare Professional (8)
  - \_\_\_\_\_ Scientific literature (9)
  - \_\_\_\_\_ Advertisements (10)
  - \_\_\_\_\_ Running websites (11)
  - \_\_\_\_\_ Manufacturer (12)
  - \_\_\_\_\_ Social media (13)
  - \_\_\_\_\_ Other (please specify) (14)
  - \_\_\_\_\_ None of the above (15)
-

Q15 What factors influenced you when buying your running shoes? (Check all that apply).

- Color (1)
- Brand (2)
- Style (3)
- Price (4)
- Same model that you normally wear (5)
- Specifications and technologies (i.e heel-toe drop, heel height, mass, neutral, stability, motion control etc.) (6)
- Fit (7)
- Comfort (8)
- Injury prevention (9)
- Performance (10)
- Based on gait analysis, running mechanics (11)
- Recommendation from peers (12)
- Recommendations from store associate (13)
- Recommendation from coach (14)
- Recommendation from healthcare provider (15)
- Reviews (16)
- Scientific literature (17)

Other (Please specify) (18)

---

None of the above (19)

---

*Carry Forward Selected Choices from "What factors influenced you when buying your running shoes? (Check all that apply)."*



Q24 Based on your answer above, rank the top three in order of importance.

(1 being the most important factor).

- \_\_\_\_\_ Color (1)
  - \_\_\_\_\_ Brand (2)
  - \_\_\_\_\_ Style (3)
  - \_\_\_\_\_ Price (4)
  - \_\_\_\_\_ Same model that you normally wear (5)
  - \_\_\_\_\_ Specifications and technologies (i.e heel-toe drop, heel height, mass, neutral, stability, motion control etc.) (6)
  - \_\_\_\_\_ Fit (7)
  - \_\_\_\_\_ Comfort (8)
  - \_\_\_\_\_ Injury prevention (9)
  - \_\_\_\_\_ Performance (10)
  - \_\_\_\_\_ Based on gait analysis, running mechanics (11)
  - \_\_\_\_\_ Recommendation from peers (12)
  - \_\_\_\_\_ Recommendations from store associate (13)
  - \_\_\_\_\_ Recommendation from coach (14)
  - \_\_\_\_\_ Recommendation from healthcare provider (15)
  - \_\_\_\_\_ Reviews (16)
  - \_\_\_\_\_ Scientific literature (17)
  - \_\_\_\_\_ Other (Please specify) (18)
  - \_\_\_\_\_ None of the above (19)
-

Q25 Why did you not buy shoes today?

- Did not have my size (2)
  - Just browsing (7)
  - Not the right fit (8)
  - Shoes were not comfortable (9)
  - Too expensive (10)
  - Will buy it online instead (11)
  - Other (please specify) (12)
- 

Q12 Did the sales associate influence your shoe selection?

No, they did not change how I selected my running shoes    Neutral/Uncertain    Yes, definitely

0 10 20 30 40 50 60 70 80 90 100

Please move slider ( )



Q26 Where do you typically purchase your running shoes?

- Manufacturer physical location (1)
  - Manufacturer website (Nike, Adidas, Brooks) (2)
  - Multi-sport online sstore (Zappos, DSW, etc.) (3)
  - Multi-sport store (i.e. Scheels, REI, Big 5, etc.) (4)
  - Running event (5)
  - Specialty online running store (6)
  - Specialty running store (7)
  - Other (please specify) (8) \_\_\_\_\_
- 

Q27 Why did you come to a specialty running store instead of going elsewhere to buy shoes?

- Access to other running gear (1)
  - Biomechanical or gait analysis (2)
  - Employee expertise (3)
  - Selection (4)
  - Support local running community (5)
  - Try on shoes (6)
  - Other (7) \_\_\_\_\_
-

Q28 In your experience, why is it important to find the right running shoe?

---

Q29 Have you experienced a running-related injury in the last 6 months based on the following definition? Running related (training or competition) musculoskeletal pain in the lower limbs that causes a restriction on or stoppage of running (distance, speed, duration, or training) for at least 7 days or 3 consecutive scheduled training sessions, or that requires the runner to consult a physician or other health professional.

Yes (1)

No (2)

Q30 If yes, indicate the location of the injury. Please select all that apply.

Foot (1)

Ankle (2)

Lower leg (3)

Knee (4)

Thigh (5)

Hip (6)

Pelvis (7)

Low Back (8)

Other (9) \_\_\_\_\_

---

Q34 What did you want to buy?

---

---

Q33 How expensive was it?

---

---

Q32 Did you know the product before you went on the shopping trip?

- Yes (1)
- No (2)

---

Q36 How much did you think about making your purchase?

Not at all      Neutral amount      Very Much

0   10   20   30   40   50   60   70   80   90   100

---

Please move slider ()



---

Page Break

---

**End of Block: Default Question Block**

---

## Supplementary files for Chapter 4

Survey for salespeople

# Sales survey

---

### Start of Block: Default Question Block

Q27 How old are you (years)?

---

Q2 What is your gender?

Woman (1)

Man (2)

Non-binary (3)

Other (please specify) (4) \_\_\_\_\_

Prefer not to say (5)

Q3 Which of the following best describes you?

- Asian (1)
  - Black or African American (2)
  - European (3)
  - Hispanic or Latino (4)
  - American Indian or Alaska Native (5)
  - White (6)
  - Multiracial or Biracial (7)
  - Southeast Asian (8)
  - Other (please specify) (9) \_\_\_\_\_
  - Prefer not to answer (10)
- 

Q17 Do you run?

- Yes (1)
  - No (2)
- 

Q28 Do you race competitively?

- Yes (1)
- No (2)

---

Q29 How long have you been selling running shoes? (years)

---

---

Q30 Please describe your usual process of shoe selection with a customer

---

Q18 Where do you get your education/information about running shoes?

- Advertisements (1)
  - Coach (2)
  - Colleagues (3)
  - Friends (4)
  - Healthcare Professionals (5)
  - Manufacturer (7)
  - Professional or elite athletes (8)
  - Running club/group (9)
  - Running shoe store online (10)
  - Running shoe store in-person (11)
  - Running websites (12)
  - Sales Representatives (14)
  - Scientific literature (15)
  - Social media (17)
  - Other (please specify) (18)
- 
- None of the above (16)
-



Q19 Based on your answer above, rank the top three in order of importance

(1 being the most important factor)

- Advertisements (1)
  - Coach (2)
  - Colleagues (3)
  - Friends (4)
  - Healthcare Professionals (5)
  - Manufacturer (6)
  - Professional or elite athletes (7)
  - Running club/group (8)
  - Running shoe store online (9)
  - Running shoe store in-person (10)
  - Running websites (11)
  - Sales Representatives (12)
  - Scientific literature (13)
  - Social media (14)
  - Other (please specify) (15)
  - None of the above (16)
-

Q15 What factors do you believe influence the customers shoe selection? (Check all that apply).

- Based on gait analysis, running mechanics (20)
- Brand (2)
- Color (1)
- Comfort (8)
- Fit (7)
- Injury prevention (9)
- Performance (10)
- Price (4)
- Recommendation from coach (14)
- Recommendation from healthcare provider (15)
- Recommendation from peers (12)
- Recommendations from store associate (13)
- Reviews (16)
- Same model that you normally wear (5)
- Scientific literature (17)
- Specifications and technologies (i.e heel-toe drop, heel height, mass, neutral, stability, motion control etc.) (6)
- Style (3)

Other (Please specify) (18)

---

None of the above (19)

*Carry Forward Selected Choices from "What factors do you believe influence the customers shoe selection? (Check all that apply)."*



Q24 Based on your answer above, rank the top three in order of importance.

(1 being the most important factor).

- \_\_\_\_\_ Based on gait analysis, running mechanics (1)
  - \_\_\_\_\_ Brand (2)
  - \_\_\_\_\_ Color (3)
  - \_\_\_\_\_ Comfort (4)
  - \_\_\_\_\_ Fit (5)
  - \_\_\_\_\_ Injury prevention (6)
  - \_\_\_\_\_ Performance (7)
  - \_\_\_\_\_ Price (8)
  - \_\_\_\_\_ Recommendation from coach (9)
  - \_\_\_\_\_ Recommendation from healthcare provider (10)
  - \_\_\_\_\_ Recommendation from peers (11)
  - \_\_\_\_\_ Recommendations from store associate (12)
  - \_\_\_\_\_ Reviews (13)
  - \_\_\_\_\_ Same model that you normally wear (14)
  - \_\_\_\_\_ Scientific literature (15)
  - \_\_\_\_\_ Specifications and technologies (i.e heel-toe drop, heel height, mass, neutral, stability, motion control etc.) (16)
  - \_\_\_\_\_ Style (17)
  - \_\_\_\_\_ Other (Please specify) (18)
  - \_\_\_\_\_ None of the above (19)
-

Q31 Why do you think some customers do not end up buying the shoes that they choose?

- Size (1)
  - Fit (2)
  - Price (3)
  - Comfort (4)
  - Will buy it online instead (5)
  - Just browsing (6)
  - Other (please specify) (7) \_\_\_\_\_
- 

Q25 Why do you think some customers do not end up buying the shoes that they choose?

\_\_\_\_\_

---

Q12 In your experience, do you believe that you influence the customer's shoe selection?

No, I do not believe that I influence a customer's running shoe selection      Neutral/Uncertain      Yes, definitely

0   10   20   30   40   50   60   70   80   90   100

Please move slider ()



Q26 Many brands offer incentives to boost sales. Does this affect your shoe recommendation?

- Yes, more likely to recommend incentivized product (1)
  - Yes, less likely to recommend incentivized product (2)
  - No, it has no effect on my shoe recommendation (3)
  - Unsure (4)
- 

Q27 In your experience, why is it important to find the right shoe for runners?

---

**End of Block: Default Question Block**

---

## Interview questions

1. Please describe your usual process of shoe selection
2. Why do you think some runners do not end up buying the shoes that they choose?
3. In your experience, why is it important to find the right running shoe?

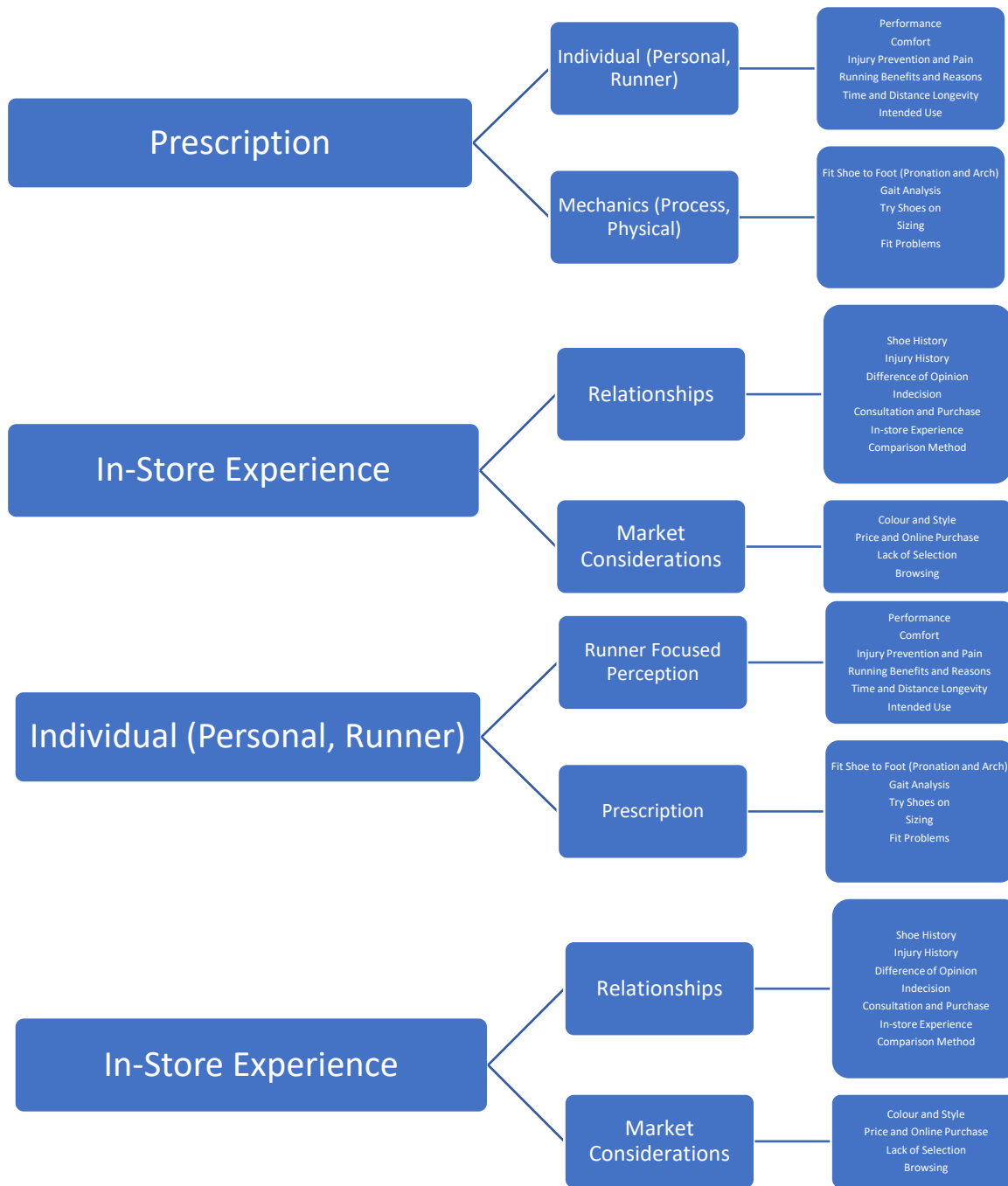
## Data ranges of salespeople interviews

<b>N=</b>	<b>Store Name</b>	<b>Interview (minutes)</b>	<b>Gender</b>	<b>Age (years)</b>	<b>Shoe Sales (years)</b>
<i>N=3</i>	Fleet Feet	2:20-4:30	2M, 1F	24.8-28.8	0.8-5.5
<i>N=2</i>	Bellingham Bay Running	1:31-9:16	2F	23.5-29.6	2.5-4.7
<i>N=5</i>	Fleet Feet	2:32-3:23	2M, 3F	22.7-27.8	0.5-2.3
<i>N=2</i>	Everyday Athlete	1:38-3:09	2M	20.2-31.6	3.2-17
<i>N=11</i>	Fairhaven Runners	1:10-9:31	9M, 2F	20.8-40.8	0.3-13.3
<i>N=11</i>	Super Jock 'n' Jill	1:39-7:57	9M, 2F	19-52.9	0.1-32.9
<i>N=3</i>	Super Jock 'n' Jill	1:48-3:21	3M	18.8-25.9	0.2-4.8
<i>N=1</i>	Skagit Running Co.	1:45	1F	24.3	1.5

Evolution of themes and subthemes

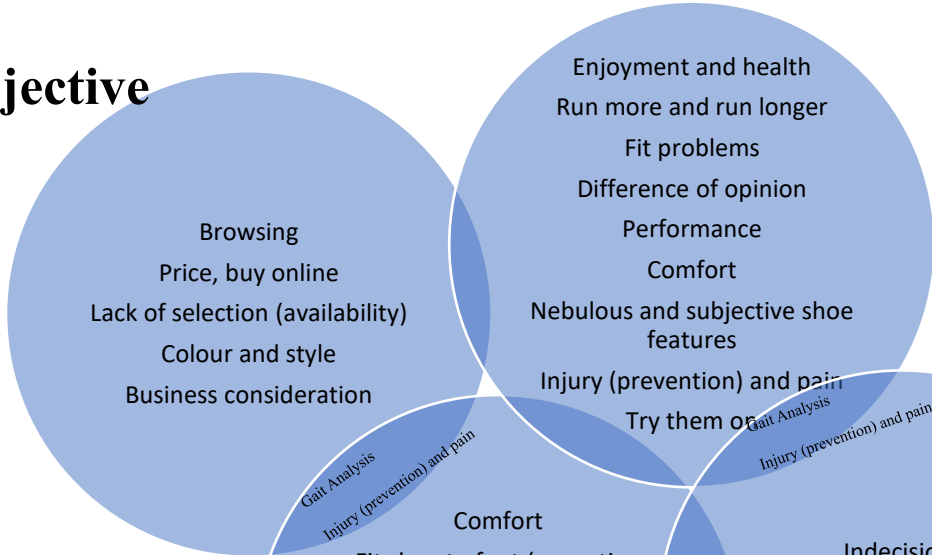
<b>Physical (business)</b>	<b>Emotional (expertise)</b>
Runner-Sales relationship Business: gain rapport, communicate Emotional: respect, trust, confidence, authority	
	Interviewing the runner
Business	Put some shoes on
<u>Make a sale subtheme:</u> Gait analysis Subjective shoe features	Runner goals Expertise Shoes solving a problem Conflict? Between sales/run and sales/med prof

<b>Theme one: Business focused</b>	<b>Theme two: Runner focused</b>
	Shoes solving a problem
Runner-Sales relationship	Put some shoes on
Expertise	Subjective shoe features
Business	Runner goals
Gait analysis	Interviewing the runner



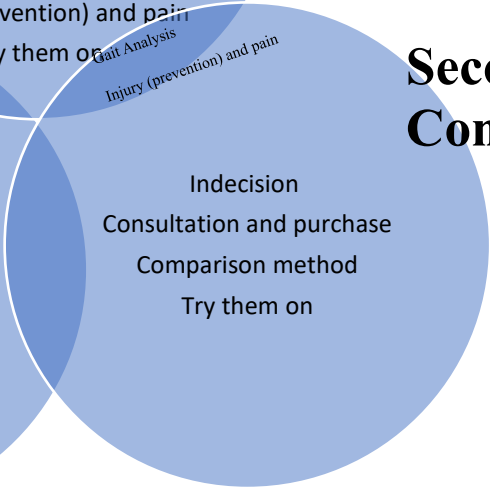
And

# Objective



# Subjective

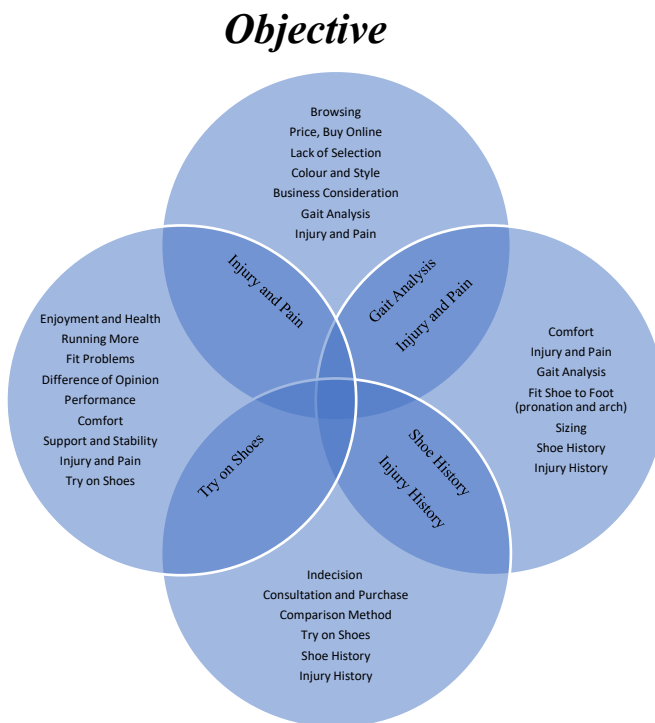
# Secondary Considerations



# Primary Consideration

# Runner Selection

*Subjective*



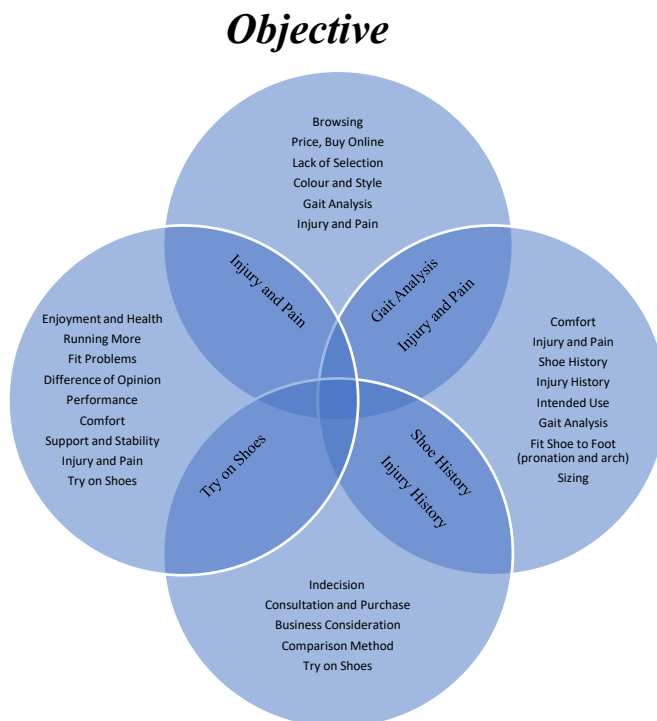
*Primary Considerations*

*Secondary Considerations*

**Salespeople Recommendations**

# Runner Selection

*Subjective*



*Secondary Considerations*

*Primary Considerations*

**Salespeople Recommendations**

## Summary of themes and subthemes

Theme	Category of subtheme	Subtheme
Runner Shoe Selection	Objective	Browsing
		Price, Buy Online
		Lack of Selection
		Colour and Style
		Gait Analysis
		Injury and Pain
		Injury and Pain
Subjective	Subjective	Enjoyment and Health
		Running More
		Fit Problems
		Difference in Opinion
		Performance
		Comfort
		Comfort

		Support and Stability
		Injury and Pain
		Try on Shoes
Salespeople Shoe Recommendation	Primary Considerations	Comfort
		Injury and Pain
		Gait Analysis
		Fit Shoe to Foot (pronation/arch)
		Sizing
		Shoe History
		Injury History
	Secondary Considerations	Indecision
		Consultation and Purchase
		Comparison Method
		Try on Shoes
		Shoe History
		Injury History
		Business Consideration

Note. Some subthemes can be categorised in multiple ways. For example, shoe and injury history are listed in both the primary and secondary considerations for when salespeople make recommendations. This is because some salespeople consider the history of the runner to be key to their recommendation process, whereas others place less emphasis on its importance.

# Supplementary files for Chapter 5

## Recruitment flyer general

Hi there! My name is Andrew Fife, and I am a PhD student at the University of Waikato in New Zealand, but currently operating out of Bellingham, WA.

I am recruiting runners for a research project in the Bellingham and Seattle area. We are tracking how an educational presentation influences comfort and satisfaction in new running shoes, and those factors over time. We also want to know what runners look for when they select their shoes.

I need runners that are willing to participate over a three-month study that involves an educational presentation and the purchase of new shoes. While this study takes place over several months, the time and energy commitment is quite small. The presentation is under eight minutes, and each of the three main surveys take 5-10 minutes.



Are you planning on buying new shoes for road running?  
Have you been a runner for a month or longer?  
Do you run 1x a week or more?  
Save \$10/10% local stores!\*



*We are looking for runners to participate in an online research project.  
Runners will have to fill out three online surveys over a three month period.*



\*Some exclusions may apply

Please contact Andrew by phone: (208) 874-7132 or  
email: [af150@students.waikato.ac.nz](mailto:af150@students.waikato.ac.nz)



Please give me a call for more information and to get started. The requirements to join are in the graphic above.

**Please pass this invitation to anyone that you know that would be willing to help.**

Thanks in advance!

Runners need to be 18 and older



Before first use survey

# Before 1st use

---

## Start of Block: demographics

Q35 What is your study participant ID number?

---

Q1 When is your birthday?

Please select month (3)

▼ January (1) ... December (12)

Q8 When is your birthday?

Please select year (4)

▼ 2005 (1) ... 1924 (82)

Q2 What is your gender?

- Woman (1)
  - Man (2)
  - Other (please specify) (4) \_\_\_\_\_
  - Prefer not to say (5)
- 

Q3 Which of the following best describes you?

- Asian (1)
  - American Indian or Alaska Native (5)
  - Black or African American (2)
  - Hispanic or Latino (4)
  - Native Hawaiian or other Pacific Islander (7)
  - White (6)
  - Other (please specify) (9) \_\_\_\_\_
  - Prefer not to answer (10)
- 

Page Break \_\_\_\_\_

Q4 How many years have you been running regularly (at least once per week)?

Please select an answer (1)

▼ Less than 1 year (1) ... More than 3 years (3)

---

Q5 Think about the last month...

On average, how many sessions did you run per week?

Average sessions per week (4)

▼ 1 (1) ... 15 + (15)

---

Q6 Think about the last month...

On average, how far did you run per week?

Average distance per week (4)

▼ 1 miles, or 2 kilometers (1) ... More (121)

---

Page Break

---

Q59 Do you consider yourself a competitive runner?

Yes (1)

No (2)

---

Q9 Did you participate in any races over the last year?

Yes (1)

No (2)

---

*Display This Question:*

*If Did you participate in any races over the last year? = Yes*

Q28 What events do you compete in? Check all that apply

- Less than 400 meters (12)
  - 400-800 meter (1)
  - 1500-3200 meter (6)
  - 5k (7)
  - 8k to 10k (8)
  - Half-marathon (9)
  - Marathon (10)
  - Ultra-marathon (11)
  - Other (please specify) (13)
- 

-----  
Page Break

---

**End of Block: demographics**

---

**Start of Block: Loop for more than one pair of shoes**

Display This Question:

*If Loop all: Are you currently running in an another pair of shoes? != No*

Q37 Which shoes are you running in currently?

- Make (e.g., Brooks) (1) \_\_\_\_\_
- Model (e.g., Ghost 13) (2) \_\_\_\_\_
- Men's or women's sizing (i.e., M/W) (7)  
\_\_\_\_\_
- Size (e.g., 10.5) (8) \_\_\_\_\_
- Cost in USD (6) \_\_\_\_\_

---

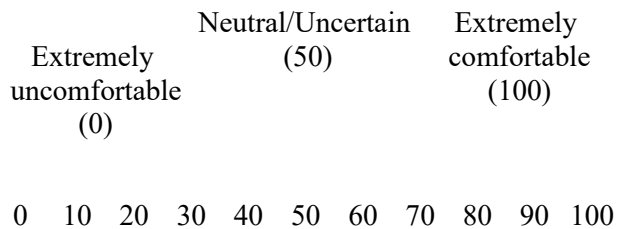
Page Break

Display This Question:

*If Loop all: Are you currently running in an another pair of shoes? != No*

Q38 With regards to the shoes that you are currently running in...

How comfortable are you in this pair of running shoes?



Please move slider ()



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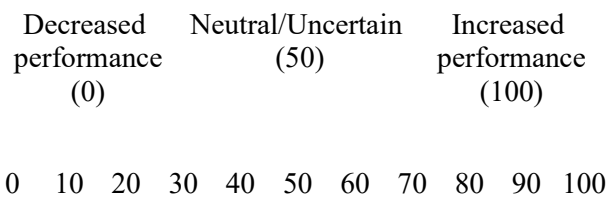
Page Break

Display This Question:

*If Loop all: Are you currently running in an another pair of shoes? != No*

Q39 With regards to the shoes that you are currently running in...

How does this pair of running shoes influence your running performance?



Please move slider ()



---

Page Break

*Display This Question:*

*If Loop all: Are you currently running in an another pair of shoes? != No*

Q41 Are you currently running in an another pair of shoes?

Yes (1)

No (2)

**End of Block: Loop for more than one pair of shoes**

---

**Start of Block: Shoes for the survey**

Q10 What shoes did you purchase as part of the survey?

Make (e.g., Brooks) (1) \_\_\_\_\_

Model (e.g., Ghost 13) (2) \_\_\_\_\_

Size (US) (e.g., 10.5) (3) \_\_\_\_\_

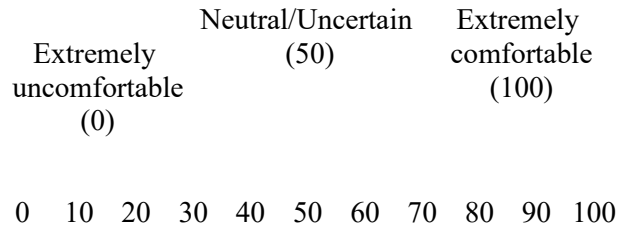
Men's or Women's sizing (i.e., M/W) (4)  
\_\_\_\_\_

Cost in USD (5) \_\_\_\_\_

-----  
Page Break \_\_\_\_\_

Q33 With regards to the shoes you purchased as part of the survey...

How comfortable are you in your new running shoes?



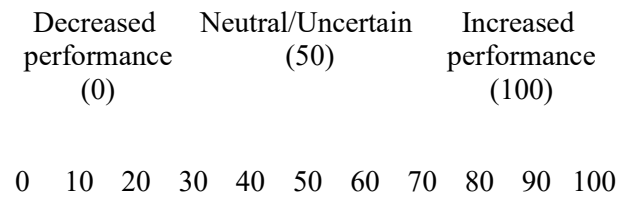
Please move slider ()

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Page Break

Q34 With regards to the shoes you purchased as part of the survey...

How do you believe your new running shoes will influence your running performance?



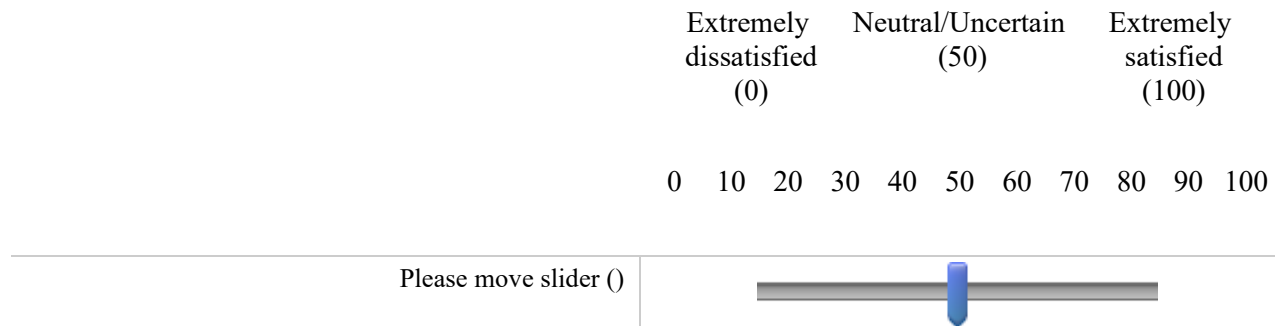
Please move slider ()

---

Page Break

Q12 With regards to the shoes you purchased as part of the survey...

How satisfied are you with your purchase at this time?



---

Page Break

Q60 From which store did you purchase your shoes for the study?

- Ballard Fleet Feet (1)
  - BBay Running (2)
  - Capitol Hill Fleet Feet (3)
  - Everyday Athlete (4)
  - Fairhaven Runners (5)
  - Green Lake Super Jock 'n Jill (6)
  - Redmond Super Jock 'n Jill (7)
  - Skagit Running Co (8)
-

Q15 What factors influenced you when buying your running shoes? (Check all that apply).

- Based on gait analysis, running mechanics (11)
- Educational module from study (20)
- Fit (7)
- Footwear brand (2)
- Footwear colour (1)
- Footwear comfort (8)
- Footwear style (3)
- Injury prevention (9)
- Performance (10)
- Price (4)
- Recommendation from coach (14)
- Recommendation from healthcare provider (15)
- Recommendation from peers (12)
- Recommendations from reviews (16)
- Recommendations from store associate (13)
- Sales experience (22)
- Scientific literature (17)
- Shoe cushioning (23)

Shoe feel (21)

Shoe features and technologies (i.e heel-toe drop, heel height, mass, neutral, stability, motion control etc.) (6)

Similar model to what you normally wear (5)

Other (Please specify) (18)

---

*Carry Forward Selected Choices from "What factors influenced you when buying your running shoes? (Check all that apply)."*



Q16 Based on your previous answer, rank them in order of importance. (First being the most important factor).

Rank the factors by clicking and dragging them into place

- \_\_\_\_\_ Based on gait analysis, running mechanics (1)
- \_\_\_\_\_ Educational module from study (2)
- \_\_\_\_\_ Fit (3)
- \_\_\_\_\_ Footwear brand (4)
- \_\_\_\_\_ Footwear colour (5)
- \_\_\_\_\_ Footwear comfort (6)
- \_\_\_\_\_ Footwear style (7)
- \_\_\_\_\_ Injury prevention (8)
- \_\_\_\_\_ Performance (9)
- \_\_\_\_\_ Price (10)
- \_\_\_\_\_ Recommendation from coach (11)
- \_\_\_\_\_ Recommendation from healthcare provider (12)
- \_\_\_\_\_ Recommendation from peers (13)
- \_\_\_\_\_ Recommendations from reviews (14)
- \_\_\_\_\_ Recommendations from store associate (15)
- \_\_\_\_\_ Sales experience (16)
- \_\_\_\_\_ Scientific literature (17)
- \_\_\_\_\_ Shoe cushioning (18)
- \_\_\_\_\_ Shoe feel (19)
- \_\_\_\_\_ Shoe features and technologies (i.e heel-toe drop, heel height, mass, neutral, stability, motion control etc.) (20)
- \_\_\_\_\_ Similar model to what you normally wear (21)
- \_\_\_\_\_ Other (Please specify) (22)

---

Q17 Did the educational module influence how you selected your new pair of running shoes?

No, it did not influence how I selected my shoes (0)	Neutral/Uncertain (50)	Yes, it did influence how I selected my shoes (100)								
0	10	20	30	40	50	60	70	80	90	100

Please move slider ( )



Q18 Why or why not? Please explain.

---

**End of Block: Shoes for the survey**

---

**Start of Block: thought qs and ending**

Q23 Were you familiar with the shoes before you went on the shopping trip?

Yes (1)

No (2)

---

Q24 How much did you think about your shoes between seeing them for the first time and buying them?

Not at all      Neutral amount      Very much  
(0)                      (50)                      (100)

0   10   20   30   40   50   60   70   80   90   100

---

Please move slider ()




---

Page Break

Q25 How much did you think about making your purchase?

Not at all      Neutral amount      Very much  
(0)                      (50)                      (100)

0   10   20   30   40   50   60   70   80   90   100

Please move slider ()	
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---

Page Break

Q26 Before you finish the survey, do you have any additional comments?

---

**End of Block: thought qs and ending**

---

One month post-purchase

# Online RCT Follow-up 1 month

---

**Start of Block: Default Question Block**

Q18 What is your Participant ID number?

---

Q2 Think about the last month...

On average, how many sessions did you run per week?

Average sessions per week (4)

▼ 1 (1) ... 15 + (15)

Q3 Think about the last month...

On average, how far did you run per week?

Average distance per week (4)

▼ 1 miles, or 2 kilometers (1) ... More (121)

Q20 Think about the last month...

What percentage of your running volume (sessions and distance) took place in the shoes that you

purchased for the study?

Choose a percentage here (4)

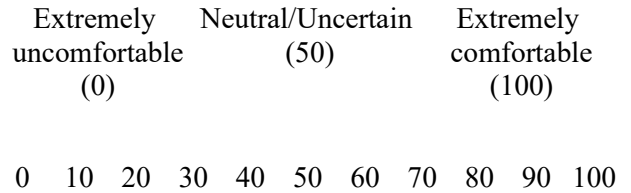
▼ 0% (1) ... 100% (11)

---

Page Break

Q5 In relation to the shoes that you purchased for the study...

How comfortable are you in your purchased running shoes?



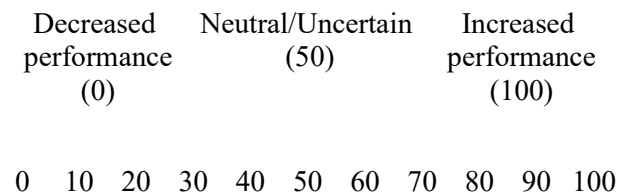
Please move slider () 

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Page Break

Q16 In relation to the shoes that you purchased for the study...

How do your purchased running shoes influence your running performance?

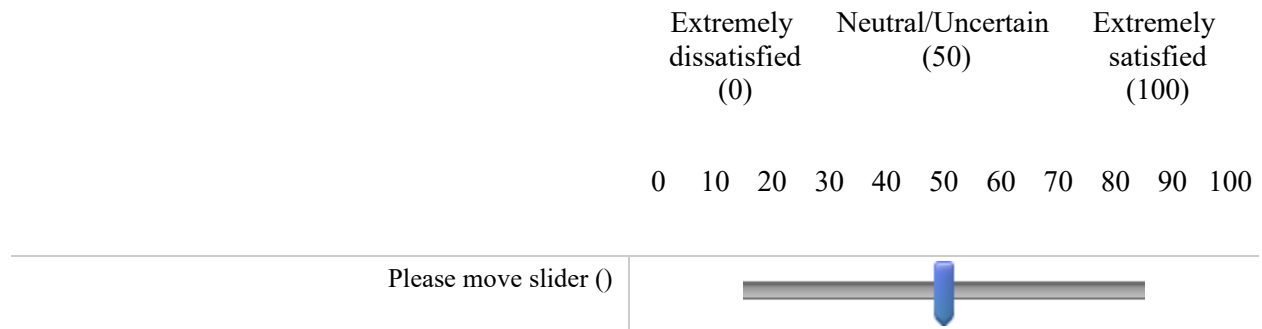


Please move slider () 

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Page Break

Q4 How satisfied are you with your purchase at this time?



---

Page Break

Q9 Have you become injured while using the shoes you bought for the study?

*Running related (training or competition) musculoskeletal pain in the lower limbs or low back that causes a restriction on or stoppage of running (distance, speed, duration, or training) for at least 7 days or 3 consecutive scheduled training sessions, or that requires the runner to consult a physician or other health professional.*

- Yes (1)
- No (2)

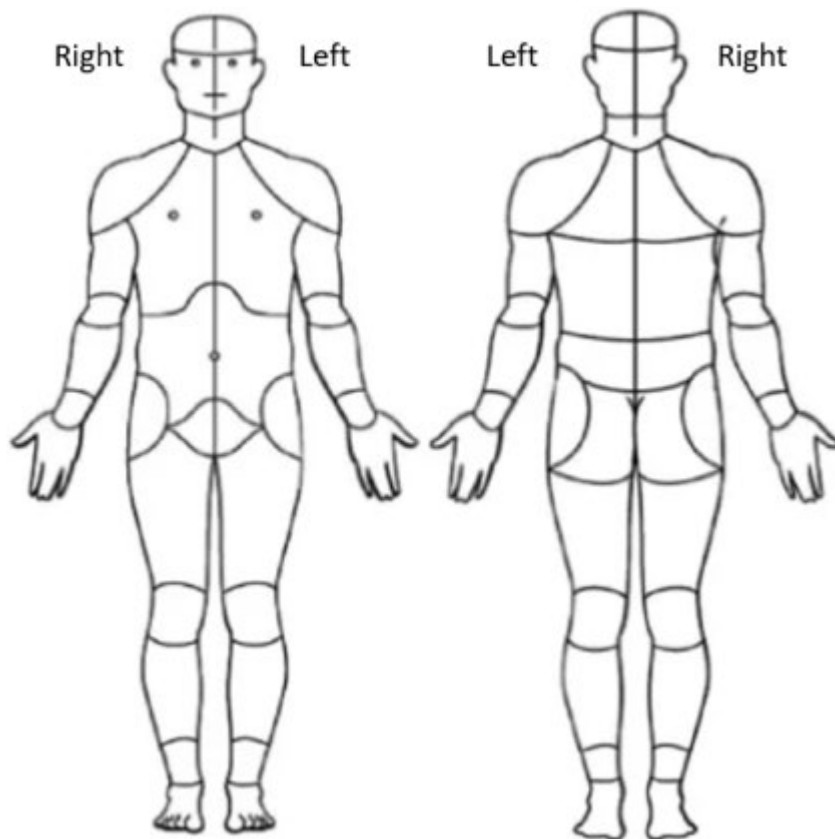
*Skip To: Q12 If Have you become injured while using the shoes you bought for the study? Running related (trainin... = No*

---

Page Break

Q16 If yes, where are you hurt?

	Off (1)	On (2)
Pelvis (62)		
Back Thigh Left (63)		
Foot Back Right (64)		
Foot Back Left (65)		
Front Right Hip (66)		
Knee Back Left (67)		
Lower Leg Back Left (68)		
Buttocks (69)		
Ankle Back Right (70)		
Ankle Back Left (71)		
Lower Leg Back Right (72)		
Knee Back Right (73)		
Knee Front Right (74)		
Knee Front Left (75)		
Lower Leg Front Right (76)		
Lower Leg Front Left (77)		
Ankle Front Right (78)		
Ankle Front Left (79)		
Foot Front Right (80)		
Foot Front Left (81)		
Back Thigh Right (82)		
Front Thigh Right (83)		
Front Thigh Left (84)		
Front Left Hip (85)		
Back Left Hip (86)		
Back Right Hip (87)		
Low Back (88)		



---

Page Break

Q12 Before you finish the survey, do you have any additional comments?

---

**End of Block: Default Question Block**

---

Three months post-purchase

# Online RCT Follow-up 3 month

---

## Start of Block: Default Question Block

Q18 What is your Participant ID number?

---

Q2 Think about the last month...

On average, how many sessions did you run per week?

Average sessions per week (4)

▼ 1 (1) ... 15 + (15)

Q3 Think about the last month...

On average, how far did you run per week?

Average distance per week (4)

▼ 1 miles, or 2 kilometers (1) ... More (121)

Q20 Think about the last month...

What percentage of your running volume (sessions and distance) took place in the shoes that you

purchased for the study?

Choose a percentage here (4)

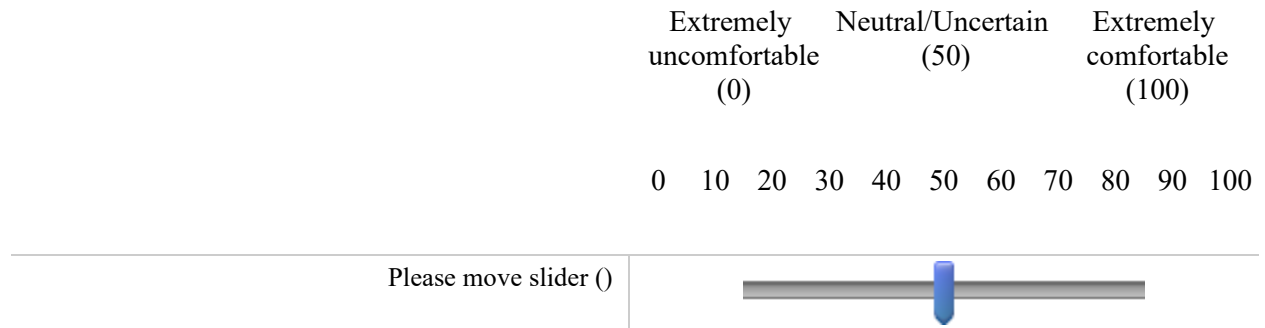
▼ 0% (1) ... 100% (11)

---

Page Break

Q5 In relation to the shoes that you purchased for the study...

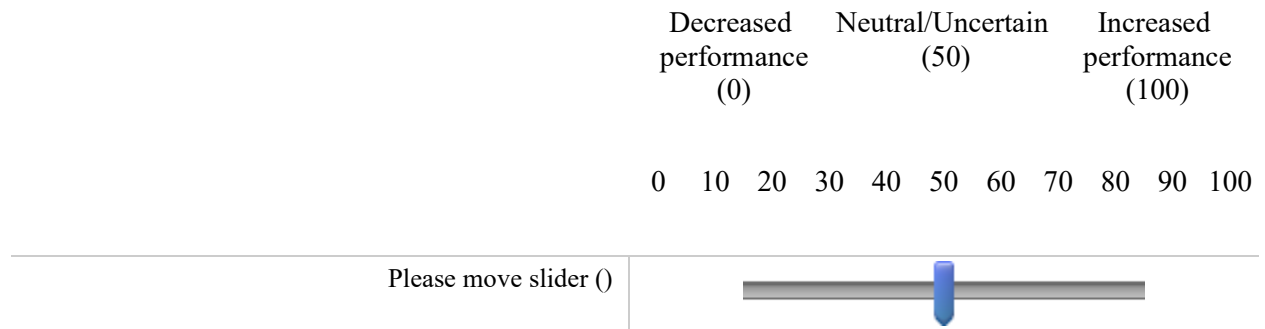
How comfortable are you in your purchased running shoes?



Page Break

Q16 In relation to the shoes that you purchased for the study...

How do your purchased running shoes influence your running performance?




Page Break

Q4 How satisfied are you with your purchase at this time?

Extremely dissatisfied (0)      Neutral/Uncertain (50)      Extremely satisfied (100)

0 10 20 30 40 50 60 70 80 90 100

Please move slider ()



---

Page Break

Q9 Have you become injured since the last survey while using the shoes you bought for the study?

*Running related (training or competition) musculoskeletal pain in the lower limbs or low back that causes a restriction on or stoppage of running (distance, speed, duration, or training) for at least 7 days or 3 consecutive scheduled training sessions, or that requires the runner to consult a physician or other health professional.*

- Yes (1)
- No (2)

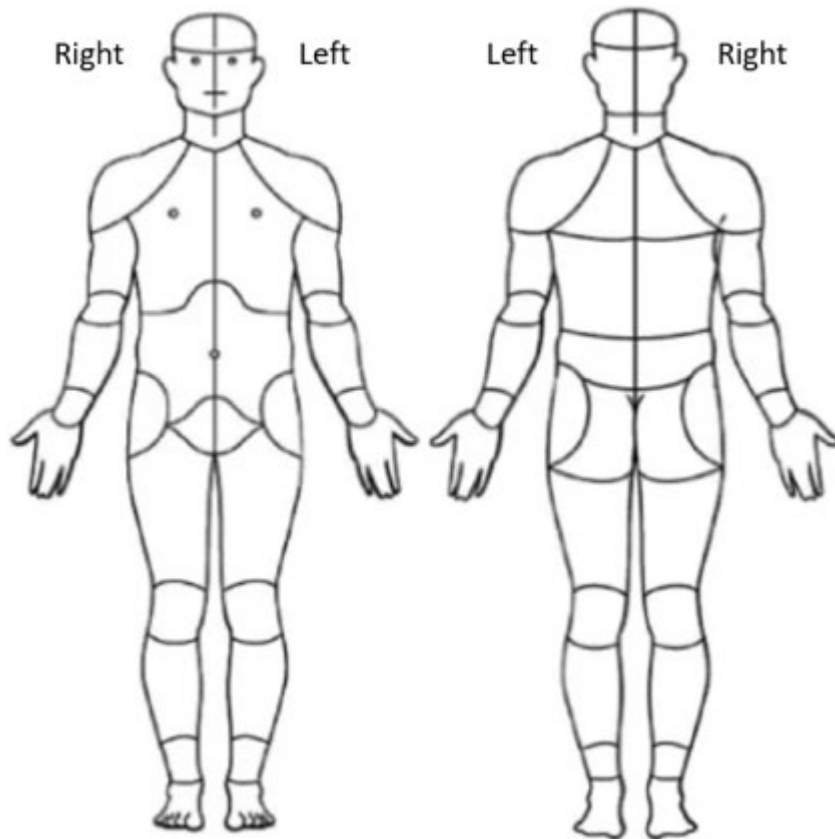
*Skip To: Q12 If Have you become injured since the last survey while using the shoes you bought for the study? Ru... = No*

---

Page Break

Q16 If yes, where are you hurt?

	Off (1)	On (2)
Pelvis (62)		
Back Thigh Left (63)		
Foot Back Right (64)		
Foot Back Left (65)		
Front Right Hip (66)		
Knee Back Left (67)		
Lower Leg Back Left (68)		
Buttocks (69)		
Ankle Back Right (70)		
Ankle Back Left (71)		
Lower Leg Back Right (72)		
Knee Back Right (73)		
Knee Front Right (74)		
Knee Front Left (75)		
Lower Leg Front Right (76)		
Lower Leg Front Left (77)		
Ankle Front Right (78)		
Ankle Front Left (79)		
Foot Front Right (80)		
Foot Front Left (81)		
Back Thigh Right (82)		
Front Thigh Right (83)		
Front Thigh Left (84)		
Front Left Hip (85)		
Back Left Hip (86)		
Back Right Hip (87)		
Low Back (88)		



---

Page Break

Q21 You were randomly assigned to be in the experimental or control group at the beginning of this study and assigned the relevant presentation. Which group do you think you were in?

- Experimental (1)
- Control (2)
- I don't know (4)

---

Q23 Please describe why you selected your previous answer

---

Page Break

---

Q12 Before you finish the survey, do you have any additional comments?

---

**End of Block: Default Question Block**

---

## Links to video presentations

Educational module-intervention group:

<https://youtu.be/ZQmF2gvsYlg?si=XLjCDGDslsxhKIsN>

Sham module-control group: [https://youtu.be/A79eNdb3bcA?si=ftGkW\\_lfgNnull-l](https://youtu.be/A79eNdb3bcA?si=ftGkW_lfgNnull-l)

## Educational module screenshot presentation

Please note that this online educational module is intended to provide a brief overview of the research about the effects of running shoes on biomechanics and injury prevention. It has been slightly adapted and updated from a module used in previously published research: What are the perceptions of runners and healthcare professionals on footwear and running injury risk? Dhillon et al. 2020. *BMJ Open Sport & Exercise Medicine*

Footwear represents only one part of the prevention and treatment of running injuries, along with training loads, biomechanics and recovery. No studies on treatment were included given the lack of scientific evidence. This module should not be used to determine a treatment plan if you have a running injury. You should consult a qualified healthcare professional if you have an injury.

Only references with the highest level of evidence (systematic reviews, randomized controlled trials) or those addressing timely topics (e.g. maximalist shoes, minimalist shoes) have been included.

Several healthcare professionals, shoe retailers and runners have provided input on the module before reaching the final version.

**Before we start... Which biomechanical factors are associated with running injuries?**

**BIOMECHANICAL FACTORS RELEVANT FOR INJURIES...**

**1. GROUND IMPACT PEAK & LOADING RATE**  
Force applied on the shoe by the ground (measured by force plates)

**WHY IS THIS IMPORTANT?**

- Multiple studies have associated ↑ loading rate with injuries
- One study reported that runners who learned to "run softer" had **62% less injuries** over the following year compared with runners who did not.

*"How hard a runner hits the ground"*

Vertical ground reaction force vs Time graph showing Impact peak and Loading rate (steepness of curve). Phases: Foot strike, Midstance, Push off.

**2. JOINT FORCES & LOADING RATE**  
Estimated using 3D motion capture and force plates. The ground reaction force is needed to estimate joint forces.

**WHY IS THIS IMPORTANT?**

- ↑ forces can potentially overload joint structures beyond tolerance and lead to injury
- Injured runners can potentially benefit from reductions in forces to allow for healing

Forces at the knee & knee cap  
Forces at the ankle & pressure measured at the bottom of the foot

**4. Dye (2005)** The pathophysiology of patellofemoral pain: a tissue homeostasis perspective. *Clin Orthop Relat Res.*

**5. Barton et al. (2016)** Running retraining to treat lower limb injuries: a mixed methods study of current evidence synthesised with expert opinion. *Br J Sports Med.*

**1. Zandvoort & Nijssen. (2013)** The relationship between lower extremity stress fractures and the ground reaction force: a systematic review. *Clin Biomech.*

**2. van der Worp et al. (2016)** Do runners who suffer injuries have higher vertical ground reaction forces than those who remain injury free? A systematic review and meta-analysis. *Br J Sports Med.*

**3. Chan et al. (2018)** Gait Retraining for the Reduction of Injury Occurrence in Novice Distance Runners: 1-Year Follow-up of a Randomized Controlled Trial. *Br J Sports Med.*

# #1 Does running shoe cushioning affect running biomechanics and joint forces?



### DIFFERENT LEVELS OF RUNNING SHOE CUSHIONING...

Note that minimalist and maximalist shoes are defined by more than just cushioning (weight, flexibility, technologies, rocker sole, etc.). Shoes can be given a % score on 'how minimalist' they are:

6. Esculler et al. (2015) A consensus definition and rating scale for minimalist shoes. J Foot Ankle Res.

### #1 DOES MAXIMAL CUSHIONING AFFECT RUNNING BIOMECHANICS & JOINT FORCES?

<b>Study 7</b>	<p>Downhill loading rate in Maximal +31.5%</p> <p>Level ground Same impact</p>	<b>Study 9</b>	<p>Vertical ground reaction force Loading rate in Maximal +14%</p>
<b>Study 8</b>	<p>knee cap forces in Maximal &amp; Traditional vs. Minimal +20% each step +10% each mile</p>	<b>Study 10</b>	<p>Vertical ground reaction force Loading rate in Maximal +33%</p>

**MAXIMAL CUSHIONING INCREASES GROUND IMPACT AND KNEE JOINT FORCES**

7. Chen et al. (2013) Does maximalist footwear have impact loading during level ground and downhill running? Int J Sport Sci & Exercise. 8. Sinclair et al. (2016) The influence of minimalist and maximalist footwear on treadmill and overground running. PLoS One. 9. Maffei et al. (2015) Running in highly cushioned shoes increases leg stiffness and Achilles tendon loading. Sci Rep. 10. Telford et al. (2015) Influence of Maximalist Running Shoes on Biomechanics, Balance and Fall Risk. Gait Posture. 11. Esculler et al. (2015) Consensus: characteristics are related to running mechanics to runners with pathological pain. Gait Posture. 12. Bonnet et al. (2016) The influence of cushion and shoe on paraspinal joint kinetics in runners with patellofemoral pain. J Sport Sci. 13. Bui et al. (2015) Running posture, volume of footstrike and footstrike on footstrike during running. J Sport Sci. 14. Sinclair et al. (2016) Effect of minimalist and maximalist running shoes on knee and ankle loading during running. Gait Posture.

### #1 DOES MINIMAL CUSHIONING AFFECT RUNNING BIOMECHANICS AND JOINT FORCES?

<b>Study 11</b>	<p>Minimalist shoes ↓ knee forces</p> <p>↑ Achilles tendon forces</p>	<b>Study 14</b>	<p>knee cap forces in Minimal (Vibram &amp; Inov8) vs. Partial minimal &amp; Traditional -20%</p> <p>Achilles tendon forces in Minimal (inov8) vs. Partial minimal &amp; Traditional +16%</p>
<b>Study 12</b>	<p>knee cap forces in Minimal vs. Traditional -17%</p>	<b>Study 13</b>	<p>Overall ground impact loading rate in Minimal vs. Traditional</p>

**SUMMARY OF THE EFFECTS OF MINIMAL CUSHIONING**

- ↓ KNEE JOINT FORCES
- ↓ ACHILLES TENDON FORCES & FOOT PRESSURE
- ↑ GROUND IMPACT IF NOT LANDING ON HEEL
- ↑ GROUND IMPACT IF STILL LANDING ON HEEL

# #2 Do cushioning features in running shoes reduce injuries?



### TWO CUSHIONING FEATURES IN RUNNING SHOES

- 1. Midsole density**  
How soft or hard the shoe sole is when compressed by the foot
- 2. Heel to toe drop**  
Difference in thickness between the heel and the front of shoe

### #2 DO CUSHIONING FEATURES IN RUNNING SHOES REDUCE INJURIES?

247 recreational runners (1) randomized to... 848 recreational runners (2)

Harder sole OR Softer sole

5 months of regular running OR 6 months of regular running

**NO DIFFERENCE IN RUNNING INJURY RISK BASED ON MIDSOLE DENSITY**

**RUNNERS WITH SOFT SHOES HAD A SLIGHTLY DECREASED RISK OF INJURY**

15. Theisen et al. (2014) Influence of midsole hardness of standard cushioned shoes on running-related injury risk. Br J Sports Med.

### #2 DO CUSHIONING FEATURES IN RUNNING SHOES REDUCE INJURIES?

553 recreational runners randomized to different heel to toe drops...

0 mm OR 6 mm OR 10 mm

6 months of regular running

**OVERALL, HEEL TO TOE DROP DOES NOT INFLUENCE RUNNING INJURY RISK**

19. Mallouk et al. (2016) Influence of the heel-to-toe drop of standard cushioned running shoes on injury risk in leisure-time runners. Am J Sports Med.

### #3 Changing to a different category of running shoes: Does it cause injuries?

UBC  
THE UNIVERSITY OF  
WAIKATO  
OTAGO

### #3 CHANGING TO A DIFFERENT CATEGORY OF RUNNING SHOES: DOES IT CAUSE INJURIES?

A scientific article summarizing 20 previous studies concluded that:

Some studies report  $\uparrow$  injury risk while others don't.  
It depends on how big the change is, and how gradual the transition is.

Transitioning to minimalist shoes? Consider AT LEAST 4-8 weeks!  
(greater changes on the Minimalist Index require more time to adapt muscles, tendons and bones)

20. Warne & Gruber (2017) Transitioning to minimalist footwear: a systematic review of methods and future clinical recommendations. Sports Med Open

0% MINIMALIST INDEX 100%

Going to more cushioning:  
 $\uparrow$  risk of knee injury

Going to less cushioning:  
 $\uparrow$  risk of injury to foot/Achilles tendon

### #4 Selecting running shoes based on foot type: Does it reduce injuries?

UBC  
THE UNIVERSITY OF  
WAIKATO  
OTAGO

- Scan foot
- Determine foot type
- Select corresponding shoe

High arch Low arch "Normal" arch

Neutral shoe  
Cushioned shoe designed to provide more pronation

Motion control shoe  
Cushioned shoe designed to control excessive foot pronation

Stability shoe  
Cushioned shoe with moderate motion control characteristics

21. Knapik et al. (2014) Injury-reduction effectiveness of prescribing running shoes on the basis of foot arch height: Summary of military investigations. J Orthop Sports Phys Ther

### #4 SELECTING RUNNING SHOES BASED ON FOOT TYPE: DOES IT REDUCE INJURIES?

Study 21  
7,213 soldiers

Shoe assigned based on foot type OR Shoe not assigned based on foot type

6 to 12 weeks of military training

SELECTING RUNNING SHOES BASED ON FOOT TYPE DOES NOT  $\downarrow$  RUNNING INJURY RISK

Study 22  
81 runners

Randomly assigned a shoe OR Shoe assigned based on foot type

13-week half-marathon program

SELECTING RUNNING SHOES BASED ON FOOT TYPE DOES NOT  $\downarrow$  RUNNING INJURY RISK

Study 23  
372 runners (all foot types)

Assigned a neutral shoe OR Assigned a motion control shoe

6 months of regular running

RUNNERS WITH PRONATED FEET HAD A SLIGHTLY  $\downarrow$  INJURY RISK WITH MOTION CONTROL SHOES

21. Knapik et al. (2014) Injury-reduction effectiveness of prescribing running shoes on the basis of foot arch height: Summary of military investigations. J Orthop Sports Phys Ther  
22. Ryan et al. (2015) The effect of three different levels of footwear stability on pain outcomes in women runners: A randomized control trial. Br J Sports Med  
23. Mallouk et al. (2016) Injury risk in runners using standard or motion control shoes: a randomized controlled trial with participant and assessor blinding. Br J Sports Med

### Current state of research on running shoes

#1 Minimalist shoes tend to  $\downarrow$  knee forces but  $\uparrow$  Achilles tendon & foot forces. Maximalist shoes tend to  $\uparrow$  knee forces & ground impact but  $\downarrow$  Achilles tendon & foot forces.

#2 Cushioning in running shoes may not be the injury prevention answer. It may have a slight protective effect for some runners

#3 Transition to a different category of running shoes should be gradual to reduce injury risk.

#4 Selecting running shoes based on foot type does not seem to  $\downarrow$  injury.

#5 Selecting shoes based on comfort is a good idea.

\*More research is needed to provide guidance, especially about effective treatment of running injuries

### References

- Zadpoor & Nhoosyan. (2011) The relationship between lower-extremity stress fractures and the ground reaction force: a systematic review. Clin Biomech.
- van der Worp et al. (2016) Do runners who suffer injuries have higher vertical ground reaction forces than those who remain injury-free? A systematic review and meta-analysis. Br J Sports Med.
- Chan et al. (2016) Gait Retraining for the Reduction of Injury Occurrence in Novice Distance Runners: 1-Year Follow-up of a Randomized Controlled Trial. Br J Sports Med.
- Dye (2009) The pathophysiology of patellofemoral pain: a tissue homeostasis perspective. Clin Orthop Relat Res.
- Bennett et al. (2016) Running returning to full lower limb injuries: a multi-method study of current evidence synthesized with expert opinion. Br J Sports Med.
- Esculier et al. (2016) A consensus definition and rating scale for minimalist shoes. J Foot Ankle Res.
- Chan et al. (2016) Does maximal footwear lower impact loading during level ground and downhill running? Eur J Sport Sci.
- Stinkler et al. (2016) The influence of minimalist and traditional footwear on patellofemoral kinematics during running. J Appl Biomech.
- Katani et al. (2016) Running in highly cushioned shoes increases leg stiffness and amplifies impact loading. Sci Rep.
- Pollard et al. (2016) Influence of Maximal Running Shoes on Biomechanics Before and After a 5K Run. Orthop J Sports Med.
- Esculier et al. (2017) Footwear characteristics are related to running mechanics in runners with patellofemoral pain. Gait Posture.
- Bonetti et al. (2016) The influence of cadence and shoes on patellofemoral joint kinematics in runners with patellofemoral pain. J Sci Med Sport.
- Rice et al. (2016) Footwear matters: Influence of footwear and foot strike on isometrics during running. Med Sci Sport Exerc.
- Stinkler et al. (2016) Effects of barefoot and barefoot inspired footwear on knee and ankle loading during running. Clin Biomech.
- Theriac et al. (2016) Influence of insole hardness of standard cushioned shoes on running-related injury risk. Br J Sports Med.
- Mallouk et al. (2017) The effect of shoe cushioning on injury risk, landing impact forces and spatiotemporal parameters during running: results from a randomized trial including 800+ recreational runners. Footwear Sci.
- Mallouk et al. (2017) Lower impact forces but greater burden for the musculoskeletal system in running shoes with greater cushioning stiffness. Eur J Sport Sci.
- Mallouk et al. (2017) Effect of shoe cushioning on landing impact forces and spatiotemporal parameters during running: results from a randomized trial including 800+ recreational runners. Eur J Sport Sci.
- Mallouk et al. (2016) Influence of the heel-to-toe drop of standard cushioned running shoes on injury risk in leisure-time runners. Am J Sports Med.
- Warne & Gruber (2017) Transitioning to minimalist footwear: a systematic review of methods and future clinical recommendations. Sports Med Open.
- Knapik et al. (2014) Injury-reduction effectiveness of prescribing running shoes on the basis of foot arch height: Summary of military investigations. J Orthop Sports Phys Ther.
- Ryan et al. (2015) The effect of three different levels of footwear stability on pain outcomes in women runners: A randomized control trial. Br J Sports Med.
- Mallouk et al. (2016) Injury risk in runners using standard or motion control shoes: a randomized controlled trial with participant and assessor blinding. Br J Sports Med.

# Sham module screenshot presentation

Please note that this online educational module is intended to provide a brief overview participation in distance running worldwide.

The 5K, half-marathon, and marathon represent popular running distances that have an interesting history.

Several researchers and healthcare professionals have provided input on the module. Many images and information are credited and used with permission from Jens Andersen, founder of RunRepeat.com

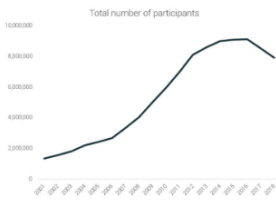
- The authors  
Andrew Fife M.S., Jean-Francois Esculier PT, PhD, Codi Ramsey, PhD, Kim Hébert-Losier, PT, PhD

## How many people participate in mass-start races?



## MASS PARTICIPATION RUNNING EVENTS

### HOW MANY RUNNERS ARE THERE WORLDWIDE? Statistics inclusive up until 2018

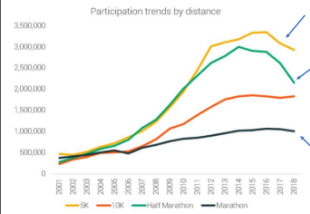


Race participation is in recent decline, but recently peaked in 2016. That year, 9.1 million results were recorded from races.

Andersen, J. (2021, December 01). The State of Running 2019. RunRepeat. Retrieved from: <https://runrepeat.com/state-of-running>

## PARTICIPATION TRENDS BY DISTANCE

### 5-KILOMETER AND HALF-MARATHON MOST POPULAR Races such as 10Ks and marathons have less participation, but appear more stable over the recent years.



New growth may come with attrition: it is likely that not all new runners will stick with it.

Niche distance participation has increased (ultramarathon, trail running, Ironman etc.). This may be a reason for traditional race decline.

Andersen, J. (2021, December 01). The State of Running 2019. RunRepeat. Retrieved from: <https://runrepeat.com/state-of-running>

## Do people prefer longer or shorter races?

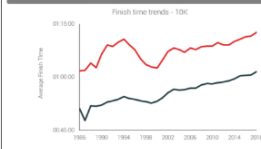
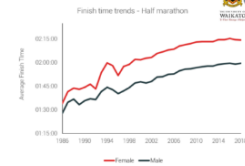


### MARATHON

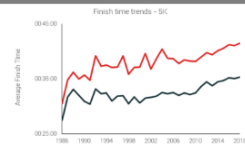


### AVERAGE TIMES ARE INCREASING

### HALF-MARATHON



### 10-KILOMETER



### 5-KILOMETER

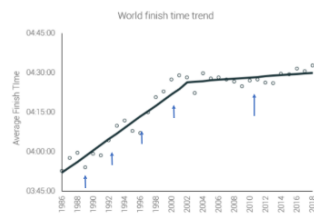
## BREAKDOWN OF MARATHON TIME CHANGES

### WHAT IS GOING ON?

Marathon finish time is slowing down.

From 1986 to 2001 times increased from 3:52:35 to 4:28:56.

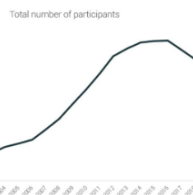
From 2001 to 2018 times increased to 4:32:49, only 4 more minutes.



Andersen, J. (2021, December 01). The State of Running 2019. RunRepeat. Retrieved from: <https://runrepeat.com/state-of-running>

## MORE PARTICIPATION DOES NOT ALWAYS MEAN COMPETITION

### REMEMBER THIS GRAPH?



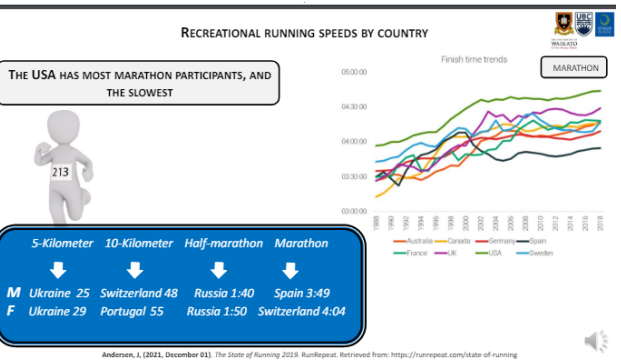
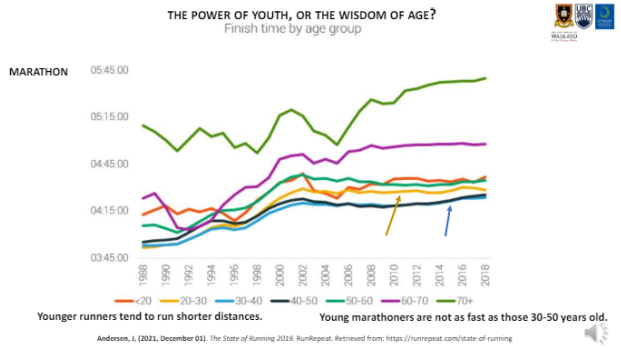
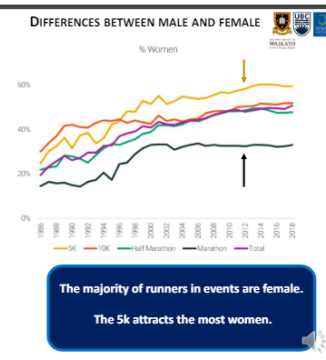
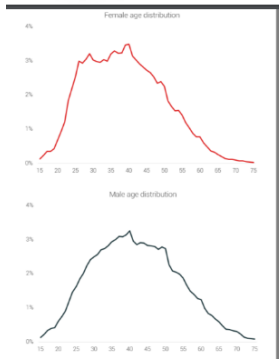
With more runners than ever, it is likely that many are participating for reasons other than competition.

Runners may sign up for events to have a target to guide their training, or for social reasons.

There may be a fight for the win at the front of the race, but many are happy to finish.

Andersen, J. (2021, December 01). The State of Running 2019. RunRepeat. Retrieved from: <https://runrepeat.com/state-of-running>

## Demographics of runners



**Minutes/Mile**

**HOW DO PACE AND DISTANCE INTERACT?**

	5K	10K	Half Marathon	Marathon
<b>Female</b>	13:21	11:13	10:15	11:58
<b>Male</b>	11:22	9:25	9:07	10:49

**THE LONGEST IS NOT THE SLOWEST**  
The half-marathon participants run faster than other distances

**THE 5K MAY HAVE THE MOST NOVICE AND CASUAL PARTICIPANTS BASED ON THE PACE.**  
HALF-MARATHON RUNNERS MAY BE MORE COMPETITIVE.

Anderson, J. (2021, December 01). The State of Running 2019. RunRepeat. Retrieved from: <https://runrepeat.com/state-of-running>

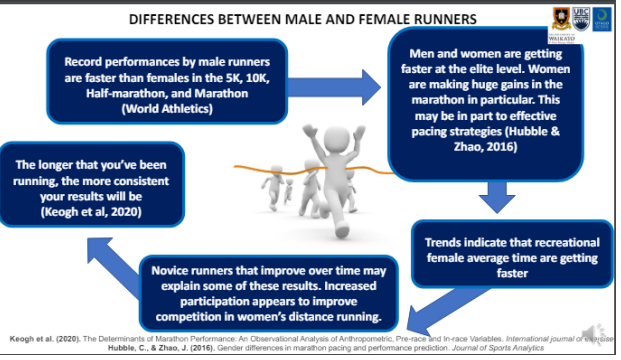
**What about the fastest runners, are they also slowing down?**

**WORLD RECORDS ARE STILL FALLING**

World Record and Date	Distance	World Record and Date
Joshua Cheptegei 12:35 2020 Dix Quax 13:12 1977	<b>5k</b>	Letesenbet Gidey 14:06 2020 Natalia Mărășescu 15:41 1977
Rhonex Kipruto 26:24 2020 Bill Rogers 28:35 1976	<b>10k</b>	Joyciline Jepkosgei 29:43 2017 Peg Neppel 35:36 1976
Kibiwott Kandie 57:32 2020 Juan RAP 1:03:46 1976	<b>Half Marathon</b>	Letesenbet Gidey 1:02:52 2021 Silvana Cruciatu 1:22:05 1977
Eliud Kipchoge 2:01:39 2018 Shigeru So 2:09:05 1978	<b>Marathon</b>	Brigid Kosgei 2:14:04 2019 Liane Winter 2:42:24 1975

\*All times are road racing, and recognized by World Athletics  
\*\*Faster times pending notification in some events.

World Athletics. (2021, December 01). World Records. World Athletics. Retrieved from: <https://www.worldathletics.org/records/by-category/world-records>



## CONCLUSION



Andersen, J. (2021, December 01). *The State of Running 2019*. RunRepeat. Retrieved from: <https://runrepeat.com/state-of-running>

## References

1. Andersen, J. (2021, December 01). *The State of Running 2019*. RunRepeat. Retrieved from: <https://runrepeat.com/state-of-running>
2. World Athletics. (2021, December 01). *World Athletics World Athletics*. Retrieved from: <https://www.worldathletics.org/news/ib/singapore/2021/01>
3. Hobbie, C., & Zhou, J. (2016). Gender differences in marathon pacing and performance prediction. *Journal of Sports Analytics*
4. Krugh et al. (2020). The Unconscious of Marathon Performance: An Observational Analysis of Anthropometric, Pre-race and In-race Variables. *International Journal of Exercise Science*



Intake survey

# Gait Analysis Intake Questions

---

**Start of Block: Default Question Block**

Q32 What is your Participant ID number?

---

---

Page Break

Q29 Have you been running at least once per week for at least one month?

Yes (1)

No (2)

*Skip To: End of Survey If Have you been running at least once per week for at least one month? = No*

---

Q35 Are you comfortable and used to running on a treadmill?

Yes (1)

No (2)

*Skip To: End of Survey If Are you comfortable and used to running on a treadmill? = No*

---

Q34 Have you experienced a running-related injury in the last month based on the following definition?

Running related (training or competition) musculoskeletal pain in the lower limbs that causes a restriction

on or stoppage of running (distance, speed, duration, or training) for at least 7 days or 3 consecutive scheduled training sessions, or that requires the runner to consult a physician or other health professional.

Yes (1)

No (2)

*Skip To: End of Survey If Have you experienced a running-related injury in the last month based on the following definition... = Yes*

---

Page Break

---

Q27 What is your birthday? Day, month, year format (example: 20/08/1992)

\_\_\_\_\_

---

Q2 What is your gender?

Woman (1)

Man (2)

Other (please specify) (4) \_\_\_\_\_

Prefer not to say (5)

---

Q3 Which of the following best describes you?

- Māori (2)
- NZ European (11)
- European (1)
- Pacific peoples (3)
- Asian (4)
- MELAA (Middle Eastern/Latin American/African) (5)
- Other (please specify) (6) \_\_\_\_\_

---

Page Break

Q4 How many years have you been running regularly (at least once per week)? If less than one year, how many months?

Please indicate years or months (6 years or 5 months)

\_\_\_\_\_

Q5 What is your average weekly training over the last month?

Sessions per week:

\_\_\_\_\_

Q6 What is your average weekly training over the last month?

Kilometres per week:

---

Q9 Do you race competitively?

Yes (1)

No (2)

Q29 In the last 12 months, what was your best 5K time? (Example 31:24)

---

Page Break

Q17 Do you consider running as your main sport-related activity?

Yes (1)

No (2)

Q39 Rank the following in order of most important to least important to your personal running motivation.

Click and drag your selection

(1 being the most important)

- Improve general health (1)
- Enjoyment (2)
- Weight management (3)
- Team affiliation (4)
- Competition (5)

---

Page Break

Q38 Rank the following in order of most important to least important to your priorities of footwear design.

Click and drag your selection (1 being the most important)

- Improve comfort (1)
- Reduce injury risk (2)
- Improve performance (3)

---

Page Break

Q18 Where do you get advice on running shoes?

- Friends (1)
  - Family (2)
  - Running club/group (3)
  - Professional of elite athletes (4)
  - Coach (5)
  - Running shoe store online (7)
  - Running shoe store in-person (8)
  - Healthcare Professional (9)
  - Scientific literature (10)
  - Advertisements (11)
  - Running websites (12)
  - Manufacturer (13)
  - Social media (14)
  - Other (please specify) (15)
- 
- None of the above (16)

-----  
Page Break

Carry Forward Selected Choices from "Where do you get advice on running shoes?"



Q19 Based on your answer above, rank the top three in order of importance.

Click and drag your selection

(1 being the most important factor)

- Friends (1)
- Family (2)
- Running club/group (3)
- Professional of elite athletes (4)
- Coach (5)
- Running shoe store online (6)
- Running shoe store in-person (7)
- Healthcare Professional (8)
- Scientific literature (9)
- Advertisements (10)
- Running websites (11)
- Manufacturer (12)
- Social media (13)
- Other (please specify) (14)
- None of the above (15)

---

Page Break

Q15 What factors influenced you when buying your running shoes? (Check all that apply).

Based on gait analysis, running mechanics (20)

- Brand (2)
  - Color (1)
  - Comfort (8)
  - Fit (7)
  - Injury prevention (9)
  - Performance (10)
  - Price (4)
  - Recommendation from coach (14)
  - Recommendation from healthcare provider (15)
  - Recommendation from peers (12)
  - Recommendations from store associate (13)
  - Reviews (16)
  - Same model that you normally wear (5)
  - Scientific literature (17)
  - Specifications and technologies (i.e heel-toe drop, heel height, mass, neutral, stability, motion control etc.) (6)
  - Style (3)
  - Other (Please specify) (18)
-

None of the above (19)

---

Page Break

---

Carry Forward Selected Choices from "What factors influenced you when buying your running shoes? (Check all that apply)."



Q24 Based on your answer above, rank the top three in order of importance.

Click and drag your selection

(1 being the most important factor).

- Based on gait analysis, running mechanics (1)
  - Brand (2)
  - Color (3)
  - Comfort (4)
  - Fit (5)
  - Injury prevention (6)
  - Performance (7)
  - Price (8)
  - Recommendation from coach (9)
  - Recommendation from healthcare provider (10)
  - Recommendation from peers (11)
  - Recommendations from store associate (12)
  - Reviews (13)
  - Same model that you normally wear (14)
  - Scientific literature (15)
  - Specifications and technologies (i.e heel-toe drop, heel height, mass, neutral, stability, motion control etc.) (16)
  - Style (17)
  - Other (Please specify) (18)
  - None of the above (19)
- 

Page Break

---

Q26 Where do you typically purchase your running shoes?

- Manufacturer website (Nike, Adidas, Brooks) (2)
- Multi-sport online store (Player's Sports, Sports Direct, etc.) (3)
- Multi-sport store (i.e. Rebel Sport, Torpedo 7, Stirling Sports, etc.) (4)
- Running event (5)
- Specialty online running store (6)
- Specialty running store (7)
- Other (please specify) (8) \_\_\_\_\_

---

Page Break \_\_\_\_\_

End of Block: Default Question Block

---

Post-run survey

# After each run survey

---

**Start of Block: Default Question Block**

Q18 What is your Participant ID number?

---

---

Page Break

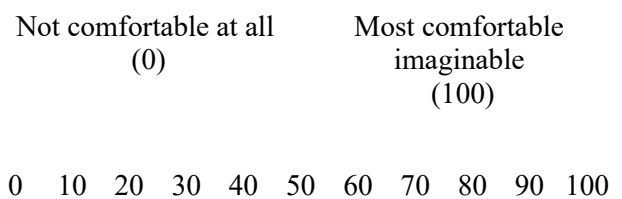
Q31 Which shoe are you responding for?

- Own shoes trial 1 (1)
- Own shoes trial 2 (5)
- Recommended shoes (2)
- Basic shoes (3)

---

Page Break

Q5 Consider your overall comfort in these shoes. How did the shoe feel?



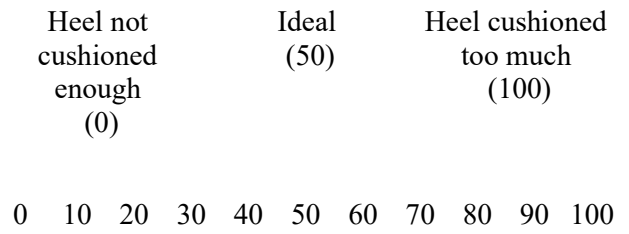
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Please move slider ()



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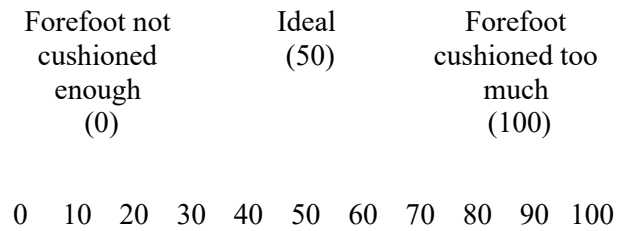
Q21 Consider the cushioning in the heel of the shoe. How did the shoe feel?




Please move slider ()	
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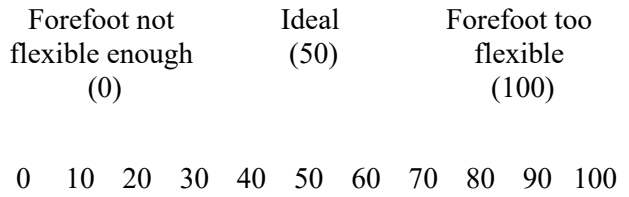
---

Q22 Consider the cushioning in the forefoot region of the shoe. How did the shoe feel?




Please move slider ()	
-----------------------	--

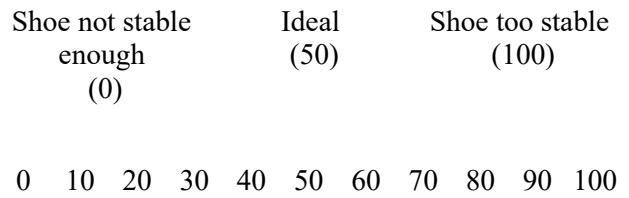
Q23 Consider the flexibility in the forefoot region of the shoe. How do you feel?




Please move slider ()



Q24 Consider the overall stability of the shoe. How do you feel?

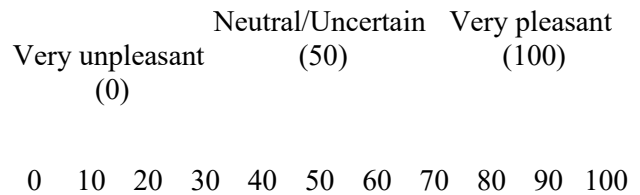


Please move slider ()




Page Break

Q38 Consider overall how you felt running in these shoes (pleasure-displeasure).

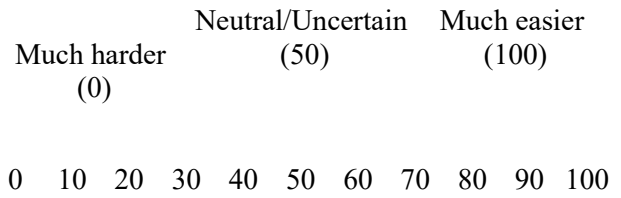



Please move slider ()



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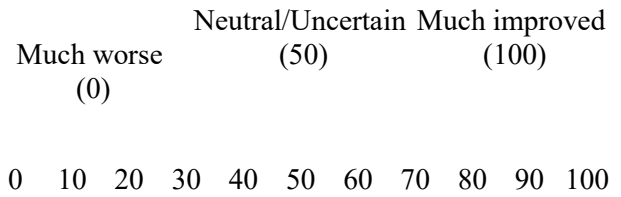
Q27 Consider overall how difficult you felt it was to run in these shoes (easier-harder).




Please move slider ()	
-----------------------	--

---

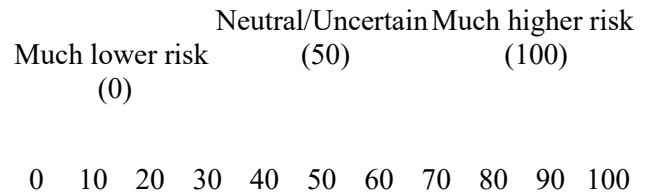
Q28 Consider overall how you feel these shoes might influence your performance (worse-improve).



Please move slider ()	
-----------------------	--

---

Q29 Consider overall how you feel these shoes might influence your injury risk (increase-decrease).

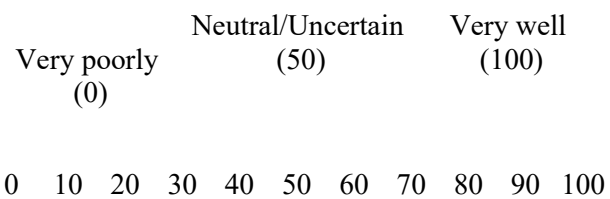


Please move slider ()



---

Q30 Consider overall how you feel these shoes match your running gait/style (poorly-well).



Please move slider ()



**End of Block: Default Question Block**

---

Final rankings

# Final rankings

---

**Start of Block: Default Question Block**

Q18 What is your Participant ID number?

---

---

Page Break

Q31 Overall, which shoe was the most comfortable? 1 being the most comfortable

Click and drag your selection

- Own shoes (1)
- Recommended shoes (2)
- Basic shoes (3)

---

Page Break

Q33 Overall, in which shoe do you think your injury risk would be lowest? 1 being the lowest risk

Click and drag your selection

- Own shoes (1)
- Recommended shoes (2)
- Basic shoes (3)

---

Page Break

Q34 Overall, which shoe do you think you would perform the best under a race or time trial situation? 1 being the best performance

Click and drag your selection

- Own shoes (1)
  - Recommended shoes (2)
  - Basic shoes (3)
- 

Page Break

---

Q35 Overall, which shoe do you think matches your running style/gait the best? 1 being the best match

Click and drag your selection

- Own shoes (1)
  - Recommended shoes (2)
  - Basic shoes (3)
- 

Page Break

---

Q36 Overall, which shoe did you prefer the most? 1 being the favourite

Click and drag your selection

- Own shoes (1)
- Recommended shoes (2)
- Basic shoes (3)

**End of Block: Default Question Block**

---

## Minimalist index checklist

### WEIGHT



Place shoe on the scale. According to the scale, what is the weight of the shoe (in grams)?

 grams

### HEEL THICKNESS

Using a digital caliper, measure the height of the shoe at the heel (including insole, midsole and outsole). The caliper must be placed at the middle of the heel when looking at the shoe from the rear end, and in the middle of the heel when looking at the shoe from the side.

Caution must be taken when placing the caliper on the outsole, as the most external (thickest) point of the shoe has to be considered.

 millimeters

The caliper must be placed at the middle of the shoe when looking from the rear end.



The caliper must be placed at the middle of the heel when looking from the side

## HEEL TO TOE DROP

Using a digital caliper, measure the height of the shoe at the metatarsal heads (including insole, midsole and outsole). The caliper must be placed at the middle of the shoe when looking at the shoe from the top. Caution must be taken when placing the caliper on the outsole, as the most external (thickest) point of the shoe has to be considered.

Now, subtract the height at the metatarsal heads from the stack height to obtain the heel to toe drop.

millimeters



The caliper must be placed under the metatarsal heads



The caliper must be placed at the middle of the shoe when looking from the top

## MOTION CONTROL AND STABILITY TECHNOLOGIES

Among these technologies, which ones can you observe on the shoe?



Multi-density midsole: Typically, a different color is used to emphasize this feature.



Thermoplastic medial post. Plastic is used to reinforce the medial portion of midsole.



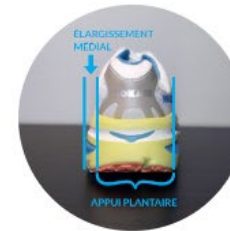
Rigid heel counter.



Elevated medial insole under arch (left), compared with a flat insole (right).



Supportive tensioned medial upper. Material is used to reinforce medial upper in order to limit medial foot movement.



Medial flare. Medial tip of midsole extends beyond footbed.



## Longitudinal stiffness



**5/5**

Minimal resistance to longitudinal bending (the shoe can be rolled on itself more than 360 degrees)



**4/5**

Slight resistance to longitudinal bending (anterior tip of shoe sole reaches posterior tip of shoe sole in a maximal bending of 360 degrees)



**3/5**

Moderate resistance to longitudinal bending (anterior tip of shoe sole doesn't reach posterior tip of shoe sole, but anterior and posterior parts of the shoe can form an angle of at least 90 degrees)



**2/5**

High resistance to longitudinal bending (anterior and posterior parts of the shoe can form an angle between 45 and 90 degrees)



**1/5**

Very high resistance to longitudinal bending (longitudinal deformation is possible, but anterior and posterior parts of the shoe form a maximum angle of 45 degrees)



**0/5**

Extreme resistance to longitudinal bending (longitudinal forces don't significantly change the orientation of the anterior part of the shoe relative to the posterior part)

**Torsional Stiffness (Pronate the shoe)**



**5/5**

Minimal resistance to torsion (anterior part of the shoe is turned 360 degrees; anterior outsole faces inferiorly after a complete twist while posterior outsole faces inferiorly)



**4/5**

Slight resistance to torsion (anterior part of the shoe is turned at least 180 degrees but less than 360 degrees; anterior outsole faces at least superiorly while posterior outsole faces inferiorly)



**3/5**

Moderate resistance to torsion (anterior part of the shoe is turned more than 90 degrees but less than 180 degrees; anterior outsole faces at least laterally while posterior outsole faces inferiorly)



**2/5**

High resistance to torsion (anterior part of the shoe is turned more than 45 degrees but less than 90 degrees; anterior outsole can't face laterally while posterior outsole faces inferiorly)



**1/5**

Very high resistance to torsion (torsional deformation is possible, but anterior part of the shoe reaches less than 45 degrees)



**0/5**

Extreme resistance to torsion (torsional forces don't significantly change the orientation of the anterior part of the shoe relative to the posterior part)

# Ethical approval

The University of Waikato  
Private Bag 3105  
Hamilton, New Zealand, 3240  
0800 WAIKATO (924 528)

HECS Human Ethics Committee  
Brett Langley  
Telephone +64 77 838 4060  
Hecs-ethics@waikato.ac.nz



THE UNIVERSITY OF  
**WAIKATO**  
*Te Whare Wānanga o Wāikato*

3 March 2022

**Andrew Fife**  
**Kim Hebert-Losier**  
**Codi Ramsey**  
**Jean-Francois Esculier**  
**Christopher Johnson**

**Re: HECS Ethics Approval of Application HREC(HECS)2021#31 "Factors that influence running footwear selection, satisfaction, and comfort"**

Dear Andrew:

Thank you for submitting your application amendment HREC(HECS)2021#31 for ethical approval.

We are pleased to provide formal amendment approval for your project, including the following activities:

- Recruit up to 100 participants for in-person surveys and up to 134 participants for online intervention/questionnaire studies.
- For the in-person surveys, you will conduct in-store surveys and interviews with participants who are purchasers of running shoes and footwear sales personnel in the greater Seattle, Washington USA, area. Interviews may be audio recorded.
- For the online intervention/questionnaire studies, you will ask participants to submit a sagittal plane video of their running technique. You will provide online participants with a running shoe informational module or sham informational module (control group). For participants that purchase shoes, you will conduct questionnaire at three time points (before 1<sup>st</sup> use, 1 month, and 3 months) following the purchase of their shoes.

Please use this updated approval for your studies moving forward.

Please contact the committee by email ([hecs-ethics@waikato.ac.nz](mailto:hecs-ethics@waikato.ac.nz)) if you wish to make changes to your project as it unfolds, quoting your application number with your future correspondence. Any minor changes or additions to the approved research activities can be handled outside the monthly application cycle.

We wish you all the best with your research.

Kind regards,

A handwritten signature in black ink, appearing to read "Brett Langley".

---

**Brett Langley, PhD**  
**Chairperson**  
**HECS Human Ethics Committee**  
**University of Waikato**

The University of Waikato  
Private Bag 3105  
Hamilton, New Zealand, 3240  
0800 WAIKATO (924 528)

HECS Human Ethics Committee  
Brett Langley  
Telephone +64 77 838 4060  
Hece-ethics@waikato.ac.nz



10 March 2023

**Andrew Fife**  
**Codi Ramsey**  
**Jean-Francois Esculier**  
**Kim Hébert-Losier**

**Re: HECS Ethics Approval of Application HREC(HECS)2023#11 "Effect of recommending running shoes on comfort, satisfaction, and spatio-temporal parameters"**

Dear Andrew:

Thank you for submitting your amended application HREC(HECS)2023#11 for ethical approval.

We are pleased to provide formal approval for your project, including the following activities:

- Recruitment of approximately 18 adult female recreational runners for a study that examines how prescribing shoes based on gait analysis influences runners.
- Perform gait analysis on participant, which will involve the placing sensors/markers on the participant for camera tracking.
- Have participants run 10 minutes in their own running shoes, followed by 5 minutes in their own shoes, 5 minutes in a prescribed shoe, and 5 minutes a generic neutral shoe.
- Have participants complete a baseline and post experimental questionnaire.

Please contact the committee by email ([hecs-ethics@waikato.ac.nz](mailto:hecs-ethics@waikato.ac.nz)) if you wish to make changes to your project as it unfolds, quoting your application number with your future correspondence. Any minor changes or additions to the approved research activities can be handled outside the monthly application cycle.

We wish you all the best with your research.

Kind regards,



---

**Brett Langley, PhD**  
**Chairperson**  
**HECS Human Ethics Committee**  
**University of Waikato**

# Co-authorship forms

## Chapter 2



### Co-Authorship Form

School of Graduate Research  
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Chapter 2  
Road running shoe selection  
Systematic review  
<https://doi.org/10.1080/19424280.2023.2180543>

Nature of contribution by PhD candidate:

Extent of contribution by PhD candidate (%):

#### CO-AUTHORS

Name	Nature of Contribution
Kim Hebert-Losier	Conception, study design, analysis, critical review
Codi Ramsey	Conception, study design, analysis, critical review
Jean-Francois Esculier	Conception, study design, analysis, critical review

#### Certification by Co-Authors

The undersigned hereby certify that:

- ❖ the above statement correctly reflects the nature and extent of the PhD candidate's contribution to this work, and the nature of the contribution of each of the co-authors; and
- ❖ that the candidate wrote all or the majority of the text.

Name	Signature	Date
Kim Hebert-Losier		19 August 2024
Codi Ramsey		20 August 2024
Jean-Francois Esculier		19 August 2024

July 2015

# Chapter 3



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Chapter 3 Road running shoe selection In-store survey <a href="https://doi.org/10.1080/19424280.2024.2353597">https://doi.org/10.1080/19424280.2024.2353597</a>
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Nature of contribution by PhD candidate	Conception, study design, execution, data acquisition, analysis, writing
Extent of contribution by PhD candidate (%)	80

### CO-AUTHORS

Name	Nature of Contribution
Kim Hebert-Losier	Conception, study design, analysis, critical review
Codi Ramsey	Conception, study design, analysis, critical review
Jean-Francois Esculier	Conception, study design, analysis, critical review

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Chapter 4 Salesperson perspective running shoe selection Thematic analysis
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Nature of contribution by PhD candidate	Conception, study design, execution, data acquisition, analysis, writing
Extent of contribution by PhD candidate (%)	80

### CO-AUTHORS

Name	Nature of Contribution
Kim Hebert-Losier	Conception, study design, analysis, critical review
Codi Ramsey	Conception, study design, analysis, critical review
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Chapter 5 Effects of an educational module on shoe selection and subjective perceptions Online RCT
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Nature of contribution by PhD candidate	Conception, study design, execution, data acquisition, analysis, writing
Extent of contribution by PhD candidate (%)	80

### CO-AUTHORS

Name	Nature of Contribution
Kim Hebert-Losier	Conception, study design, analysis, critical review
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Jean-Francois Esculier	Conception, study design, analysis, critical review

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Chapter 6 Effects of shoe recommendation using deceptive product descriptions on subjective perceptions Lab-based study
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Nature of contribution by PhD candidate	Conception, study design, execution, data acquisition, analysis, writing
Extent of contribution by PhD candidate (%)	80

### CO-AUTHORS

Name	Nature of Contribution
Kim Hebert-Losier	Conception, study design, analysis, critical review
Codi Ramsey	Conception, study design, analysis, critical review
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