The mind and the miles: Exploring motivational and psychological factors related to recreational running maintenance

Chloe Taneil Blacket

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Abbreviations

AIC	Akaike information criterion
App	application
BCT	behaviour change techniques
BIC	Bayesian information criteria
BPNES	basic psychological needs in exercise scale
BREQ-3	behavioural regulations in exercise questionnaire, version 3
CON	control
COVID-19	coronavirus disease 2019
d	Cohen's d
EBBS	exercise benefits/barriers scale
ES	effect size
FITT	frequency, intensity, time and type
GPS	global positioning system
IM	intervention mapping
INT	intervention
IQR	interquartile range
km	kilometre
km/wk	kilometre per week
LPA	latent profile analysis
min/km	minutes per kilometre
min/wk	minutes per week
MSES	multidimensional self-efficacy for exercise scale

PA	physical activity
RCT	randomised controlled trial
REDCap	research electronic data capture
RPE	rating of perceived exertion
SD	standard deviation
SDT	Self-determination Theory
SET	Self-efficacy Theory
SF-12v2	12-item short form health survey, version 2
TPB	**T**heory of planned behaviour
TTM	Transtheoretical model
wk	week
yrs	years

Summary

Regular running elicits a myriad of physical and mental health benefits, making running appealing to many. Despite the known health benefits, many individuals who start running often struggle to maintain a consistent running routine, and in some cases, discontinue running altogether. The overarching aim of this thesis was to explore the motivational and psychological influences of running to support maintenance of the behaviour, allowing individuals to reap the health benefits of regular, long-term running. This was achieved through a series of studies, which aimed to 1) investigate whether distinct motivational profiles exist within a large sample of runners, and explore differences in training characteristics between these profiles, 2) examine the psychosocial factors related to recreational running maintenance from both current and discontinued recreational runners' perspectives, 3) design an educational program to promote ongoing running participation in novice runners using an intervention mapping process, and 4) deliver an intervention to facilitate running maintenance in a 12-week feasibility randomised controlled trial (RCT).

Chapter 1 introduces motivation and the psychological factors important in facilitating behaviour maintenance, particularly in physical activity. Several relevant psychological theories tested and applied in health psychology are outlined. More recent developments in the psychology of behaviour maintenance are also described, shedding light on the interplay between behaviour change theories and physical activity maintenance. After establishing the current landscape of the psychology underlying physical activity behaviour maintenance, several gaps in the literature are outlined.

Study 1 (Chapter 2) was a cross-sectional analysis that aimed to investigate the presence of motivational profiles in a large sample of runners from the Garmin-RUNSAFE study (n = 2,278), and whether these profiles are associated with running activity. Motivation towards running was assessed using the six regulations of Self-determination Theory via a modified Behavioural Regulations in Exercise Questionnaire, version 3. Differences in training characteristics, measured via global positioning system (GPS)-enabled smartwatches, were compared between profiles. Latent profile analysis identified four distinct motivational profiles. Over 90% of the sample fit within three profiles, which were characterised by high levels of autonomous motivation towards running, and low levels of controlled regulation. The remaining 10% of the sample demonstrated lower overall motivation towards running. Training characteristics differed between all four profiles, highlighting the importance of considering motivational orientations when designing interventions to promote running maintenance.

In Study 2 (Chapter 3), psychological factors contributing to running maintenance of current and discontinued recreational runners were explored qualitatively through individual interviews. Guided by ontological relativism, thematic analysis identified five overarching themes influencing people's decision to run – making it a 'priority', the 'people' who run with you and the running community around them, 'planning', making 'progress', and experiencing 'pleasure' with running. Together, these factors influenced how much an individual saw running as a priority in their lives, and ultimately whether it was something worth continuing. Findings of this study were used to inform strategies to enhance running maintenance in Study 3.

In Study 3 (Chapter 4), an intervention mapping process was used to guide the development of a theory-based motivational and psychological intervention aimed at improving the continuation of running activity in novice runners. Running stakeholders, including runners, coaches, and relevant experts in physical activity and behaviour change, provided valuable insight through interviews and pre-testing and pilot testing that informed the development of the intervention. Key themes included in the intervention were identified through both literature review and stakeholder engagement. These themes related to goal setting, self-efficacy, intrinsic motivation, social support and overcoming barriers. The outcome of this chapter was a novel, 12-week online educational intervention.

Finally, Study 4 (Chapter 5) assessed the feasibility of conducting a 12-week RCT of the intervention designed in Study 3, compared to basic training advice in novice runners. Recruitment targets were successfully met (n = 60). Despite low-to-moderate engagement with the online intervention, participants reported high levels of satisfaction with the program. Despite low-to-moderate engagement with the online intervention over the course of the intervention, both groups demonstrated a shift towards more autonomous regulations (identified, integrated and intrinsic regulation) towards running. Further refinement of the intervention and strategies for improved engagement and retention are recommended before conducting a future fully powered RCT.

This thesis concludes with an overall discussion of the main findings (Chapter 6). This includes key contributions to current literature on running motivation, identification of limitations of the research, and recommendations for future research directions.

Declaration

I declare that this thesis presents work carried out by myself, and does not incorporate without acknowledgement, any material previously submitted for a degree or diploma in any university.

To the best of my knowledge, this thesis does not contain any materials previously published or written by another person except where due reference is made in the text, and all substantive contributions by others to the work presented, including jointly authored publications, is clearly acknowledged.

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Signed: 

Miss Chloe Blacket

Date: 27 May 2024

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Publications and presentations

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Skejø, S. D., **Blacket, C. T.**, Nielsen, R., Fuller, J., Bennett, H., Crozier, A. J., & Arnold, J. (2024). Why do we run? Motivation profiles and training characteristics in the Garmin-RUNSAFE Running Health Study. The European Journal of Public Health, 34(s2).

Gower, B., **Blacket, C.T.**, Girard, D., Boyle, T., & Davison, K. (2024). Prospective associations between systolic blood pressure, serum cholesterol, and physical activity behaviour and the development of cardiovascular disease. Preventive Medicine, 183.

Bennett, H., Chalmers, S., Arnold, J., B., Milanese, S., **Blacket, C.T.**, Niculescu, A., & Fuller, J.T. (2022). The Relationship between performance and injury in junior Australian

football athletes. International Journal of Sports Physiology and Performance, 17(5):761-767.

Chapter 1

Introduction

Some people feel they were born to run. Yet for many, the reality of maintaining running for more than a few weeks is difficult. This introductory chapter will provide a background on the role of motivation in physical activity, the psychological underpinnings of behaviour maintenance including key theories of behaviour change, and finally, how these theories inform approaches to behaviour maintenance that can be applied to running. This chapter will conclude with an outline of my thesis aims and structure.

Health benefits of running

Running has witnessed a remarkable surge in popularity in recent decades. For example, participation in parkrun, a worldwide, weekly community-based 5 kilometre event, has grown considerably since its inception in 2004, with over 1.5 million people participating in 2022 alone (1). In addition, running was the most popular form of aerobic exercise for Australian adults aged between 18 and 44 years in 2018, with approximately 4.6 million Australians reporting that they run regularly (2). The appeal of running may be attributed in part to its low barriers to entry, as it is often considered time efficient, inexpensive, and easily accessible (3, 4).

Running offers a plethora of benefits spanning across physical fitness, mental well-being, and community engagement, making it appealing to not only individuals, but also from a public health perspective. Numerous epidemiological studies have reported health benefits associated with running, including a reduced risk of certain cancers (5), reductions in hypertension and dyslipidaemia (6) and likelihood of developing chronic diseases (7), combined with improvements in body composition (8), type 2 diabetes mellitus (6). Individuals who engage in running can also experience a notable (25 – 40%) decrease in premature mortality risk compared to non-runners (9, 10). Even running in small amounts, as minimal as once a week, can yield reduced risk of all-cause, cardiovascular and cancer related mortality (5). Yet, despite compelling evidence for the health benefits of running (11-14) many individuals struggle to maintain it as form of regular activity.

Running (dis)continuation

While commencing running is gaining traction amongst individuals, global physical inactivity levels are a significant concern. In addition, a significant proportion of those who initially take up running fail to sustain their engagement over the long term (11-14). Running-related injury and lack of motivation are two main reasons people discontinue running (15-20). For example, research has shown that after competing in a running event, up to 30% of runners had discontinued by 9 months (14). Furthermore, studies suggest that sustaining an injury only accounts for 20 – 24% of runners discontinuing, indicating most runners (76 – 80%) discontinue due to non-injury related reasons (13, 14, 21). Existing studies promoting ongoing running participation have largely focused on understanding and quantifying the training characteristics (type, volume, and intensity of running) that may predispose continuing runners to sustaining a running-related injury (22-25). Moreover, these interventions are often ineffective, and poorly adhered to (26), suggesting that despite efforts to mitigate physical risk factors, adherence remains a challenge.

Whilst injury prevention is an important aspect of running maintenance, comparatively fewer studies have explored non-injury related reasons for running discontinuation. Some existing studies have explored beyond physical characteristics of running participation, such as assessing motives or other psychosocial factors from a cross-sectional perspective of recreational runners (27), in a general adult population (28) or in ultra-marathoners (29). Some qualitative explorations with novice runners during the initial months of adopting a running regime (30) and individuals participating in community running events (31-33) have also provided insight into what may promote running

participation beyond physical attributes alone. These cross-sectional and qualitative studies have given means to exploring non-injury related reasons to why some people run, and identified factors conducive to participation. However, given that 76 – 80% of individuals who start running discontinue, it is critical to understand the catalysts for both continuation and discontinuation from the perspective of those who could not sustain a running regime. Despite this need, no known studies have engaged with discontinued runners to understand how these factors influenced their decision to stop running. This gap is particularly significant considering that these underexplored areas account for a larger proportion of running discontinuation than the well-researched area of injury prevention.

Motivation as the catalyst

As with all exercise, long-term running participation relies on sufficient motivation (34). The American Psychological Association (APA) defines motivation as "*the impetus that gives purpose or direction to behaviour and operates humans at a conscious or unconscious level*." More recently, researchers have identified the role automatic and reflective forms of motivation play in why people engage in behaviour (or not). The APA continues to describe these forms of motivation, with automatic motivation being the automatic process that are often outside of one's awareness, such as emotional responses, habits, impulses and inhibitions. Reflective motivation, on the other hand, relates to high level cognitive processes, such as beliefs, values, goals and identity.

To effectively address discontinuation, it is important to understand the motivational and psychological factors that support and discourage regular running. Recently, researchers have explored barriers and facilitators of running through a range of methods and

perspectives (30). These studies have revealed the multidimensional, dynamic, and complex experience that can contribute to individuals' perceptions of, and attitude towards, running that build on existing research into individual motives to run (35). These often centre around physical health and fitness (30, 35, 36), and mental health (12, 37), although some find motivation through competition (35), personal goal achievement (29) and social connection (38). Given the high levels of discontinuation, simply running for any of these benefits alone may not be a sufficient motive for maintaining the behaviour.

More recently, researchers have explored motives to running, and how these may change overtime. A longitudinal study by McCormick and colleagues qualitatively explored the motivation of individuals in the first six to twelve months after commencing running (30). In this study, the authors found that identifying a meaningful reason to engage with running underpinned continued behaviour. For example, for some participants, having a strong desire to run with their friends and maintain social connection promoted running continuation. While these findings highlight the importance of understanding the dynamic nature of motivation, and experiences of new runners as they navigate the initial stages of their running endeavours, they did not examine the motivation in the runners who discontinued. There is also limited evidence of the psychological mechanisms of these underlying motives (e.g., why motivation to run can shift overtime in some runners, and not others). This is a critical area that remains unexplored, and could provide integral information to aid in promoting long-term running engagement. Advancing this understanding is necessary to not only identify contributors of sustained participation, but also to inform interventions targeting running maintenance.

Theories of behaviour change applied to health behaviours

It is now well established that engagement in physical activity, and more recently running goes beyond simply being motivated to participate. Rather, motivation is a complex and dynamic psychological endeavour. At the heart of adopting any health behaviour, is motivation that regulates the individual's intention, effort, and reason for engaging in that behaviour. The quality and quantity of motivation to adopt and maintain that health behaviour can shift overtime. This is clearly demonstrated in the proportion of individuals who intend to be active regularly, but fail to do so, also known as the intention-behaviour gap. When examining theories of behaviour change, motivation often serves as a linchpin in understanding the adoption and maintenance of a behaviour or running in relation to this thesis. Theories of behaviour change, whether they focus on the stages of behaviour change towards engaging in the behaviour, or the influence of intrinsic and extrinsic motivators, inherently recognise the central role of motivation (39). Behaviour change theories provide frameworks for understanding how motivation fluctuates and drives participation in health behaviour. As such, it is important to review the landscape of behaviour change theories that have been used to explain, predict, and promote successful engagement in health behaviours that may translate to running participation.

Psychological theories of behaviour change have been extensively studied and integrated into health and physical activity interventions for decades (40). These theories vary widely in how they approach behaviour change and maintenance, each proposing a variety of social-cognitive variables that relate to motivation and intention to engage in a behaviour. These theories often complement each other by considering various influencing factors of behaviour, leading to researchers frequently integrating multiple theories to

comprehensively explain engagement in specific health behaviours (41-43). Whilst many theories exist, select frameworks were identified to serve as a foundation for the projects within this dissertation, drawing upon their application within existing health and physical activity, and if available, running literature. Of particular note, Self-determination Theory (SDT) (44-46), is prominent throughout this research, serving as a cornerstone in explaining motivation towards running, aligning closely with the central aims of this research. These foundational theories are described in detail below.

Self-determination Theory

Self-determination Theory (SDT), developed by Deci and Ryan (44-46), suggests an individual's motivation is regulated by how much they believe the behaviour, such as running, is integrated within the self (47, 48). Here, a behaviour is proposed to be regulated by six types of motivation: amotivation, external, introjected, identified, integrated and intrinsic regulation. These six types of behavioural regulation represent varying degrees of internalisation, moving from externally driven motivation to more autonomous, self-determined forms of motivation (44-46), and are described below:

- Amotivation refers to a complete lack of motivation to engage in the behaviour. For example, a runner might feel that running is pointless, and lacks the intention to engage in it.
- External regulation occurs when the behaviour is driven by external rewards or pressures. A runner might participate in a race solely for a medal or prize, or to avoid criticism from others.
- Introjected regulation reflects behaviour that is somewhat internalised, but the person is still motivated by external factors, such as feelings of guilty or obligation.

For instance, a runner might feel compelled to run to avoid low self-esteem or to maintain a sense of self-worth.

- Identified regulation represents a more internalised form of motivation, where individuals recognise and accept the personal value of the behaviour. A runner may continue because they see the health benefits of running, even if it is not inherently enjoyable.
- Integrated regulation occurs when the behaviour is fully aligned with one's values and sense of identity. For example, a runner would consider running as a core part of their identity, and view it as essential to their overall lifestyle.
- Intrinsic regulation is the most self-determined form of motivation, where individuals engage in the behaviour purely for the inherent satisfaction and enjoyment it brings. A runner who is intrinsically regulated to run would do so for the joy of the activity itself.

When an individual is intrinsically motivated, they are more likely to engage in the behaviour (45, 49). Conversely, the more externally motivated an individual is, the less likely they are to value and engage in that behaviour (47). According to SDT, individuals must satisfy their innate, basic psychological needs for autonomy, competence, and relatedness to 'move' from more external motives, towards intrinsic or maintenance motives (maintenance motives will be described in detail in the section labelled, *Theoretical basis of behaviour maintenance on page 13*). The SDT continuum is presented in Figure 1.1.

There is considerable evidence demonstrating successful use of SDT-based interventions to support behaviour change (49-52). Literature reveals that more autonomous forms of

motivation, or more internally regulated motives, predict exercise participation across populations and settings. In relation to running, many individuals begin running for external reasons such as weight loss or to improve health, which may assist in short-term motivation (53), but may not necessarily foster behaviour maintenance.

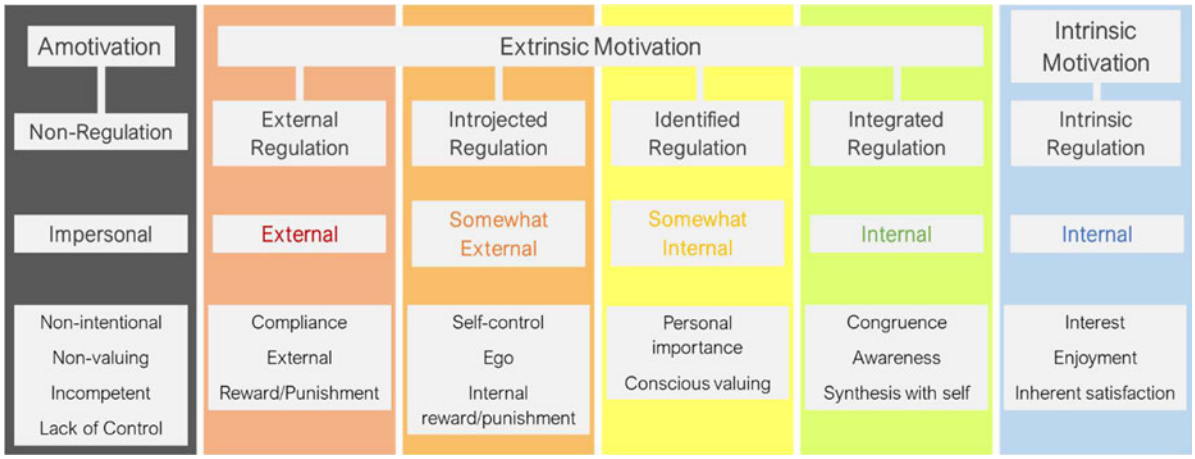


Figure 1.1 Self-determination continuum

Copyright © 2000, American Psychological Association. Reproduced with permission. Ryan & Deci 2000, Self-Determination theory and the facilitation of intrinsic motivation, social development, and well-being, American Psychologist, vol. 55, no. 1, pp. 68 – 78.

Affective-Reflective Theory

The Affective-Reflective Theory (ART) of physical inactivity and exercise highlights how affective responses, both automatic and reflective, influence whether an individual engages in, or avoids physical activity (Figure 1.2) (54). Brand and Ekkekakis (2018) propose the ART occurs with an exercise-related stimuli, which trigger immediate, affect-driven impulses, which can either promote or restrain behaviour change, depending on the emotional response and self-control resources available. This dual-process occurs when an individual either automatically or reflectively evaluates engaging in exercise as pleasant/positive (e.g., positive feelings of accomplishment) or unpleasant/negative (e.g.,

negative associations with discomfort), which influences their motivation to change their state, or remain in the present state.

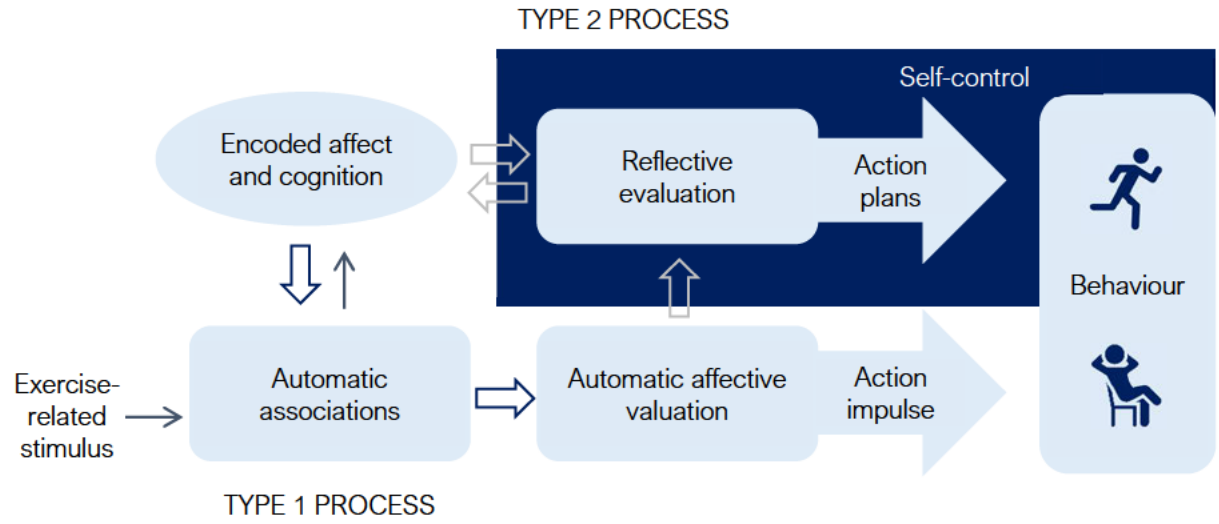


Figure 1.2 Affective-Reflective Theory of physical inactivity and exercise

Reprinted from the German Journal of Exercise and Sport Research, Ralf Brand et al, Affective-Reflective Theory of physical inactivity and exercise, November 14, 2017. Springer Nature. In the public domain.

The ART, as an emerging framework, has been used to understand exercise behaviour, focusing on the automatic affective responses that influence individual's decision-making regarding physical activity. Researchers have shown that both positive and negative automatic associations with exercise can impact participation in exercise (55). For example, positive automatic evaluations have been linked to greater adherence to exercise programs, while negative associations can trigger avoidance behaviours (55), demonstrating that individuals with positive affective responses are more likely to engage in exercise regularly. Therefore, strengthening positive affective responses, and increasing self-control resources (e.g., beliefs about anticipated affective experiences with the behaviour, deliberative reasoning about one's needs and values) may help individuals maintain regular running engagement over time.

Health-Action Process Approach

The Health Action Process Approach (HAPA) emphasises that the adoption, initiation, and maintenance of health behaviours, such as running, occur in two key phases: motivation and volition. In the motivation phase, individuals must set goals towards the behaviour, with self-efficacy and outcome expectancies critical in forming intentions to act, while risk perceptions (e.g., perceiving a health threat) play a limited role in motivating individuals to change (56, 57). In the volition phase, these intentions must be translated into action through detailed planning and self-regulatory processes. Self-efficacy remains crucial throughout this period, influencing both the formation of specific plan and the persistence needed to maintain behaviours despite obstacles or competing demands. As such, the HAPA combines the features of stage-based models (see 'Transtheoretical Model') and continuum models (see 'Self-determination Theory') to distinguish between motivation and volition in changing health behaviours. This model sheds light on the role of self-belief and planning in sustaining a behaviour over time (Figure 1.3).

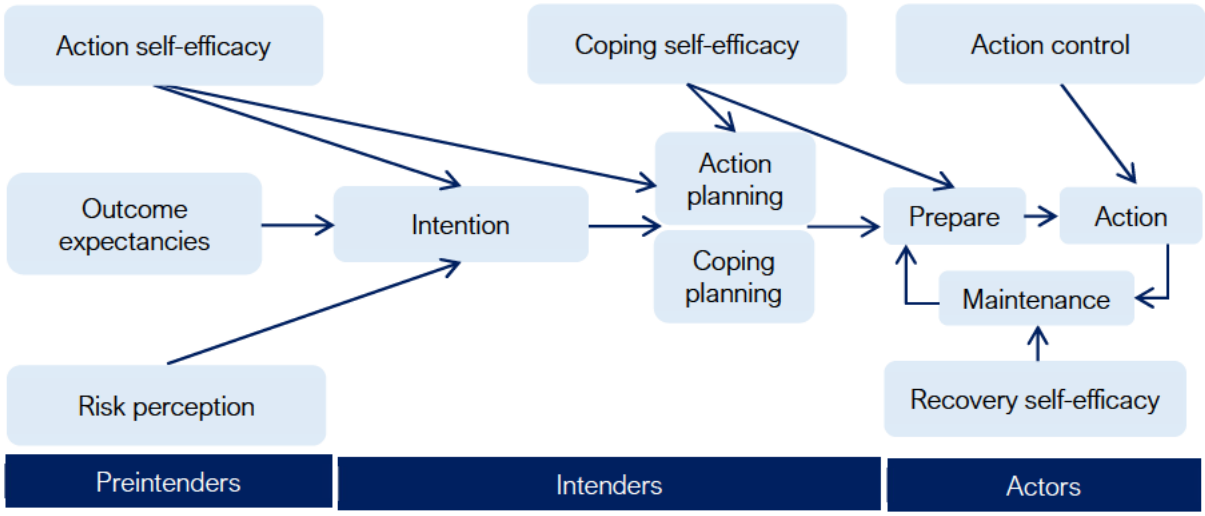


Figure 1.3 The Health-Action Process Approach

Adapted from Schwarzer, R. (1992). Self-efficacy in the adoption and maintenance of health behaviors: Theoretical approaches and a new model. In Schwarzer, R. (Ed.), Self-Efficacy: Thought Control of Action (pp. 217–243). Washington, DC: Hemisphere. In the public domain.

The HAPA and its constructs has been used to guide the development of a number of interventions promoting engagement in health behaviours with small-to-medium effects (56). Larger effects were found in the action self-efficacy construct on intentions to participate in physical activity compared to dietary behaviours. Action self-efficacy incorporates the ability to imagine success and anticipate potential outcomes of the strategies to support engagement in a new behaviour (58). By targeting action self-efficacy, runners may develop the confidence to overcome obstacles and continue engaging in the activity long-term, facilitating the physical and mental health benefits associated with running.

Theory of Planned Behaviour

The Theory of Planned Behaviour (TPB) suggests that behaviour is determined by individual intentions, which are influenced by attitudes toward the behaviour, subjective norms, and perceived behavioural control (59). Here, TPB posits that favourable intentions predict adoption of the behaviour. Attitudes towards the behaviour are a function of the beliefs and value of the possible outcomes of engaging in the behaviour. The component of subjective norms refers to the perceived social pressure to engage in the behaviour. Lastly, perceived behavioural control involves the individual's perception of their ability to perform the behaviour. The theory and its components are presented in Figure 1.4.

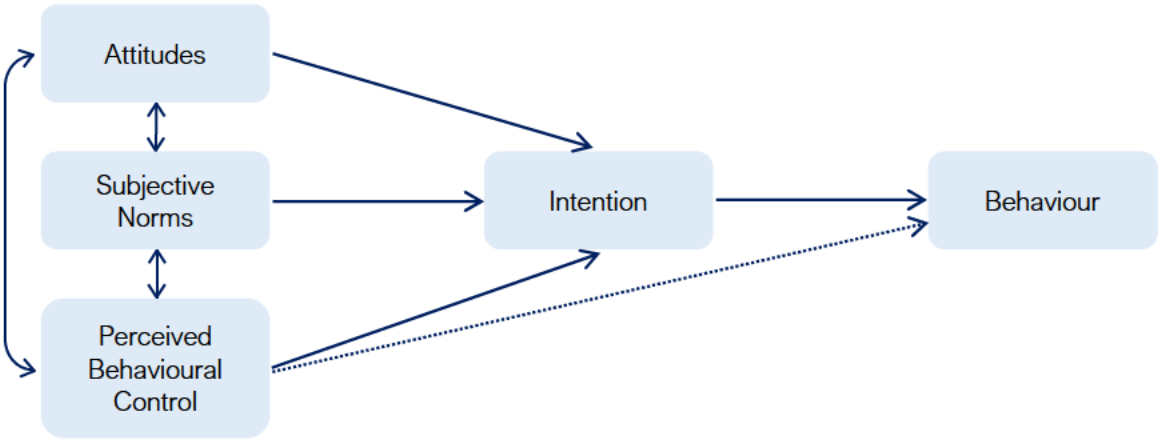


Figure 1.4 Theory of Planned Behaviour

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The TPB has regularly been used to explain and address engagement in physical activity (43). Intention to being active has been found to be a predictor of physical activity behaviour (59, 60). A mixed-methods study assessing intention-behaviour in runners found certain strategies, such as reinforcing positive feelings of accomplishment, to be effective in supporting running participation (61). However, a clear intention-behaviour discrepancy exists within physical activity literature, whereby the intention to be active does not always translate into successfully performing the activity (62). De Bruijn and Rhodes identified that 48% of those intending to exercise do not successfully follow through with the behaviour (60). As such, continued participation in running relies on positive intentions to be a sustainable driver for behaviour (41, 60). Attitudes, subjective norms, and perceived behavioural control can also determine how an individual experiences and copes with barriers that influence the likelihood of successful intention-behaviour conversion in activity (63). The interplay of these psychosocial factors contributes to the intention-behaviour gap in physical activity behaviour, making them important potential variables to facilitate running maintenance.

Self-efficacy Theory

Self-efficacy Theory, as a sub-set of Social Cognitive Theory, emphasises an individual's perception and belief in their ability to change and pursue their goals (64). Bandura (65) proposed that self-efficacy stems from four main sources of influence: 1) mastery experiences/performance outcomes, 2) vicarious experiences, 3) verbal persuasion, and 4) physiological states (Figure 1.5). Mastery experiences are the most influential source of self-efficacy, as this encompasses reflecting on past personal experiences of success (or failure) that act as reinforcing evidence for strategies and skills that may be applied to future efforts of behaviour change (65). Vicarious experiences encompass the observation of role models successfully completing a behaviour that can manifest beliefs of the individual's own capability to change. Verbal persuasion refers to feedback that encourages or discourages an individual's ability to perform the behaviour. Lastly, physiological states (e.g., arousal) can provide a sense of efficacy depending on how it is interpreted. For example, arousal may facilitate self-efficacy if it is interpreted as positive.

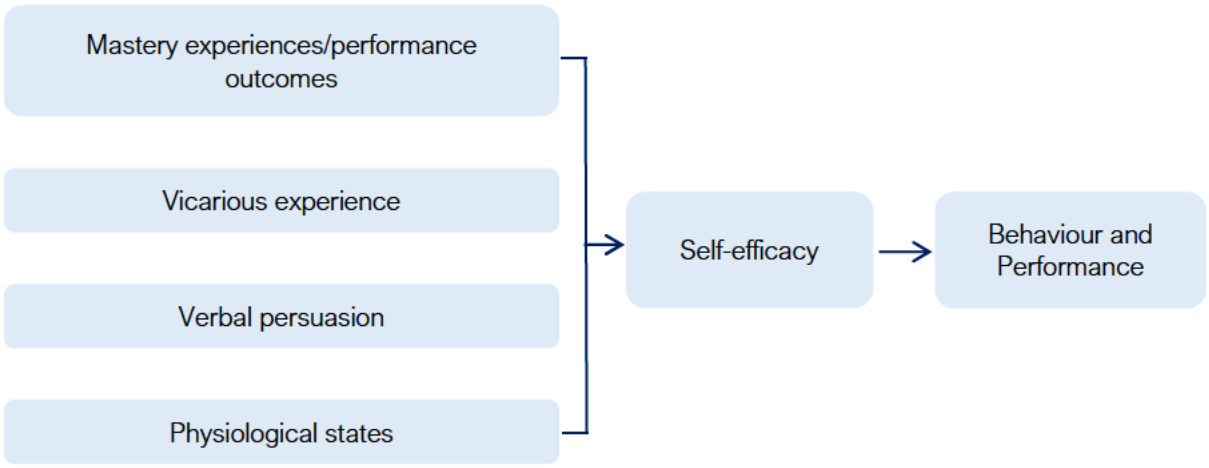


Figure 1.5 Self-efficacy Theory

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Self-efficacy is one of the strongest predictors of exercise behaviour (66, 67). Researchers found that individuals with high levels of self-efficacy are more likely to pursue challenging goals and persevere in the face of obstacles (68). Additionally, self-efficacy beliefs seem to facilitate greater affect towards physical activity (65). Self-efficacy has been found to play an important role in shaping behaviour. In endurance activities, individuals with a higher level of self-efficacy were found to persist longer (e.g., hold a plank exercise for longer) (69). Given the role in both predicting behaviour and influencing the effort towards an activity, it is essential that self-efficacy is explored in the context of promoting running maintenance.

Transtheoretical Model

The Transtheoretical Model (TTM) offers another lens through which to understand motivation and readiness to change (70). The TTM proposed individuals move through 'stages of change', delineated by their readiness to change and intentions (e.g., no intention, or intending to make small changes towards the activity), or time (e.g., have sustained the behaviour for six months). The transtheoretical model proposes that change begins with precontemplation (e.g., no intention to start being active), and individuals move through to contemplation, preparation, action and finally, a maintenance stage of the behaviour (engages in regular activity for more than six months). Other proposed stages include relapse and termination, where an individual can revert to former stages or cease the behaviour altogether. Importantly, an individual can cycle back and forth through stages before the behaviour is maintained. To support movement through the stages, a number of cognitive and behavioural techniques are proposed. For example, conducting a decisional balance, whereby an individual reflects on the costs and benefits

of changing and not changing; self-efficacy (and related components previously discussed), and processes of change (e.g., cognitive and behavioural strategies) can be influential in moving through towards behaviour maintenance (39). The TTM stages are presented in Figure 1.6.

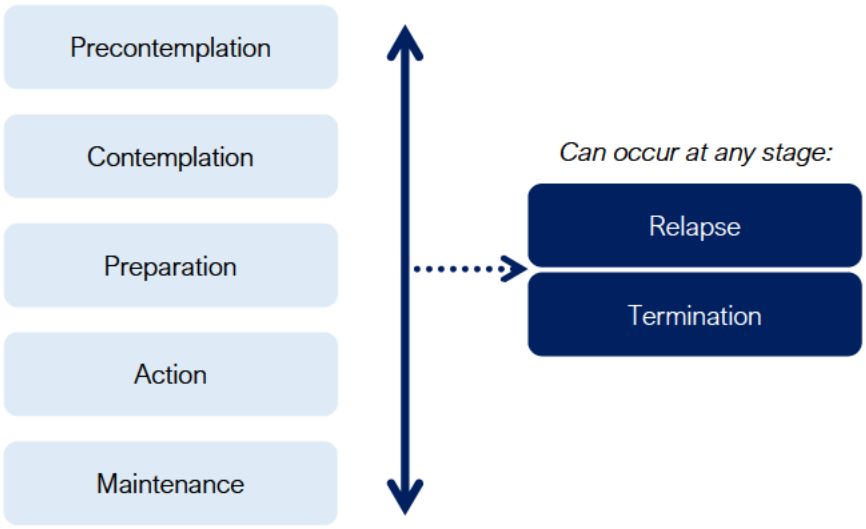


Figure 1.6 Transtheoretical Model

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In the context of physical activity, the TTM can be applied to understand individuals' readiness to adopt and maintain the behaviour. Intervention strategies can be tailored to match individuals' stage of change, addressing specific barriers and facilitators relevant to each stage. Several studies have investigated TTM in physical activity, finding that cross-sectional readiness to change reflects engagement in physical activity (71-73). Importantly, research establishes an individual's readiness to change corresponds with physical activity behaviour, with Marshall and Biddle confirming 'stage membership is associated with different levels of physical activity, self-efficacy, pros and cons, and processes of change' (72). The processes and strategies to support an individual towards behaviour maintenance (e.g., promoting self-efficacy), regardless of their stage of change, could be an important inclusion when designing motivational interventions.

Theoretical basis of behaviour maintenance

In pursuit of understanding mechanisms that underpin what motivates people to adopt or sustain health behaviours, many researchers have proposed the integration and application of psychological theories in behaviour maintenance. As discussed, these theories have frequently been applied in behaviour change interventions, including physical activity engagement (51, 74). To facilitate understanding of how these theories have been, or may be applied to running, it is helpful to understand how these theories collectively target behaviour maintenance.

Recently, several theories of behaviour maintenance have emerged, synthesising constructs from established psychological frameworks to describe the complex processes underlying behaviour maintenance. Among these, models such as the MAINTAIN-IT model (75ch) and the Multi-Process Action Control (M-PAC) model (76) offer valuable perspectives. The M-PAC model builds on components of reflexive and self-regulatory processes, intentions, habit formations, goal setting, affect and basic psychological needs, while the MAINTAIN-IT model integrates elements of executive function, all of which contribute to behaviour maintenance. Another model developed by Australian researchers, the behaviour maintenance model by Kwasnicka and colleagues, offers a framework for understanding the complexities of behaviour maintenance (77). Through the synthesis of over 100 behaviour change theories relevant to exercise maintenance, Kwasnicka and colleagues developed a process that helps explain the underpinnings of behaviour maintenance (77). They defined behaviour maintenance as *"continuous performance of a behaviour following an initial intentional change at a level that significantly differs from the baseline performance in the intended direction"* (77).

Through the theories identified, five overarching themes were revealed to play critical roles in whether a behaviour is maintained or not; these being: maintenance motives, self-regulation, resources, habits, and contextual influences.

Fundamental to these themes is the understanding that, in any given situation, individuals have various 'behavioural options' (77) (e.g., will I or will I not go for a run today?). These options are influenced by individual, psychological, social and environmental factors (39). Which of these behavioural options is enacted reflects the current individual and contextual factors. For example, it is likely that individuals adopt a new behaviour, such as running, when motivation is at its highest, and the perceived benefits of running are appealing. However, as motivation decreases, the costs of running supersede the benefits, self-regulatory strategies and resources such as healthy habits, stress management, emotional regulation are required to ensure that behaviour continue. Such self-regulation strategies refer to the ability to consciously control behaviour by replacing automatic behaviour and emotions with goal-directed responses and coping strategies to deal with barriers (78). Alternatively, when someone chooses to continue the behaviour on a regular basis, it is likely a reflection of the presence of what Kwasnicka and colleagues label 'maintenance motives' (77). Maintenance motives include when the individual experiences regular gratification from engaging in the behaviour, a sense of enjoyment, satisfaction, and self-determination, and congruence of the behaviour with their identity and values (39, 77, 79). It is proposed that individuals need at least one maintenance motive to manifest for the behaviour to continue across time and varying contexts (77).

By targeting both maintenance motives and self-regulation, individuals may experience an increased ability to maintain the behaviour. Thus, successful behaviour maintenance requires educating individuals to possess positive behaviour change maintenance motives and self-regulation, as well as healthy habit development, access to physical and psychological resources, and reshaping the environment to support maintenance (77). It is evident that people's experiences of maintaining health behaviour is dynamic and can change over time. The proposed relationships are presented in Figure 1.7.

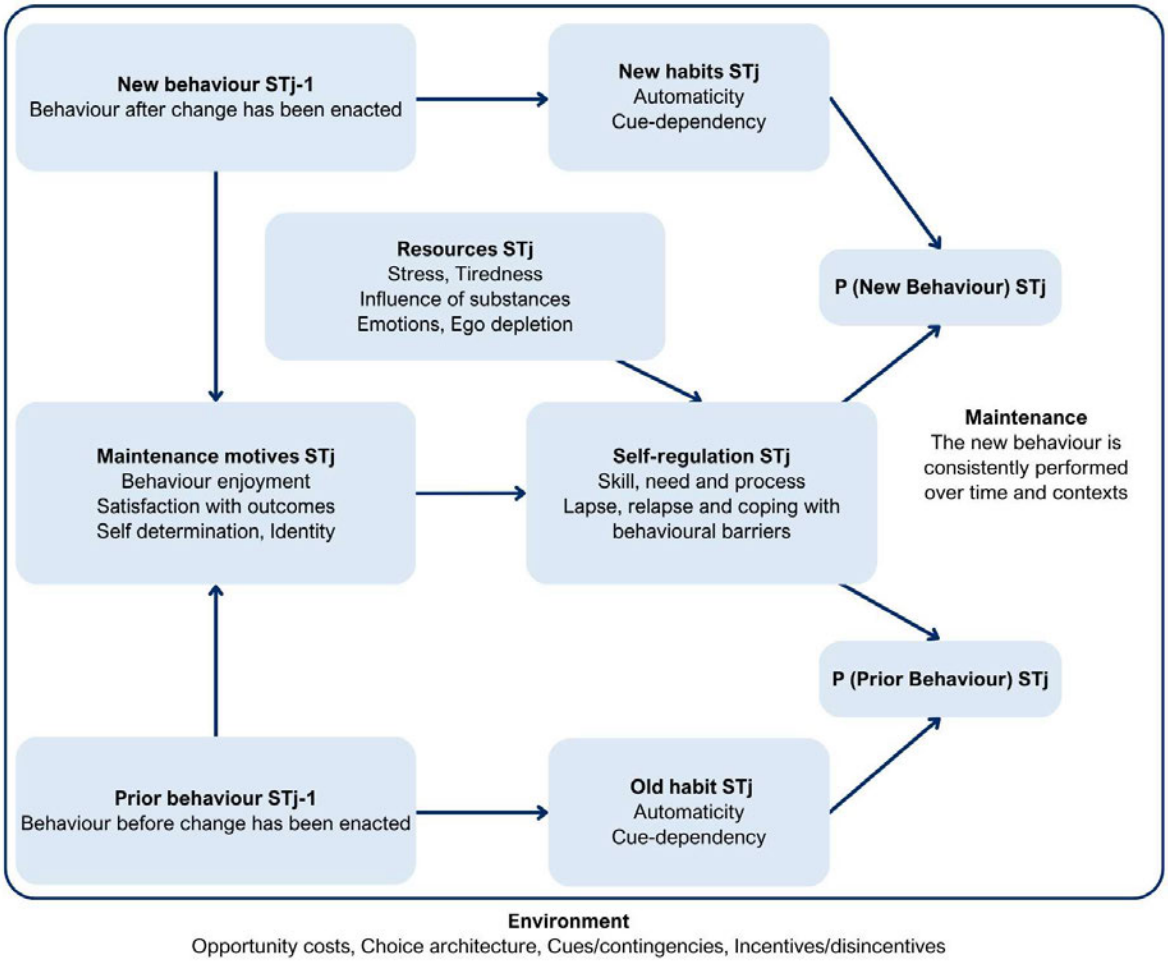


Figure 1.7 Hypothesised relationships of behaviour maintenance, as proposed by Kwasnicka and colleagues (2016).

Note: ST_j describes the psychological situation S defined by features of the environment (e.g., available choices, external dis(incentives), cues and opportunity costs) and person features (e.g., motivation, automaticity) at that point T_j. P indicates proposed new or prior behaviour. New and prior behaviour are competing against each other after initial behaviour change. Adapted from Kwasnicka (2016).

Gaps in the literature

Despite the interest in the field of physical activity and exercise psychology, several gaps persist in understanding recreational running behaviour and its psychological underpinnings. First, the literature concerning reasons for discontinuation of running primarily focuses on injury-related factors. Not only does this account for a small proportion of discontinuation, but overlooks other potentially influential motives. Injuries undoubtedly play a significant role in running discontinuation, but non-injury related reasons for discontinuation, such as motivation-related reasons, remain underexplored. Understanding these factors is important when considering how to effectively promote continued participation in running.

Motivation has been examined in the context of general physical activity engagement, research specific to recreational running remains sparse. While some existing studies have examined motives of runners examined the motives of runners, the exploration of these motives in relation to the psychological mechanisms of behaviour change and maintenance is limited. Examining how individual motivations interact with psychological processes could provide valuable insights into the complexities of maintaining a regular running routine.

Moreover, while some studies have investigated motives driving individuals to adopt running, none have examined how these motives may relate to training characteristics, such as the frequency, intensity, distance, duration of running activity. Understanding how motivation shapes training behaviours could provide valuable insights into how to establish training routines that may be conducive in supporting long-term maintenance.

In addition, this knowledge could enhance motivation and promote sustainable running habits.

Critically, despite recognition of the importance of psychological theories in physical activity behaviour change interventions, there is a lack of interventions informed by such theories aimed at promoting running maintenance among novice runners. Incorporating established psychological principles into intervention design could offer effective strategies for enhancing intrinsic motivation, fostering self-efficacy, and facilitating behaviour change maintenance for running specifically. Thus, addressing these gaps in the literature is essential to advance our understanding of recreational running behaviour, and developing effective interventions for long-term maintenance.

Thesis aims and structure

The central aim of this thesis was to explore the motivational and psychological influences to support running maintenance, which could allow individuals to reap the health benefits of regular, long-term running. In the pages that follow, this central aim is explored through four key subsequent aims:

Aim 1: investigate whether distinct motivational profiles exist within a large sample of runners, and explore differences in training characteristics between these profiles,

Aim 2: to explore the psychosocial aspects related to recreational running maintenance from both current and discontinued recreational runners,

Aim 3: to design an educational program to promote ongoing running participation in novice runners, mapped to psychological theories through an intervention mapping approach, and

Aim 4: deliver an intervention to facilitate running maintenance in a 12-week feasibility randomised controlled trial.

The outline and relationship of each study in relation to the thesis aims are depicted in Figure 1.8. This thesis has been formatted in the traditional way. Any instances where the paper has been accepted for publication is disclosed at the start of the chapter. Each chapter is dedicated to exploring one of the above aims. **Chapter 2** addresses the Aim1 through examining cross-sectional motivation in a large sample of runners. **Chapter 3** explores Aim 2 through qualitative interviews to identify barriers, enablers and other psychosocial factors that promote(d) or hinder(ed) running activity with current and discontinued runners. **Chapter 4** builds on findings from Chapter 3 to develop, design and pre-test an online intervention (*Just Run)* to support novice and returning runners

continue running (Aim 3). Chapter 5 presents the evaluation of the feasibility of the *Just Run* intervention (Aim 4). The final chapter of this thesis (Chapter 6) discusses the implications of this research for runners, coaches, and intervention designers, and outlines key areas for additional research.

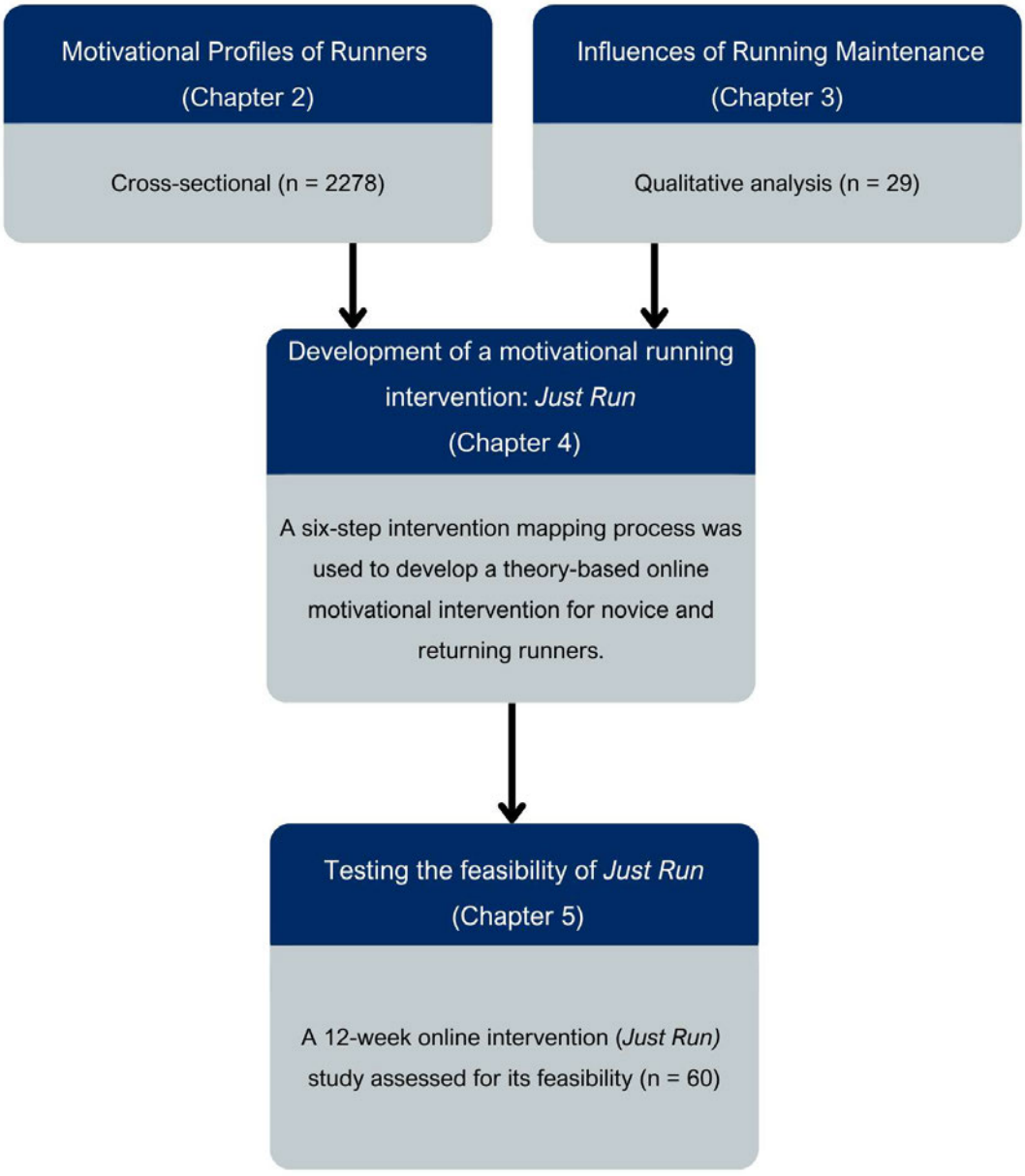


Figure 1.8 Chapter/study outlines and relationship of each chapter in relation to the thesis aims.

Chapter 2

Understanding Runners' Motivation and Training Profiles: A Latent Profile Analysis of the Garmin-RUNSAFE Running Health Study

Given the known role motivation plays in behaviour maintenance, understanding how runners are motivated, and how their motivational orientation influences how they train, provides an important piece of the running maintenance puzzle, This chapter reports on findings from an analysis of data from the Garmin-RUNSAFE Running Health Study (80).

Abstract

Running is a popular form of physical activity, yet little is known about how runners are motivated and how motivational orientation reflects how individuals choose to engage in running. This cross-sectional study aimed to investigate the presence of distinct motivational profiles among runners and explore their associations with objective training characteristics. Utilising Self-determination Theory (SDT) as a theoretical framework, the Behavioural Regulations in Exercise Questionnaire, version 3 (BREQ-3) was administered to participants enrolled in the Garmin-RUNSAFE Running Health Study to assess motivation towards running. A total of 2,278 participants completed the BREQ-3 and were included in this analysis, with training characteristics (frequency, intensity, duration, and distance) from the previous four weeks analysed. Latent profile analysis identified four motivational profiles based on responses of the BREQ-3: 'balanced engagers' (n = 620), 'autonomous achievers' (n = 1,379), 'reluctant runners' (n = 117), and 'controlled engagers' (n = 162). These profiles reflected varying levels of autonomous and controlled motivation. 'Autonomous achievers', comprising the majority of the sample, demonstrated high levels of autonomous motivation, and engaged in running more frequently (median difference: 0.5 - 1.5 count/wk, $p < 0.01$) and for longer durations (median difference: 41.5 – 120.0 mins/wk, $p < 0.01$) compared to other profiles. Conversely, reluctant runners exhibited low motivation alongside limited running activity. The findings highlight the importance of considering individuals' underlying motivational profiles, which may promote running maintenance and the associated long-term health benefits. Further research should aim to validate these findings in diverse running populations, investigate

temporal associations using longitudinal approaches to better understand the influence of motivational profiles on training characteristics.

Introduction

The popularity of running is undeniable, ranking among the top three forms of physical activity (PA) across the five regions of Africa, the Americas, Eastern Mediterranean, Europe, Southeast Asia and the Western Pacific (81). Regular running can improve mental health and reduce the risk of all-cause and cardiovascular mortality (7, 9). However, accruing the health benefits of running depends on regular and sustained engagement. Individuals who engage in running as a form of PA may be driven to do so for a variety of reasons, such as weight management, or to improve fitness or mental health (30, 37, 82). What motivates an individual to participate in any PA modality, including running, is an important factor in determining whether that behaviour is maintained (34). Behaviour change theories have played a critical role in understanding what influences individual motivation and decisions to engage in health behaviours. Self-Determination Theory (SDT) (44-46) is one theory used by researchers and health professionals to understand how to promote exercise adherence that is appropriate for their current motivation and psychological preparedness (83). According to the SDT, motivation exists on a continuum from more controlled (external) to more autonomous (intrinsic) regulation. Furthermore, SDT posits that individuals have innate psychological needs for autonomy, competence and relatedness, which are essential for fostering intrinsic motivation and sustained engagement in health behaviours. When these basic psychological needs are satisfied, individuals can 'move' along the motivation continuum, from being amotivated (i.e., no desire to participate in behaviour) and externally regulated (i.e., participating because of pressure from others), towards more internal forms of regulation (i.e., inherent enjoyment of the behaviour). Importantly, people often experience multiple or even competing types

of motivation towards exercise (84). As such, SDT has been used as a framework for distinguishing individuals based on the distribution, or profiles, of their motivation to participate in PA (84-89).

Existing research has highlighted a multitude of motives driving individuals to run (12, 30, 37). These motivations often align to the six distinct motivational regulatory styles outlined within SDT (44-46). For example, an individual may run because a friend has asked them to join (e.g., a form of external regulation), but simultaneously feel an obligation to run to avoid feelings of internal guilt if they do not exercise (e.g., introjected regulation). Prior research has provided valuable insight into how such motivational orientations can interact with and shape exercise behaviours. For example, Nuss et al. (85) found exercisers that shared high levels of both external and internal motivation participated in more moderate-to-vigorous PA compared to other motivational profiles. As such, exploring motivational orientations shared amongst runners could shed light on the influence motivation has in shaping running behaviour. For this reason, having a greater understanding of how runners are motivated, coaches and individuals may be better able to prescribe and manage training prescription for those profiles to promote optimal outcomes, and prevent discontinuation.

Researchers have previously profiled runners based on factors external to motivation orientation (90, 91). For example, Van Iperen and colleagues profiled runners according to their passion towards running, and consequently assessed whether this related to running-related injury risk (91). In this study, runners who had a healthy passion for running, and better coping strategies, reported experiencing fewer injuries compared to two other profiles (91). Additionally, Thuany et al. explored profiles of runners based on

socioeconomic factors and dichotomous motivation to run ('performance' or 'health and quality of life') to explore associations with running performance (90). Here, running for performance seemed to differentiate between amateur and recreational runners. Whilst these studies demonstrate the ability for cluster analysis to profile runners, it is difficult to apply their findings to understand the complexities of running motivation. For example, measuring passion or unidimensional motivation is not reflective of the multidimensional nature and intricacies of exercise motivation, and therefore is unlikely to capture the true extent of the role of motivation in potentially shaping running behaviour. Furthermore, whilst Thuany and colleagues assessed training characteristics, they relied solely on self-reported data, limiting the ability to accurately evaluate the running characteristics as a distinguishing factor between profiles (90). The application of SDT in distinguishing motivational profiles and objective training characteristics runners remains unexplored. Clustering runners using more comprehensive measures of motivation, and capturing objective training characteristics may prove beneficial to confidently distinguish profiles. Moreover, determining whether motivational profiles are associated with training characteristics may help address physical and motivational factors preceding dropout, and promote more sustainable training habits.

The aim of this cross-sectional study was to 1) investigate whether distinct SDT-based motivational profiles exist within a large sample of runners, and 2) to identify and explore differences in GPS-based training characteristics between these potential profiles.

Method

Data source

This study involved a secondary analysis of data from the Garmin-RUNSAFE Running Health Study (80). The aim of the study was to investigate risk factors for running-related injury, and how these factors may interact with injury progression to inform prevention strategies. As outlined in the protocol paper, the study is observational in nature, and thus no permission was required according to the Danish Act on Research of Health Projects, Section 14. no. 2 (80). Further, the Danish Data Protection Agency approved the data collection procedures and storage (80).

Context for this study

The context for this study lies within the broader framework of the Garmin-RUNSAFE study (80), which aimed to explore the relationship between training load and running-related injuries among a global cohort of runners. Enrolment in the Garmin-RUNSAFE study was open from 1 August 2019 to 31 December 2020. At enrolment, participants provided information on the country of residence and date of birth. Participants gave permission to access daily information on running distance during follow-up (enrolment to 31 December 2020) from their Garmin Connect account (a worldwide web-based training diary). Participants already recruited in the study agreed to respond to questionnaires in English at regular weekly and biweekly intervals and to regularly upload their running sessions to Garmin Connect. The inclusion of the Behavioural Regulations in Exercise Questionnaire, version 3 (BREQ-3) within the Garmin study in December 2020 stemmed from collaborative discussions between the lead researcher and the author of this thesis, prompted by interest in exploring the interplay between motivational factors

and training choices. The flow of participants from the Garmin-RUNSAFFE Running Health Study included in the present study is included in Figure 2.1.

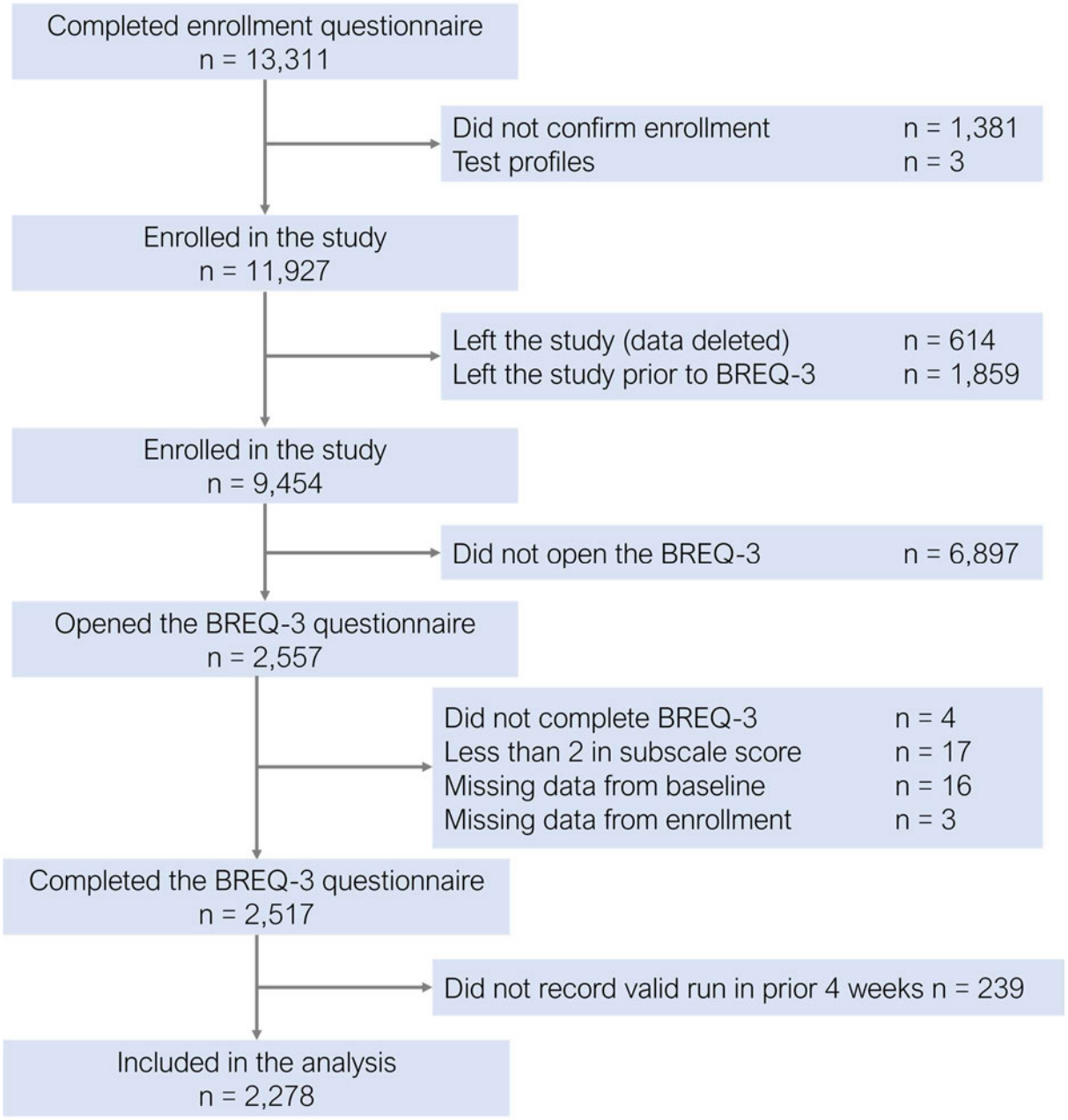


Figure 2.1 Participant flow of those included in the present study from the Garmin-RUNSAFE Running Health Study cohort. BREQ-3, Behavioural Regulations in Exercise Questionnaire, version 3.

Participant characteristics

The eligibility criteria for participants in this study were the same as the original Garmin-RUNSAFE study [25], with the additional requirements of having valid data for the motivation questionnaire and training characteristics. Included runners were aged ≥ 18 years and familiar with the English language. Participants were recruited from countries worldwide, including but not exclusive to England, United States of America, Australia, New Zealand, Denmark, Norway, Sweden, Germany, The Netherlands and Belgium. English-speakers of all levels of running experience were eligible for inclusion if they owned a compatible Garmin watch that allowed running activity to be uploaded to the Garmin Connect (Olathe, Kansas, USA) online activity tracking platform. Runners were excluded if more than one person used the same watch. The full eligibility criteria is available in the study protocol paper (80). Demographic data at study entry, including running experience and participation, were self-reported by participants.

Motivation

From 4 – 31 December 2020, participants enrolled in the Garmin-RUNSAFE study were asked to complete the Behavioural Regulations in Exercise Questionnaire, version 3 (BREQ-3), a 24-item questionnaire, which assesses six regulations of motivation for exercise according to SDT (92). The questionnaire included four items per subscale for amotivation, external regulation, introjected regulation, identified regulation, integrated regulation and intrinsic motivation. As the measure was originally designed to assess general exercise motivation, for the purpose of the current study, the term ‘exercise’ was replaced with ‘running’ or ‘run’ where applicable. Participants were asked to respond to each item using a five-point Likert scale (0 = not true for me, to 4 = very true for me).

BREQ-3 mean scores for each subscale were calculated. The BREQ-3 is the only known instrument to measure the six regulation types of motivation for exercise that exist within SDT (93). The use of the BREQ-3 has demonstrated good test-re-test reliability (ICC >0.78) (48), as well as good convergent (48, 94) and criterion validity (95).

Training characteristics

Quantitative training data from Garmin Connect via Garmin's Health Application Programming Interface were extracted for all participants for the four weeks before the BREQ-3 was completed. Assessing training from the preceding four weeks was selected to ensure motivation was reflective of participants' recent running behaviours. To capture comprehensive training characteristics for each participant, total number of runs completed, distance per run (km), duration per run (minutes) and average pace per run (min/km) from the four weeks was analysed. Runs recorded with a pace of ≤ 3 min/km or ≥ 10 min/km were excluded due to these likely representing outlier data points. When a participant did not record a run for the week, a zero was assigned for the distance and duration.

Data analysis

Descriptive statistics (means and standard deviation/medians and ranges) were used to describe BREQ-3 outcomes for the sample. All training characteristics were considered continuous variables. To examine the normality of the data, the training characteristics and motivation of recreational runners were visually inspected using histograms and descriptive statistics (means and standard deviation [SD] and/or medians and interquartile range [IQR]). Approximately 800 duplicate sessions were removed (i.e., two

sessions with the same start time but different distances recorded [i.e., within 100 metres]).

To identify common motivation patterns amongst runners, latent profile analysis (LPA) was conducted based on the BREQ-3 subscale scores (six continuous input variables). LPA identifies distinct, non-overlapping latent classes of individuals based on a certain set of variables (96). LPA assumes that people can be categorised into subpopulations that have different configural attributes (96), allowing meaningful typologies to be derived in a sample. In this study, participants with similar response patterns of the BREQ-3 were classified into a profile. LPA solutions from 2 to 9 profiles were estimated, with each factor freely estimated across profiles to assess the fit of multiple profiles (97). Factor variances were fixed across profiles due to convergence problems that can result from over-parameterisation (98, 99). LPA solutions were estimated with 25 random starting values and 100 iterations. The decision of how many profiles to retain in the final solution was based on several factors, in line with previous recommendations for LPA (96). Firstly, the statistical indicators including the Akaike Information Criterion (AIC) and the Bayesian Information Criteria (BIC) were assessed, with lower values on these indicators representing a better-fitting model (100). An elbow plot of the AIC and BIC was also constructed to identify the point where values levelled off (96, 101). Entropy values were also inspected, whereby higher values indicate better fit (97). Any models containing profiles representing less than 5% of our sample were rejected due to the possibility of being spurious (102). Lastly, theoretical compliance with SDT, interpretability, and informational value from a given profile solution were considered. Each profile was named to represent the distribution, quantity and quality of their motivation based on the BREQ-

3. Descriptive statistics were calculated for the demographic variables and BREQ-3 scores for each profile. As some of the training data were not normally distributed, the frequency, median and IQR (as appropriate) were computed for number of runs completed, total distance (km), duration (minutes) and average pace (min/km) for each motivational profile identified with the LPA. Each training characteristic was compared between profiles using Kruskal-Wallis and Dunn's test with Bonferroni correction. Statistical significance was set at $p < 0.05$. The magnitude of differences between groups following Dunn's test were contextualised through exploring differences between median values for each profile in their original units. Statistical analyses were performed using Stata Statistical Software, release 18, College Stations, TX: StataCorp.

Results

Participant characteristics

Characteristics of the included runners are presented in Table 2.1. The final sample (n = 2278) consisted predominantly of males (80.5%). Most participants were from Europe (59.6%). At baseline, almost two thirds of participants (63.6%) indicated their primary reason for running was for health and wellbeing. Almost all participants (98.0%) reported more than one year of running experience. Over a quarter of participants (28.5%) reported recording a personal best 5-kilometre time faster than 20 minutes (≤ 4 min/km pace).

Table 2.1 Participant characteristics. *Values are frequency (n) and % unless otherwise noted.*

Variable	Groups or unit	Descriptive statistics	
		N	%
Age (mean, SD)	Years	49.4	10.7
Gender	Male	1836	80.60
	Female	442	19.40
Height (mean, SD)	Centimetres	171.9	21.8
Weight (mean, SD)	Kilograms	72.1	14.5
Body mass index (mean, SD)	Kilograms / metre^2	25.7	12.7
Continent	Europe	1357	59.6
	North America	853	37.5
	Africa	39	1.7
	Asia	12	0.5
	South America	9	0.4
	Oceania	8	0.4
Primary reason for running	To socialise	13	0.6
	To compete	302	13.3
	To lose weight	55	2.4
	To get fitter	259	11.4
	For wellbeing/health	1448	63.6
	As supplementary training	72	3.2
	Other or not specified	129	5.7
Fastest 5 kilometre run ever	<20 mins	649	28.5
	>20 to 23 mins	711	31.2
	>23 to 26 mins	484	21.3
	>26 to 29 mins	232	10.2
	>29 to 32 mins	90	4.0
	>32 to 35 mins	39	1.7
	>35 mins or not specified	73	3.2
Member of running club	Yes	851	37.4
	No or other	1427	62.6
Running experience	Less than 5 yrs	471	20.7
	5 – 10 yrs	563	24.7
	10 – 20 yrs	575	25.2
	20 – 40 yrs	515	22.6
	More than 40 yrs or not specified	154	6.8
Running program	No program / schedule	419	18.4
	Program from coach	395	17.3
	Program from magazine/internet	289	12.7

Variable	Groups or unit	Descriptive statistics	
		N	%
	Self-organised program	1078	47.3
	Other	97	4.3
Perform other sport^	Yes, weight-bearing sport	118	5.2
	Yes, non-weight-bearing sport	957	42.0
	Yes, both types	245	10.8
	No	867	38.1
	Other or not specified	90	38.1

^ missing response n = 1. Baseline characteristics of the 2278 runners included in the study.

Motivation profiles

Based on both theoretical interpretation and statistical indications for AIC, BIC and entropy values, a four-profile model was favoured (Figure 2.2 and Table 2.2). Although models from five through nine were found to have lower AIC and BIC values than the four-

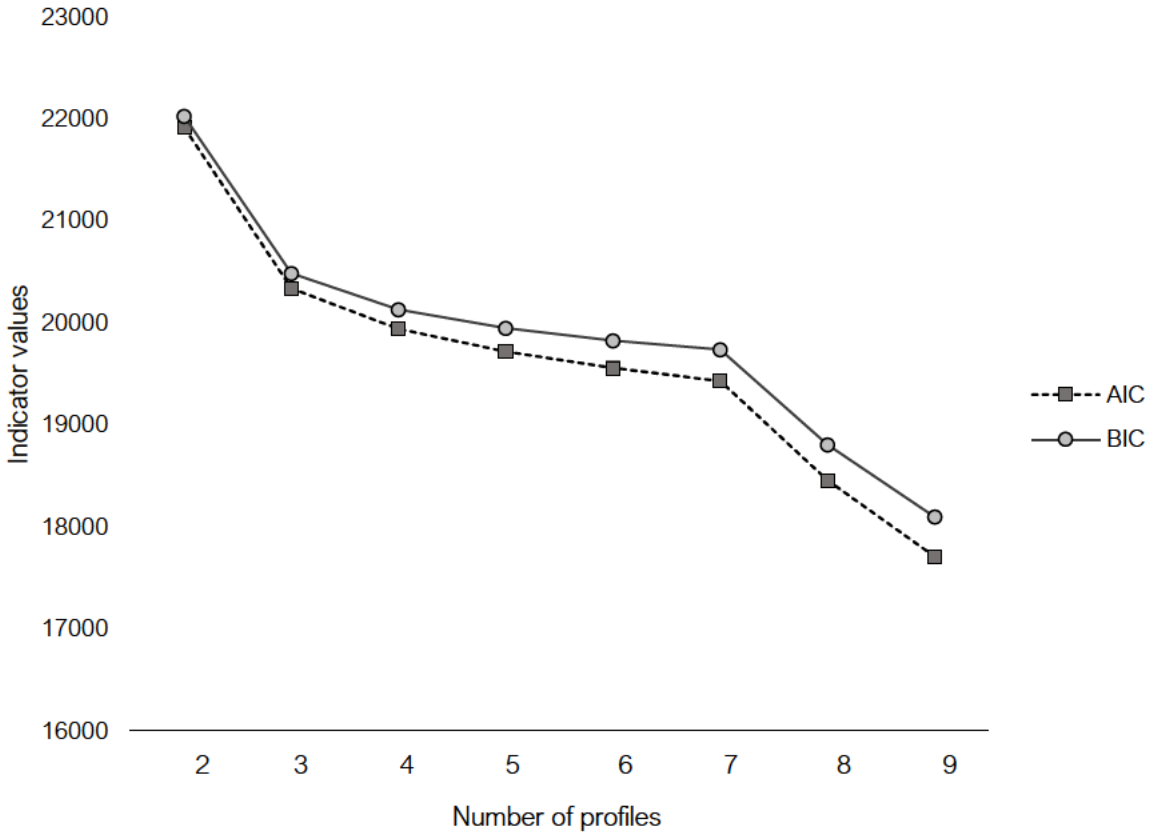


Figure 2.2 Statistical indicators for BREQ-3 profile solutions (2 – 9).

profile model, marginal gains in model fit were seen for models with more than four profiles.

Table 2.2 Fit indexes of the results of the Latent Profile Analysis (LPA).

Profiles	df	AIC	BIC	Entropy
2	19	21924.06	22032.95	0.82
3	26	20341.72	20490.72	0.90
4	33	19945.74	20134.87	0.87
5	40	19721.53	19950.77	0.97
6	47	19561.33	19830.69	0.90
7	54	19431.72	19741.2	0.66
8	61	18459.73	18809.32	0.87
9	68	17710.06	18099.78	0.89

AIC, Akaike Information Criterion; BIC, Bayesian Information Criteria

Figure 2.3 and Table 2.3 depict the four resulting profiles with the corresponding distribution of BREQ-3 subscale scores across the six regulations. Profile 1, 'balanced engagers' (n = 620, 27.2%) had moderate-to-high levels of motivation across all regulations, with higher scores attributed to the more autonomous subscales (identified, integrated and intrinsic). Profile 2, 'autonomous achievers' (n = 1379, 60.5%), had notably high levels of autonomous motivation and low levels of controlled motivation compared to the overall sample mean. The smallest profile, profile 3, 'reluctant runners' (n = 117, 5.1%), scored lowest in autonomous regulations, while scoring higher in amotivation and external regulation compared to profiles 1 and 2. Lastly, the 'controlled

engagers' in profile 4 (n = 162, 7.1%) had moderate scores in the autonomous regulations with high amotivation and external regulations scores compared to the sample means.

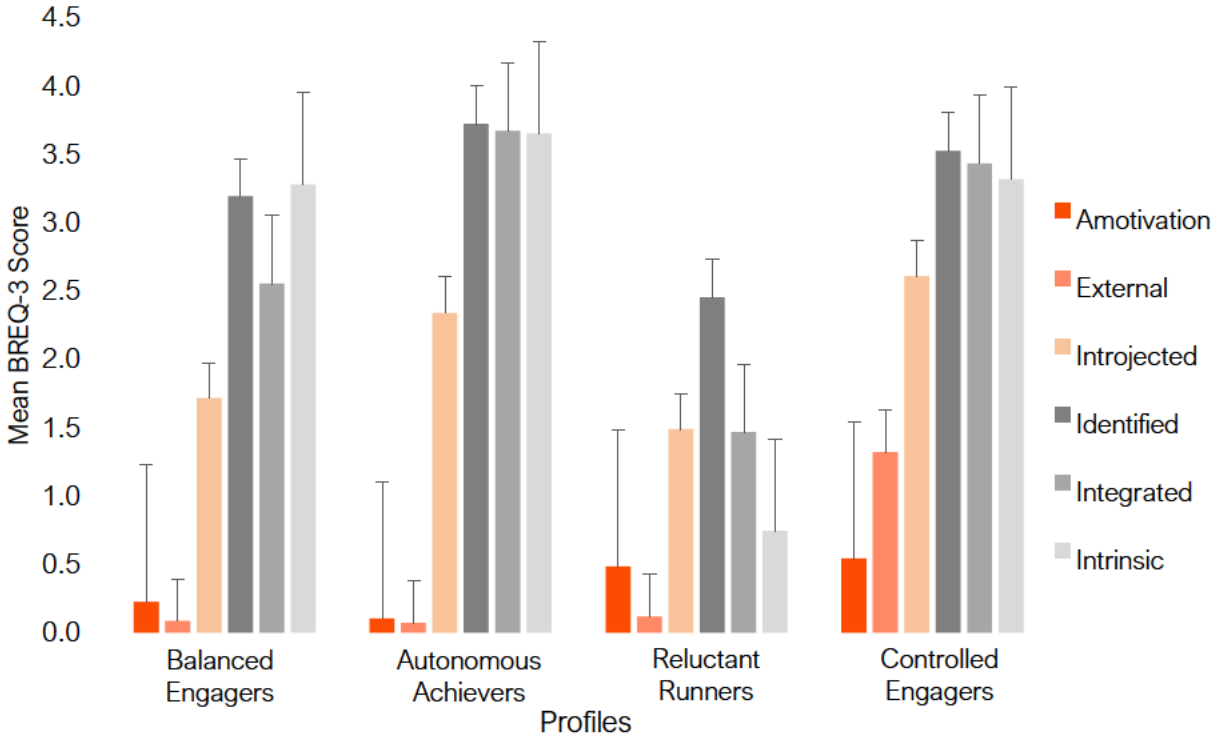


Figure 2.3 Latent Profiles with mean BREQ-3 scores.

BREQ-3: behavioural regulations in exercise questionnaire, version 3. Note. The mean score is based on each subscale in the BREQ-3 scale based on the continuum conception of motivation regulation according to Self-determination Theory [38-40]. Error bars represent SD.

Table 2.3 BREQ-3 subscale scores for each of the profiles in the 4-profile solution. Values represent mean (standard deviation).

		BREQ-3 subscale scores					
Profile	n	Amotivation	External	Introjected	Identified	Integrated	Intrinsic
Balanced Engagers	620	0.22 (0.39)	0.08 (0.17)	1.71 (0.92)	3.19 (0.40)	2.55 (0.50)	3.28 (0.57)
Autonomous Achievers	1379	0.10 (0.27)	0.07 (0.17)	2.34 (0.99)	3.72 (0.30)	3.67 (0.37)	3.65 (0.44)
Reluctant Runners	117	0.48 (0.57)	0.12 (0.25)	1.49 (0.89)	2.45 (0.53)	1.47 (0.67)	2.51 (0.74)
Controlled Engagers	162	0.54 (0.79)	1.32 (0.53)	2.60 (0.79)	3.52 (0.44)	3.43 (0.52)	3.32 (0.61)
Total	2278	0.34 (0.51)	0.40 (0.28)	2.04 (0.90)	3.22 (0.42)	2.78 (0.50)	3.19 (0.58)

The characteristics of participants within each profile are presented in Table 4. Participants age was not notably different between profiles (mean age 46.6 to 50.2 years). Each profile had a larger percentage of males (ranging between 75.3% and 87.2%) compared to females. Body mass index (kg/m^2) revealed all profiles were classified as 'overweight' (≥ 25.0 kg/m^2). Over half of participants in the 'balanced engagers', 'autonomous achievers' and 'reluctant runner' profiles resided in Europe, while 53.7% of 'controlled engagers' resided outside of Europe. All profiles reported the primary reason to engage in running was for wellbeing/health (between 53.9% to 64.4%). Fastest 5 km time recorded saw most participants in each profile reporting a time below 26 minutes (< 5:12 min/km pace), with between 15.4% and 32.7% of participants in all profiles recording a time below 20 minutes (< 4:00 min/km pace). While a moderate proportion of participants in the 'balanced engagers', 'autonomous achievers' and 'reluctant runners' were members of a running club (68.9%, 58.0% and 79.5%, respectively), only half of the 'controlled engagers' reported being a running club member (50.6%). 'Autonomous achievers' reported more years of running experience compared to other profiles, with 59.8% running for more than 10 years, compared to 'balanced engagers' (48.4%), 'reluctant runners' (40.2%) and 'controlled engagers' (45.1%). A larger number of 'controlled engagers' were following a running program from a coach (25.3%) compared to other profiles (11.1% to 19.1%). More 'autonomous achievers' were following a self-organised program (49.8%) than other profiles. Over half of participants in 'balanced engagers', 'autonomous achievers' and 'controlled engagers' participated in additional sport on top of their running activity (51.1%, 52.5% and 56.2%

respectively), although this was slightly more pronounced in the 'reluctant runners' profile (60.7%).

Differences between motivational profiles on running characteristics

Weekly training characteristics, being frequency (count/wk), intensity (min/km), duration (min/wk), and distance (km/wk) with median and IQR for each of the profile are presented in Figures 2.4 – 2.7 and Table 2.5. Post-hoc analysis indicated statistically significant differences between profiles for each of the running characteristics. Running frequency across profiles varied from 1.5 to 3.0 runs per week. Accumulated time spent running across the week varied from 57.8 to 161.5 minutes, equating to an average time of 45.1, 53.8, 38.5 and 48.0 minutes for each run across the week for each profile, sequentially. Weekly mileage varied from 9.1 to 26.6 km/wk, with the average distance per run calculated at 7.5 km (ranging from 6.1 to 8.9 km).

The 'autonomous achievers' ran more frequently (median difference: 0.5 - 1.5 count/wk, $p < 0.01$) and for longer durations (median difference: 41.5 – 120.0 mins/wk, $p < 0.001$ and distances (median difference: 7.6 – 17.5 km/wk, $p < 0.001$) compared to other profiles. In contrast, 'reluctant runners' had the lowest running activity, recording lower frequency, and distance compared to all other profiles ($p < 0.001$), and recording significantly less running volume than the 'autonomous achievers' profile ($p < 0.001$). 'Balanced engagers' recorded a frequency, distance and duration of running per week that mirrored the sample means, sharing similar running characteristics with 'controlled engagers' ($p > 0.05$). All profiles ran at a mean pace between 5:54 min/km and 6:12 min/km, with 'balanced engagers' and 'autonomous achievers' running at a faster pace compared with 'reluctant runners' ($p = 0.014$ and $p = 0.028$, respectively).

Table 2.4 Participant characteristics per profile. *Values are n (%) unless otherwise noted.*

Variable	Groups or unit	Descriptive statistics n (%)			
		1 Balanced Engagers (n = 620)	2 Autonomous achievers (n = 1379)	3 Reluctant Runners (n = 117)	4 Controlled Engagers (n = 162)
Age (mean, SD)	Years	48.4 (10.4)	50.2 (10.8)	46.6 (9.5)	47.4 (10.7)
Gender	Male	539 (86.9)	1,073 (77.8)	102 (87.2)	122 (75.3)
	Female	81 (13.1)	306 (22.2)	15 (12.8)	40 (24.7)
Height (mean, SD)	Centimetre	171.7 (21.2)	176.4 (14.8)	172.6 (22.2)	167.5 (27.3)
Weight (mean, SD)	Kilogram	72.1 (14.5)	78.2 (15.8)	74.2 (15.0)	71.1 (15.5)
BMI (mean, SD)	Kilograms / metre^2	25.3 (13.2)	25.2 (4.4)	26.1 (12.3)	27.4 (14.1)
Continent	Europe	433 (69.8)	773 (56.1)	76 (65.0)	75 (46.3)
	Other	187 (30.2)	606 (43.9)	41 (35.0)	87 (53.7)
Primary reason for running	To socialise	5 (0.8)	8 (0.6)	0 (0.0)	0 (0.0)
	To compete	62 (10.0)	209 (15.2)	8 (6.8)	23 (14.2)
	To lose weight	20 (3.2)	21 (1.5)	8 (6.8)	6 (3.7)
	To get fitter	86 (13.9)	136 (9.9)	16 (13.7)	21 (13.0)
	For wellbeing/health	399 (64.4)	887 (64.3)	63 (53.9)	99 (61.1)
	As supplementary training	13 (5.7)	80 (5.8)	9 (7.7)	5 (3.1)
	Other or not specified	35 (5.7)	80 (5.8)	9 (7.7)	5 (3.1)
Fastest 5 kilometre run ever	<20 mins	142 (22.9)	451 (32.7)	18 (15.4)	38 (23.5)
	20 to 23 mins	202 (32.6)	427 (31.0)	26 (22.2)	56 (34.6)
	23 to 26 mins	151 (24.4)	276 (20.0)	25 (21.4)	32 (19.8)
	26 to 29 mins	64 (10.3)	128 (9.3)	22 (18.8)	18 (11.1)
	29 to 32 mins	32 (5.2)	44 (3.2)	6 (5.1)	8 (4.9)
	32 to 35 mins	11 (1.8)	14 (1.0)	9 (7.7)	5 (3.1)
	>35 mins or not specified	18 (2.9)	39 (2.8)	11 (9.4)	5 (3.1)
Running club member	Yes	185 (29.8)	566 (41.0)	20 (17.1)	80 (49.4)
	No	427 (68.9)	800 (58.0)	93 (79.5)	82 (50.6)
	I don't know	1 (0.2)	3 (0.2)	2 (1.7)	0 (0.0)
	Other	7 (1.1)	10 (0.7)	2 (1.7)	0 (0.0)
Running experience	<5 yrs	156 (25.2)	232 (16.8)	44 (37.6)	39 (24.1)
	5 – 10 yrs	166 (26.8)	322 (23.4)	26 (22.2)	49 (30.3)

Variable	Groups or unit	Descriptive statistics n (%) 1 Balanced Engagers (n = 620)	2 Autonomous achievers (n = 1379)	3 Reluctant Runners (n = 117)	4 Controlled Engagers (n = 162)
	10 – 20 yrs	142 (22.9)	371 (26.9)	23 (19.7)	39 (24.1)
	20 – 40 yrs	120 (19.4)	348 (25.2)	18 (15.4)	29 (17.9)
	More than 40 yrs or not specified	36 (5.8)	106 (7.7)	6 (5.1)	6 (3.7)
Running program	No program / schedule	160 (25.8)	193 (14.0)	37 (31.6)	29 (17.9)
	Program from coach	69 (11.1)	264 (19.1)	21 (18.0)	41 (25.3)
	Program from magazine/internet	84 (13.6)	181 (13.1)	6 (5.1)	18 (11.1)
	Self-organised program	282 (45.5)	686 (49.8)	45 (38.5)	65 (40.1)
	Other	25 (4.0)	55 (4.00)	8 (6.8)	9 (5.6)
Other sport	Yes, weight-bearing sport	47 (7.6)	55 (4.00)	10 (8.6)	6 (3.7)
	Yes, non-weight-bearing sport	260 (42.0)	569 (41.3)	55 (47.0)	73 (45.1)
	Yes, both types	56 (9.1)	155 (11.2)	16 (13.7)	18 (11.1)
	No	232 (37.5)	545 (39.5)	31 (26.5)	59 (36.4)
	Other	24 (3.9)	50 (3.6)	5 (4.3)	6 (3.7)
	I don't know	0 (0.0)	5 (0.4)	0 (0.0)	0 (0.0)

Note: There are missing responses from the baseline questionnaire for running experience (n = 6) and perform other sport (n = 1), hence the count for some characteristics do not total 2278 in the table. BMI: Body Mass Index.

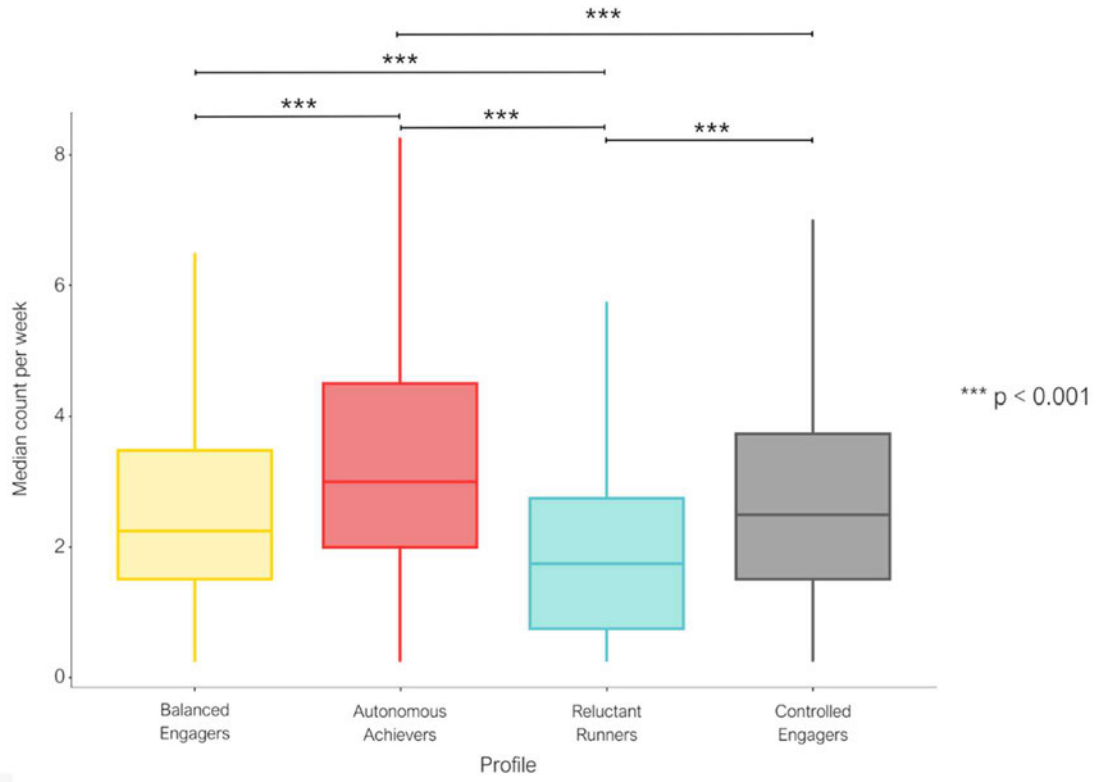


Figure 2.4 Training frequency (count) per week displayed as median (IQR).

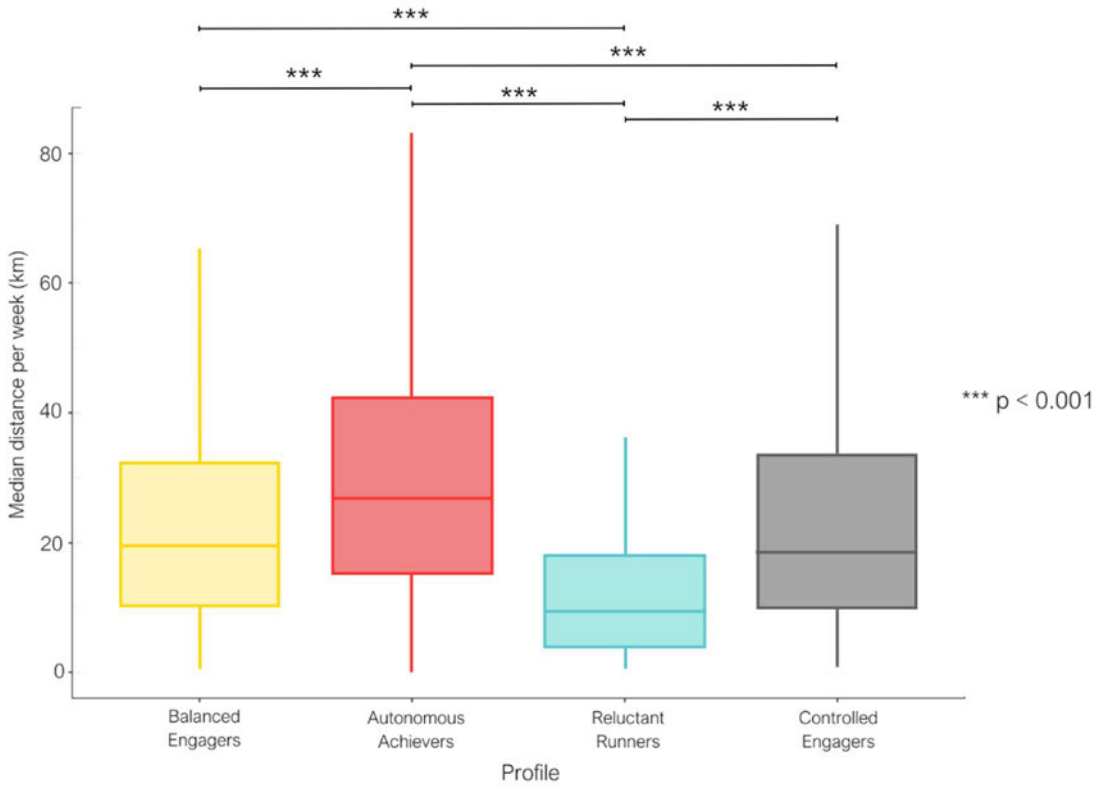


Figure 2.5 Training distance (km) per week displayed as median (IQR).

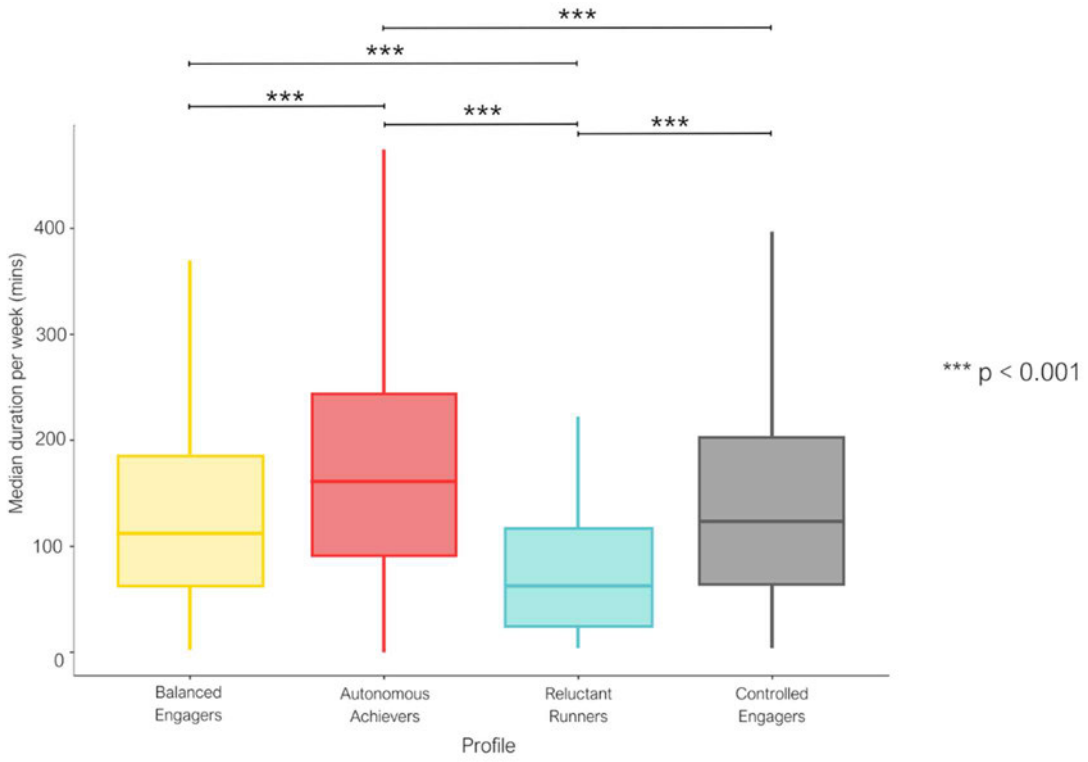


Figure 2.6 Training duration (mins) per week displayed as median (IQR).

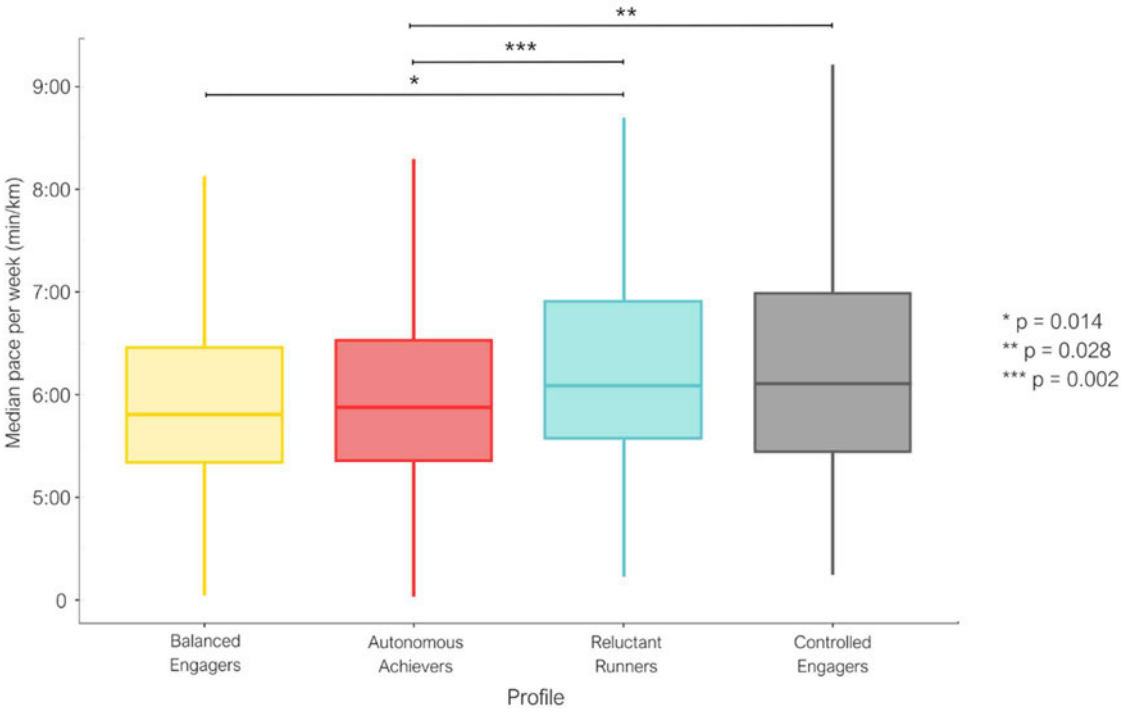


Figure 2.7 Training pace (km/min) per week displayed as median (IQR).

Table 2.5 Weekly training characteristics across profiles.

Training characteristics per week (median [IQR])	Profiles				
	Balanced engagers (n = 620)	Autonomous achievers (n = 1379)	Reluctant runners (n = 117)	Controlled engagers (n = 162)	Total (N = 2278)
Frequency (n)	2.5 (2.0)*+	3.0 (2.5)+	1.5 (2.5)	2.5 (2.5)*+	2.4 (2.3)
Intensity (min/km)	5:54 (1:07)^	5:54 (1:39)+	6:12 (1:13)	6:06 (1:21)*	6:01 (1:20)
Duration (min)	112.7 (123.4)*+	161.5 (157.4)+	57.8 (97.2)	120.0 (139.6)*+	113.0 (129.4)
Distance (km)	18.9 (2.0)*+	26.6 (2.5)+	9.1 (2.5)	19.0 (2.0)*+	18.4 (2.3)

* significant difference to 'autonomous achievers' ($p < 0.01$), + significance difference to 'reluctant runners' ($p < 0.01$), ^ significant difference to 'reluctant runners' ($p < 0.05$).

Discussion

This study aimed to investigate whether SDT-based motivational profiles exist within a large sample of runners in the Garmin-RUNSAFE Running Health Study, and to identify and explore differences in training characteristics between these profiles. The study identified four distinct motivational profiles as assessed by the six regulations of SDT. Further, training characteristics were different between profiles, indicating an association between motivation and an individual's approach to running behaviour. To the best of our knowledge, this is the first study to explore clustering runners based on their motivational profiles according to SDT, and to assess how these profiles aligned with objectively measured training characteristics. This study also provided insight into the prevalence of multidimensional motivation in runners, and provides explanation for factors that may influence profile structure through LPA. Importantly, this study revealed that an individual's motivational profile may contribute to their training characteristics, providing evidence for the relationship between motivation and running behaviour.

Motivation profiles

In relation to the first aim, the resulting four profiles were theoretically distinct and represented the unique regulatory patterns shared by runners. The structure of the profiles aligned with the logic of the SDT continuum, whereby regulations closer to one another scored more similarly than those further apart (46, 79). Specifically, the composition of three of the four profiles ('balanced engagers', 'autonomous achievers' and 'controlled engagers') shared similar levels of autonomous motivation in the identified, integrated, and intrinsic regulations, whilst simultaneously scoring lower in more controlled regulation types (i.e., amotivation, external and introjected). Whilst this alignment suggests that runners in this study tended to hold coherent motivation patterns, further examination revealed differences in motivational attributes were present, allowing reasonable distinctions to be made.

'Balanced engagers', 'autonomous achievers' and 'controlled engagers' demonstrated high autonomous motivation, but with unique compositions in the more controlled regulations. Notably, the 'autonomous achievers', characterised by high levels of autonomous motivation and low levels of amotivation and external regulation, represented a profile that aligns with the proposed optimal motivational attributes for sustained physical activity engagement (89). The 'autonomous achievers' profile structure reflects that found by Bechter and colleagues (103), whereby identified and intrinsic motivation were elevated compared to all other regulation types in physical education students. Furthermore, the 'autonomous achievers' profile represented over 60% of this study's total sample, suggesting that most runners were more autonomously motivated to run. Runners in this profile appeared to have greater running experience than other profiles,

with over half reporting having been running for ten years or more. These results align with previous findings whereby intrinsic motivation is a strong predictor of long-term exercise maintenance (104, 105).

The relationship between running experience and motives for running is mixed. Greater levels of experience have previously been found to be associated with higher competitive motives (35), negatively associated with personal goal achievement (29) or do not differ according to amount of running experience (106). Based on previous literature and findings from the current study, it appears that running experience may not be a reliable predictor of greater levels of autonomous motivation. This suggests that factors other than mere experience, such as individual differences in goal orientation or external influences play a role in determining the degree of autonomous motivation individuals have towards running. Understanding these dynamics can inform more tailored interventions aimed at fostering intrinsic motivation and sustaining long-term engagement in running activities, regardless of individuals' levels of experience.

The ‘reluctant runner’ profile was characterised by lower overall motivation, particularly in integrated and intrinsic motivation. Despite representing only 5.1% of the total sample, this profile offers valuable insights into the dynamics of motivation towards running participation. For example, within this profile, identified regulation – defined by one recognising and valuing the benefits of the behaviour (45) – was the highest scoring regulation in this profile. This finding aligns with previous research, whereby a similar profile structure (labelled ‘moderate’ to reflect this profile’s overall motivation) was found in a study assessing PA motivation (85). The composition of the ‘reluctant runner’ profile, with identified regulation as the predominant regulation, suggests that individuals within

this profile value the benefits of running, and invest time to run each week (mean = 1.9 frequency/week), despite their lower overall motivation towards running. Moreover, 'reluctant runners' were less experienced compared to other profiles, suggesting that higher levels of identified motivation may be prevalent in individuals in the initial or early stages of their running journey. This presents an opportunity for interventions to focus on fostering intrinsic motivation through targeting training characteristics specifically tailored to the needs and preferences of 'reluctant runners'. Unlike 'controlled engagers' and 'balanced engagers' who already demonstrate high levels of autonomous motivation, reluctant runners may benefit from a gradual progression in training intensity and duration. By starting with manageable frequencies, and gradually increasing distance and duration over time, a graded approach could facilitate greater feelings of competence and enhance their enjoyment of running, and may ultimately foster a shift towards greater intrinsic motivation.

'Controlled engagers' were defined by elevated levels in amotivation and external regulation compared to autonomous achievers. 'Controlled engagers', who scored highest in amotivation, extrinsic and introjected regulation compared to all other profiles, also demonstrated higher scores across identified, integrated and intrinsic motivation compared to 'balanced engagers' and 'reluctant runners'. In the present study, 'controlled engagers' shared a similar profile structure to that found in Bechter et al. (103) (profile 4, labelled 'moderately controlled'), who assessed physical activity motivation in adolescents. In both the 'controlled engagers' in the current study and the 'moderately controlled' profile in the aforementioned study, introjected regulation appeared to be a delineating domain. Introjection is particularly complex, as it reflects the partial

internalisation of the behaviour, whilst being regulated to avoid internal punishment and guilt (e.g., anxiety, fear of failure) and to satisfy ones' ego (45). In exercise, individuals exhibiting high introjection have been found to participate in high volumes or intensities of physical activity, but do so at a potential cost to psychological health (e.g., anxiety) (34). Whilst the long-term role of introjection in mediating training volume/intensity in runners is unknown, the observation that similar motivational profiles exist in broader exercise literature suggests that the dynamics of introjection could be a feature that influences running maintenance, and presents means for further exploration.

Training characteristics of profiles

In relation to this study's second aim, the motivational profiles were also associated with distinct training characteristics. 'Autonomous achievers' engaged in running more frequently, for longer durations and covered greater distances compared to all other profiles. While these differences were statistically significant, the practical implications may be relatively modest. Running an additional 0.5 – 1.5 times per week could represent a relatively minor adjustment to one's routine, particularly given variability in individual goals and priorities without contributing to shifts towards more autonomous motivation. Furthermore, while 'autonomous achievers' ran an additional 41.5 to 103.7 minutes per week compared to other profiles, it is worth recognising that this additional time spent running may reflect a greater commitment to running. Drawing on the concept of commitment to running influencing running duration, Carmack and colleagues (1979) identified significantly greater commitment to running in those who ran for longer durations (mean duration: 58 minutes) compared to those who spent less time running (mean duration: 28 minutes) ($p < 0.001$) (36). Interestingly, the 'runners high' – a feeling

of euphoria that can be experienced during and after running activity (107) – has been found to occur after 30 minutes of running, and is believed to intensify between the 40 to 60 minute mark (108). The tendency of those in the 'autonomous achievers' profile to engage in more frequent runs of longer-duration might be influenced by these experiences of euphoria. Such positive experiences could potentially contribute to greater affect and enjoyment towards running, and thus play a role in fostering greater intrinsic motivation and running maintenance. However, it is important to recognise that additional time spent running may not signify a greater commitment towards the activity, and indicates an area for future research to consider. For example, some individuals may feel running more leads to greater affect towards the activity (108), this may not be universally experienced by all runners. Simply spending more time running does not automatically shift motivation towards greater intrinsic regulation, especially if individuals do not desire to do so, and thus may not be an appropriate approach to prescription to runners more broadly. For example, 'controlled engagers' and 'balanced engagers', also demonstrated high levels of autonomous motivation, albeit recorded a lower total running volume each week compared to 'autonomous achievers'. This perspective is further reinforced with 'autonomous achievers' only accumulating an additional 6.8 to 7.6 kilometres across the week compared to 'controlled engagers' and 'balanced engagers'. While over time, the additional time spent running could lead to substantial increases in the health benefits experienced (9), it is important to consider whether this commitment is desirable and maintainable for others. Although these findings suggest that adapting training to someone's current level of motivation may offer a potential way to encourage adherence,

the exact nature of the relationship between running volume and autonomous motivation is yet to be fully understood.

Considering broader public health implications, it is worth noting that physical activity guidelines recommend at least 150 minutes of moderate-intensity physical activity per week (109). Interestingly, only the 'autonomous achievers' in our study seemed to meet this recommendation in the four weeks their activity was analysed. However, individuals in other motivational profiles were more likely to indicate they also participated in non-weight bearing sports (e.g., swimming), which may suggest they are meeting these guidelines through other modes of exercise. Taken together, these findings underscore the need for tailored interventions that acknowledge diverse motivational profiles and activity preferences to effectively promote running maintenance.

Link to behaviour maintenance

It is important to consider these findings from a behaviour maintenance lens to understand what factors may contribute to the motivational profiles. Kwasnicka and colleague's emphasised five key factors for behaviour maintenance: maintenance motives, self-regulation, habits, resources and contextual influences (77). For example, the 'autonomous achievers' profile exhibited high intrinsic motivation and more frequent running participation, suggesting strong maintenance motives such as enjoyment and self-determination, whilst also likely benefiting from strong self-regulation strategies and supportive environments that facilitate consistency in running behaviour. It is likely that 'autonomous achievers' could draw on positive goal-setting strategies and habit formations that act as a buffer against potential fluctuations in motivation, ensuring consistent running behaviour (77). In contrast, the 'reluctant runner' profile, which

exhibited lower intrinsic motivation and training frequency compared to other profiles, highlights the potential challenges in sustaining running behaviour when maintenance motives are weaker. This supports the notion that those with lower internal motivation may rely on external sources for support, or have reduced self-regulation strategies to navigate barriers that threaten continued engagement in the behaviour (77). 'Controlled engagers' may lack strong maintenance motives, or may be less successful in developing automatic running habits, which Kwasnicka identifies as critical for maintenance (77). This profile may be more vulnerable to changes in external circumstances or experience greater stress, factors that can undermine behaviour maintenance when self-regulation and habits are not well established (77). Future interventions could target individuals that appear more externally motivated to run, and foster robust habit formation and self-regulatory strategies to facilitate running maintenance.

Limitations

There are several limitations that warrant recognition in this study. The cross-sectional design precludes the ability to establish causal relationships between motivational profiles and running behaviour. Indeed, the relationship between motivation and running behaviour is bidirectional (110), and longitudinal studies are required to determine the temporal relationship in runners. However, given that motivation is multidimensional and shifting, a cross-sectional measure of running motivation may be unable to reliably assume the stability of profile membership. Whether the profiles persist over time and through various contexts – a reflection of behaviour maintenance (77) – is unknown. For example, Emm-Collison and colleagues explored the transition of motivation across time, and supported the understanding that motivation to PA is dynamic, and people are likely

to move between profiles across timepoints (89). Thus, longitudinal and transitional analysis could provide important insight into whether profile membership reflects whether the multidimensional constructs of running motivation changes over time, and what may be associated with changes in motivation profiles.

The study's focus on a specific motivational framework (i.e., SDT) limits the ability to consider other influential factors which may have explained certain motivational and sample characteristics important to account for in interpretation. Furthermore, despite including a large sample of runners from across multiple continents, males and high performing runners appeared to be overrepresented (based on fastest 5 km run time) in this sample compared to the general recreational running population. Given the average completion time for the global 5 km community parkrun – a free weekly timed fun run – is 32 minutes and 30 seconds (111), the overrepresentation of high-performing runners in this study may skew findings, and limit generalisability to the broader, recreational running population. In addition, demographic data indicates males make up just over half of the running population in Germany (55%) (112), the United Kingdom (55%) (113) and the United States of America (54%) (114), further suggesting an overrepresentation of males in the sample. Future research should aim to recruit a more diverse sample representative of the wider population of recreational runners to provide a more comprehensive understanding of running motivation across different demographics.

Lastly, it is important to acknowledge that the sample in this study may not be representative of the general population. The participants in this study were recruited from the Garmin-RUNSAFE study, which included individuals with an assumably high level of engagement in physical activity. As such, the percentage of participants meeting

Physical Activity Guidelines in this sample likely exceeds that of the general population. Therefore, while the motivational profiles identified in this study provide valuable insights into the factors influencing running behaviour within this specific group of highly active runners, caution should be exercised when attempting to generalise these findings to the broader population. It is reasonable to assume that individuals with different levels of physical activity engagement may exhibit varying motivational profiles, and thus, the applicability of these findings beyond the study sample may be limited. The effect of non-response bias must also be considered, given only approximately 30% of participants in the larger Garmin-RUNSAFE study that were invited agreed to participate in this sub-study. Future research efforts should aim to replicate these findings in more diverse populations to better understand the generalisability of motivational profiles across different activity levels.

Conclusion

In conclusion, this study identified that distinct motivational profiles exist among runners, each regulated by unique patterns of motivation. Runners from different motivational profiles demonstrated differences in objectively measured training characteristics. These findings highlight the importance of considering motivational orientations when designing interventions to promote running engagement, which could be harnessed to enhance running adherence, and thus the potential long-term health benefits.

Chapter 3

Running beyond the finish line: Exploring the factors influencing running maintenance from current and discontinued runners

It is evident, based on findings from Chapter 2, that the motivation to run is multidimensional, and that how individuals choose to structure their running activity can be explained, in part, by their motivational orientation. Given the role motivation plays in running engagement, it is worthwhile delving deeper into the lived experiences of runners to help understand what may influence their motivation to maintain their running or discontinue altogether. This chapter will qualitatively explore the psychosocial aspects of recreational running maintenance from both current and discontinued runners.

Abstract

Running is a popular physical activity, yet many people discontinue. While previous research has often focused on physical factors for discontinuation amongst experienced runners, this study aimed to explore the psychosocial aspects of recreational running maintenance from both current and discontinued recreational runners – a group seldom explored, but potentially vital for understanding running behaviour. Guided by ontological relativism, eighteen current and eleven discontinued runners across Australia participated in semi-structured interviews to explore facilitators and barriers to their running activity. Thematic analysis identified five main themes influencing people's decision to run – making it a 'priority', the 'people' who run with you and the running community around them, 'planning', making 'progress', and experiencing 'pleasure' with running. Prioritising running, perceiving it as part of their identity, and placing a high value on running promoted running maintenance. Social connections, such as running with like-minded people, having flexible running plans, goal-oriented progress and finding pleasure in running through recognising the personal and health benefits enhanced the appeal of running. Together, these factors influenced how much participants saw running as a priority in their lives, and ultimately continuing to make time for it (or not). Discontinued runners often placed low value on running, and were frequently deterred by the time commitment involved. Hearing from discontinued runners provided unique insights into the complexities of running not yet explored, allowing a deeper understanding and holistic perspective on running maintenance. This research highlights the factors affecting recreational running, offering valuable insights for intervention designers and health professionals seeking to support and promote lifelong physical activity through running.

Introduction

Despite the well-known impact running can have on mental and physical wellbeing, many individuals struggle to maintain a consistent running routine, and in some cases, discontinue running altogether. Nearly one in three novice runners discontinue within 9 months (11). Although injury is a key contributor for discontinuation, a large proportion of runners (approximately 52-77%) discontinue for non-injury reasons (11, 14), suggesting exploration of these factors may yield important insights into the determinants of running behaviour.

A variety of influences can contribute to one's decision to maintain a physically active lifestyle. Lack of time, fatigue, limited accessibility to exercise facilities, work, inclement weather, and balancing activity around family responsibilities are common barriers that influence the choice to be active (30, 32, 115, 116). Collectively, these factors can make it increasingly challenging for individuals to engage in physical activity (54, 77). While running may alleviate some of these barriers due to its time-efficiency and accessibility, continuing to maintain running activity is challenging and likely a complex process influenced by a range of psychosocial factors.

Much of the current research into running maintenance may not apply to the broader recreational running population. Often, our understanding of running maintenance has relied on reflections from ultra-runners (116) and runners who have a history of competing in events (12, 31, 117). Qualitative studies have explored specific experiences of current runners to help understand what promotes enjoyable running activity (118, 119). While these studies were able to in capture the experiences of dedicated runners, results may not generalise to individuals who are prone to disengaging from running. However, there

is no known research on what influences the decision to run and what facilitates maintenance of the behaviour from the perspective of those who have discontinued running.

Understanding how to maintain running behaviour involves distinct motivational and cognitive processes that develop overtime (77). Recently, McCormick and colleagues qualitatively explored various motivations and barriers to running maintenance with a focus on why individuals may discontinue (30). The findings emphasised the importance of identifying a meaningful "why" to see running as something worth continuing. While important, it should be noted that this finding was derived primarily from the perspectives of novice runners who have limited insight into motivations and barriers beyond the early stages of commencing running. Novice runners are yet to experience the full scale of cognitive challenges that come with attempting to maintain running behaviour in the face of diminishing motivation or less than optimal conditions (e.g., reduced opportunity to run due to demanding responsibilities) (77).Therefore, there is a clear need to evaluate the influences of running maintenance from those who have successfully maintained their running activity.

To understand the complexities to running maintenance and discontinuation, speaking with both current and discontinued runners would provide first-hand insight into the challenges of running maintenance from those who have attempted to integrate it into their life. Using semi-structured interviews, this study aimed to gain a comprehensive understanding of the complex and nuanced factors that influence individuals' decisions to continue engaging in recreational running. This qualitative analysis draws on the experiences of individuals who have engaged in recreational running for an extended time

before discontinuing, as well as current runners, seeking to identify factors related to their ability to integrate running into their life. The results of this study could inform health professionals to support recreational runners navigate challenges that lead to maintaining, or discontinuing, running activity.

Method

Paradigmatic assumptions

An ontological relativism paradigm (120) underpinned this study to collate participants' personal perspectives on barriers and enablers to their running experience. This approach allowed the researchers to acknowledge that we are finite as human beings, and that no single external reality exists independent of us (120). We interpreted that the nature of the individuals' reality is shaped by their lived experiences, perspectives and meaning attributed to the physical world, and what is perceived as real (120). This approach allowed themes and patterns to develop organically from the data, acknowledging that the factors influencing running maintenance arise from the unique perspectives of participants, even if those concepts challenge conventional assumptions. Through embracing an ontological relativism, we reflected on our own biases, given our knowledge is also shaped by our own lived experiences as social beings. However, as noted by Smith and McGannon (120), it is difficult to achieve theory-free knowledge that allows us to access an independent social reality. Although member reflections were included within our methodology (whereby participants were provided an opportunity to review not only the accuracy of transcripts, but encouraged to provide additional data and insight (120)), no participants chose to engage in this opportunity, which in itself

could be seen as a limitation in achieving true ontological relativism. This is discussed further in the limitations section of this study.

Positionality

As an Accredited Exercise Physiologist (AEP) with experience in clinical practice, running coaching, and personal engagement with running, the authors' positionality as a researcher has been shaped by professional and personal experiences. The authors' existing views on motivation and the psychological factors that contribute to running maintenance are central to their research. The author believes that psychological strategies can be employed to improve long-term running participation, a belief grounded in experience frequently confronting motivational decline and behaviour change challenges with both peers and clients. These experiences were key drivers in the authors' decision to undertake research in this field, and informed the research questions posed in the present study. The authors' professional background allowed them to recognise what they perceived as gaps in existing knowledge and resources, which further motivated them to explore how motivation could play a role in running maintenance. Throughout this research process, the authors' positionality inevitably influenced how they engaged with participants, interpreted data, and designed intervention strategies, as they sought to address behaviour change issues observed in practice.

Ethical approval

The following methods are reported in line with the COnsolidated criteria for REporting Qualitative studies (COREQ) (121) (Appendix 3.1). This study was approved by the University of South Australia Human Research Ethics Committee (protocol number

203828) (Appendix 3.2). Audio recordings were transcribed and anonymised to protect participant identity.

Study design

Participants

Eligible individuals were recruited through purposive sampling, ensuring a diverse range of perspectives and experiences. This study recruited two types of participants: (a) those who have recently ceased running as their main form of activity (herein called 'discontinued runners'), and (b) individuals who continue to engage in running on a regular basis (herein called 'current runners'). Recruitment occurred between May and July 2021 via social media advertisements on several running group pages across Australia. The inclusion criteria are included in Table 3.1.

Table 3.1 Summary of inclusion criteria.

<table>
<tr><th>All</th><th>Discontinued runners</th><th>Current runners</th></tr>
<tr><td>18 – 64 years old.</td><td rowspan="6">Self-rated as someone who stopped running as a form of PA within the preceding 12 months for reasons other than injury (using the consensus-based definition by Yamato et al. (122)) and/or medical conditions.</td><td rowspan="3">Report running at least twice per week for ≥ 20 minutes per run in the past 12 months.</td></tr>
<tr><td>Not pregnant or given birth within the last 12 months.</td></tr>
<tr><td>Not undergone surgery preventing running activity in the last 12 months.</td></tr>
<tr><td>Proficient with written and spoken English language.</td><td rowspan="3">Self-report running as their main form of physical activity.</td></tr>
<tr><td>Internet access.</td></tr>
<tr><td>Willing to have their interview recorded.</td></tr>
</table>

Eligibility decisions were informed by literature, theoretical understanding of habitual health behaviours, and the scope of this paper. Studies have defined a recreational runner as someone who either (a) runs one-to-three times per week for at least six consecutive months (123), (b) has simply been running for at least six months (124), or (c) runs 15 kilometres per week (125). Theoretically, the Transtheoretical Model of Change (126) outlines maintenance of a health behaviour occurs from six months to five years, and individuals in this phase are considered less likely to relapse (126). This theoretical framework guided our eligibility decision and enabled us to conceptualise the temporal progression and potential challenges associated with the maintenance of running behaviour amongst our participants.

It was important to ensure our criteria for the two groups were distinct and captured current runners who displayed long-term regular participation, and discontinued runners who stopped running recently enough to promote recall, whilst excluding those who have temporarily stopped running intentionally (e.g., reducing running activity due to seasonal sporting commitments).

Interview approach

One-on-one semi-structured video interviews (Zoom Video Communications Inc., 2016) were conducted. Interviews were audio recorded, and the interviewer took additional field notes. The primary researcher conducted the interviews. An experienced qualitative researcher supervised the initial interviews to ensure appropriate guidance and methodological alignment. To facilitate the line of questioning and ensure consistency, an interview guide was developed. The guide was developed through a systematic process that began with a brainstorming session to generate a pool of potential questions, which

were categorised into themes such as motivation, previous running experience, discontinued running, and education. Questions were organised from general to specific, with probing questions, to facilitate a natural flow during interviews. Questions from the interview guide underwent initial pilot testing with both a current and discontinued runner. This allowed us to gather feedback on the appropriateness of the questions. Subsequent refinements were made based on feedback and discussions with the research team. The final guide included questions such as 'what motivates you to run?', 'what impacts your motivation?' and 'what obstacles may make it difficult for you to go for a run?' (Appendix 3.4).

Data analysis

A transcription application (Otter.ai, Los Altos, California, USA) was used to assist transcription, with all transcriptions cross-checked manually by the primary researcher. Data were analysed using the six-phase reflexive thematic analysis approach proposed by Braun and Clarke (127, 128). The reflexivity allowed the researchers to explore both semantic and latent meanings within participant responses. This flexibility was especially important when we interpreted data from participants who held multiple roles within a running context that may have influenced their perspectives. For example, some current runners were also coaches, thus reflexive analysis enabled us to understand the positioning of each individuals' personal experiences that influenced their reality.

Pragmatic assumptions

Aligning with ontological relativism, reflexive thematic analysis allowed us to explore perceptions of barriers and enablers of running. To increase familiarisation with the data (Step 1), once transcribed, the researcher revisited all transcripts to reflect on key items

and recurrent descriptions whilst noting any initial interpretations of the data (Step 2). A qualitative data analysis software, NVivo (QSR International 2020), was used to create and organise notes. An inductive approach, of no framework, was used to code. This process was followed by analysis, with these notes assisting to establish key codes (Step 3) (129). To enhance the reflexivity of this process, two researchers independently analysed 20% of the transcripts before discussing individual interpretations of the data and coding process. By incorporating a critical friend and further support from an experienced qualitative researcher outside of the direct authorship team as a theoretical sounding board in this process, we were able to contrast interpretations of the data, enabling us to construct, defend and support the exploration of alternative interpretations (120). This process was then repeated with a further 10% of the transcripts, with codes continually revisited to identify patterns and begin interpreting semantic and latent meaning across the data (Step 4). For example, the initial codes labelled 'health' and 'identity as a runner' were eventually organised into a central concept where such factors were discussed in relation to running-related priorities. As such, these codes were clustered together and labelled 'prioritisation' (Step 6). Likewise, codes such as 'goals,' were found to suit an overarching theme that discussed factors around running 'progress'. The aim of the process was always to achieve balance between analytic narrative and illustrative extract (129).

Results

The final sample consisted of 18 current recreational runners (11 male, 7 female, mean age 40.9 years) and 11 discontinued runners (3 male, 8 female, mean age 41.3) from across Australia (Table 2 and 3). The interviews lasted between 36 minutes, and 1 hour

6 minutes (mean duration: 47 mins, SD 7 mins). For each theme, a brief description is provided, followed by the subtheme findings. Five overarching themes were identified: 1) prioritisation and value, 2) people, 3) planning, 4) progress and 5) pleasure. Each theme reflects the perspectives of both current and discontinued runners. A thematic map can be found in Figure 3.1.

Table 3.2 Participant characteristics of discontinued runner group.

Sex	Age (years)	Prior running experience (years) [#]	Running frequency per week (mean) [^]	Running distance range (km/week) [+]	Time since running discontinuation (year/s or month/s)
M	24	unknown[~]	1	unknown[~]	1 y
F	51	12	2.5	5 – 20	1 y
M	46	unknown[~]	7	70 – 100	5 m
F	27	4	3.5	30 – 55	4.5 m
F	23	1.5	3	3 – 10	11 m
F	47	1	7	60 – 70	1.5 m
M	50	2	2	unknown[~]	2 m
F	60	40	7	70 – 80	1 y
F	51	6	2	3 – 10	1.5 m
F	42	5	3	10 – 20	6 m
F	33	6	1	5 – 20	6 m

[#] Time until complete cessation of running for the discontinued group. [^] Self-reported frequency before discontinued running. [+] Self-reported running mileage before discontinued running. [~] "unknown" indicates participants who did not recall when they started running and/or did not track their mileage objectively (e.g., participant may have stated they ran "2 laps of the park" without knowing the park's distance).

Table 3.3 Participant characteristics of current recreational runner group.

Sex	Age (years)	Running experience (years) *	Running frequency (mean km/week)	Km/week (min – max)
M	23	17	6	30 – 40
F	49	15	4.5	40 – 50
M	48	16	4	50 – 120
M	35	24	3.5	40 – 50
M	24	11	5	50 – 70
F	61	6	3	5 – 20
F	47	10	4	20 – 35
M	41	31	6	100+
F	38	3	7	70 – 160
M	29	5	6	50 – 60
M	52	9	3.5	20 – 30
M	42	7.5	2.5	30 – 40
F	59	26	5	30 – 40
F	47	8	2	5 – 15
M	34	12	6.5	80 – 100
M	41	6	4	60 – 70
M	35	15	6	60 – 70
F	31	2	7	20 – 30

* Running experience for current runners was based on self-reported years of running without extensive interruption.

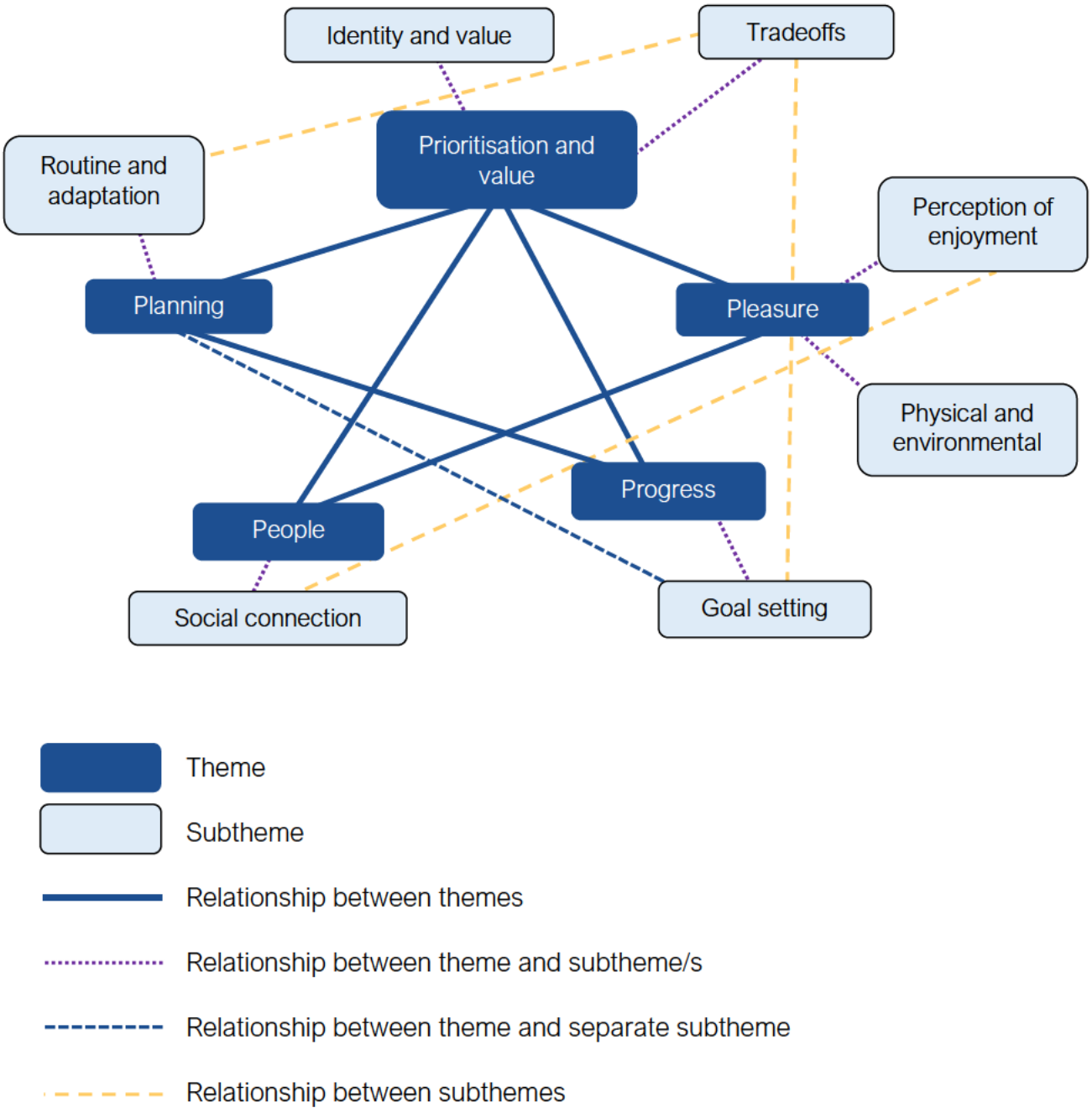


Figure 3.1 Thematic map of findings.

Prioritisation and value

Prioritising and valuing running was pivotal for running maintenance. Two sub-themes emerged, whereby running was seen as part of their identity, or they considered running as an important priority and of high personal value, and the requirement or desire to see running as a tradeoff amongst competing responsibilities.

Identity and personal value

Current runners described running as a core aspect of their identity. For many, running was not just a form of physical activity – it was '…the centre or the foundation of my health and wellbeing' (current runner, aged 42). Running was a central part of current runners' self-concept, with many depicting themselves as "runners" and feeling a sense of pride and accomplishment associated with this identity. These participants often placed high value on running and as an integral part of their daily routine that developed an important part of themselves. A current runner (aged 41) reflected this sentiment:

> It's not like [it] purposely becomes part of your identity… it's just once it becomes ingrained, and you might have some time not doing it, you realise that you just don't feel as good mentally… like, I can see myself as a runner now.

Another current runner (aged 35) reflected on the multiple identities they hold: 'I am a runner, but I'm also a husband. A father. Running doesn't define me, but it's a big part of me'. This same attitude was echoed by many other current runners when reflecting on why they ran. This sense of identity associated with running was found to be a significant motivator for many to continue running, even in the face of barriers. It also appeared that the interplay between personal meaning and external obligations could cause tension

when choosing to integrate running into their life. Yet, for current runners, the strength of their running identity often overruled such barriers. One current runner (aged 49) recognised this:

> I guess you just start associating with [running], and on the days when I don't feel like running, I say to myself, well, do you want to be a runner or not?

While some discontinued runners acknowledged the positive outcomes associated with running, running did not appear to be deeply integrated into their sense of self. It was seen as a form of activity that could be enjoyed by many for a time but was not necessarily something that was important to maintain. This was reflected by one discontinued runner (aged 25):

> Running is one of the exercises that everyone recommends… it's cheap just to go outside and run, but there's so many other ways to exercise… I'm not saying the world's divided into runners and non-runners, but some people prefer it, others don't.

For some discontinued runners, there was a shift from the 'runner's identity' to the development of new identities when they stopped running, such as that of a cyclist, swimmer or 'gym-goer' as individuals sought new ways to maintain their activity and continue engaging in a healthy lifestyle.

Tradeoffs

Current runners often prioritised running despite competing demands for their time and energy, often recognising the 'responsibility for ourselves and our health and wellbeing'

(current runner, aged 59) to reinforce running as a priority. A current runner (aged 31) described how the choice to go for a run, however, can sometimes be difficult:

> Sometimes when I'm a bit distracted by some work-related issue or worried about something… I'm less likely to accommodate exercise in my routine… I know it's very good in terms of relieving stress and [a] good distraction, but sometimes I find it hard to get that motivation going when I have something on my mind.

Comparatively, one current runner (aged 35) identified that they make running a priority before committing to events, such as social gatherings: 'It's a priority of mine… So, I make it work with whatever else is going on. I don't go to the pub often, but if my friends asked, I would make sure I get my run in before going.' Interestingly, discontinued runners described that they felt 'guilty' if they prioritised running over work or family obligations. Some found that their running activity was influenced by others perceiving their running as a lower priority: 'my husband has commented on the amount of time I spend running, I could spend on doing stuff around the house' (discontinued runner, aged 60). The struggle between maintaining an active lifestyle and fulfilling other responsibilities or competing interests for some discontinued runners compelled them to sideline their own physical wellbeing. This was highlighted by one discontinued runner (aged 47): 'The reason I stopped was the amount of time… it was taking a couple of hours out of my day. And I felt like I was missing out on other things.'

People

Both current and discontinued runners spoke about the influence of people on their running, highlighting the role of social connection as a facilitating factor.

Social connection

Current and discontinued runners both identified various social running contexts, such as running with others, in groups, and participating in community running events, as facilitators to running. One current runner (aged 38) emphasised avenues of support within the running community: 'So, whether it be parkrun, a local running group, or a coaching group… find your crew, and draw from them.' Running provided people with an opportunity to connect with others, with a discontinued runner (aged 27) suggesting: 'If you're starting to lose motivation, I think that's when you need to find a friend, do an event'.

A sense of community from participating in events was featured more prominently by current runners, who recognised the value interactions with other runners provided, whether they knew them or not. These social relationships brought about experiences of accomplishment and competitiveness in some runners, with some even acknowledging the value of seeing someone else achieve their goals. Additionally, some current runners spoke about the formal groups they belonged to (e.g., a running club) being critical to fostering an environment for improving fitness and achieving competitive milestones, such as with one current runner (aged 38): 'I get a lot of joy out of seeing other people hit their goals too.' Another current runner recalled, 'I'm a part of a running group and that's quite motivating and brings me enjoyment - the friendships you make, just like catching up with friends, but you do it in an exercise context.' Interestingly, a discontinued runner (aged 27) suggested that to maintain motivation, one should 'find someone that's your level. Don't try and go out with someone that runs ultramarathons, you feel bad that you're holding [them] back.'

While the camaraderie of running with companions, engaging in group activities, and participating in community events were instrumental in fostering motivation, some discontinued runners spoke about the loss of this social support, which led to a gradual waning of their desire to continue. One discontinued runner (aged 25) reflected on the loss of accountability in her running activity, stating: 'I had a cousin who would run with me, and he stopped, so I stopped'. When social support diminished, especially for those who were reliant on it, running discontinuation occurred.

Planning

Planning emerged as a critical element in enabling achievable running participation. Developing a routine that allowed flexibility was a key component for facilitating running into one's lifestyle.

Routine and adaptation

Current runners who had been running for several years, and discontinued runners who previously ran regularly for a significant period, emphasised the importance of a structured plan in maintaining their running routine. Following a plan helped motivate them whilst also facilitating a focus on their goals despite barriers. This is reflected by one current runner (aged 52), stating, 'it's time that tends to get in the way… it's just so busy. But I've made a particular point to go for a run… I know that it helps with stress.'

As part of planning, scheduling one's running into their day appeared to assist in establishing and maintaining an ongoing running routine. Current runners recognised the importance of using calendars and other tools to plan their runs and ensure they had enough time to prepare, exercise, and recover. One current runner (aged 48) noted that he knew exactly when he would be free to run each day, which helped him to establish a

regular routine and stick to his running goals: 'I sort of know what hours I'm doing at work, so I know that at 3 o'clock, I'm going to be running.' Conversely, discontinued runners were at times vague about when they ran, which may have contributed to their eventual decision to stop running. Those who struggled with running often cited a lack of planning as a barrier, such as with one discontinued runner (aged 24), '…it becomes hard to fix a specific time for running… it then becomes harder [to] find a commitment again.' A current runner (aged 22) reflected that running required a significant time investment, and that scheduling is key to making it work within a busy lifestyle:

> …you've got to really schedule it… if you're going for a half-hour run, it's going to take you 20 minutes to get ready and warm up, half an hour to do the run, at least 10 minutes to cool down…and then maybe another half-hour to eat, rehydrate, stretch, get into other clothes, and then mentally, it might take you another half hour to recover. So, it's kind of like a two-hour block.

In addition to scheduling, adapting to unprecedent obstacles contributed to sustained running engagement. This adaptability within one's running routine afforded individuals to navigate lifestyle demands while maintaining their commitment to running. This flexibility can foster sustainable running experiences by allowing people to find opportunities to run amongst competing demands. Like one current runner (aged 41) described:

> I give myself, maybe once a week, an "I don't feel like it day" and I just don't go. And then that way, the next day I know I'll definitely go. I try not to treat myself as a robot… allow yourself a bit of leeway.

In contrast, discontinued runners often lacked a plan or strategy that would allow them to overcome barriers. This is exemplified by one reflection from a discontinued runner (aged 27):

> I moved earlier this year. I think not having a routine for the year meant that I haven't really been running as much… I don't enjoy it as much as I did, because I'm not in that routine.

Progress

Seeing oneself make progress in their running appeared as an important element in promoting a drive to continue running and challenging oneself, with goal setting underlying this initiative.

Goal setting

It was evident that goal setting and pursuit facilitated running motivation in current and discontinued runners. Many current runners reported that having goals were the underlying driver of why they run. While the type of goals varied greatly, they all seemingly motivated people to begin, and continue running, with one current runner (aged 41) stating, 'I've put some goals on myself... So working towards those keeps you motivated because you've got that long term goal.' Many runners also spoke about the importance of having short-term (or 'mini') goals that enabled long-term goal achievement, even down to hitting specific speeds in a training session or simply getting out the door when they do not feel like it. Even discontinued runners recognised the importance to 'set yourself some goals… then you get into the cycle of setting goals,' (discontinued runner, aged 51). Setting personal goals could help put barriers into perspective: 'What are your goals?

What [do] you want to achieve? Break it down, look at what's stopping you… There could be other external factors at play' (discontinued runner, aged 51).

Some current runners also spoke about structuring different goals throughout their running journey. For example, one current runner (aged 42) described planning their short-term goals based on a long-term goal or event:

> I try and set myself a goal every week to set my calendar. And look at my week and try schedule in the running at the start of the week and say right, I've got a goal in a month or two, so I've got to work backwards from that.

Interestingly, constantly chasing goals was described as potentially reducing enjoyment for some. One discontinued runner (aged 47) discussed how 'once those goals have been achieved, it felt like a big effort to try and build up that fitness again.' This sentiment is echoed by a current runner (aged 48):

> I'm just out running and enjoying it, whereas my mate chases times and he feels like he's going bad, so he doesn't enjoy his run. I do run competitively, but it's not the be all and end all. It's about going out and having fun.

Discontinued runners spoke with less specificity around their goals during their running journey, with some, like one discontinued runner (aged 50) taking a simple approach, '…[I] probably set myself a timeframe. Generally, around the local park. Two to three laps is fine.'

Moreover, participating in organised running events seemed to, at times, be discussed as a way to rejuvenate or sustain motivation. One current runner (aged 52) admitted that

external motives underpinned his running behaviour, stating 'I have to sign up to events. I need a goal. I find if I haven't got any kind of event booked, the motivation tails off a little bit.' However, most current runners differed in their approach to achieving goals. Rather than perceiving an organised race as a 'motivator', it was often seen as a way of structuring their routine, and a reason for them to continue running - the event itself was simply a way to test the effectiveness of their training. One current runner (aged 41) summarised this notion: 'Just knowing that to run well in an event or achieve a certain distance, like a marathon, in a certain time, then there's a quantity of training that needs to be done to complete that.'

Pleasure

It was also evident that perceptions of enjoyment, and positive physical and environmental factors influenced the decision to run.

Perceptions of enjoyment

Enjoyment or affect towards running was apparent in those who run as part of a healthy lifestyle. For many, enjoyment was described as a sense of freedom, relaxation, and personal satisfaction that made running a worthwhile activity. The enjoyment was not just related to physical benefits, but also to the psychological and emotional states that running evoked. Reflecting on what made running enjoyable was a key part of ensuring running continued to be perceived as a worthwhile activity. The sense of accomplishment, creativity, and mental clarity that running offered played a key role in maintaining motivation. One current runner (aged 38) described it as:

> I guess the more I ran, I just, every day I would…guess after you run, you just feel awake and fresh. But also, it's hard to describe… but lighter.

> Not so weighed down, I guess probably mentally but also physically. Your body has done something active, it's probably more the mental side of the lightness, but you just felt like you had more spring in your step.

Another current runner (aged 22) noted:

> I love the wind through my hair. I love mainly the feeling of when you're really tired after you, like, maybe hit a quarter of your potential. And then you kind of just, you know, you break through those barriers of like pain and discomfort. And the longer you keep going, the better you kind of feel.

Similarly, the mental clarity afforded one current runner (aged 47) the opportunity to solve problems: 'you might have an issue at work, and while you're running, you might solve it in your head. I find it's a good space. No one's bothering you. No one's ringing you.' Another current runner (aged 29) echoed this sentiment:

> And then when I kind of moved away from soccer… I just yeah, got into running, you know, maybe three or four times a week, it was just a really nice experience just to kind of get out. And it was more like a mental kind of mind, just clearing the headspace activity more than anything else.. it was very much an escape from that kind of toxic environment.

This mental respite appeared to influence current runners' commitment to keep running. Even some discontinued runners positively acknowledged running as a form of thinking time, with one discontinued runner (aged 47) reflecting: 'I've got a full-on job… it was good just to get away… and it's amazing how much you can solve when you get away from a situation for a while.'

Enjoyment also appeared to be a dynamic experience, with one recurrent theme being the monotony associated with running, with discontinued runners acknowledging this as a barrier. Their perspectives often centered on the boredom that for some, 'really play[ed] a big part of it for me' (discontinued runner, aged 47). Even some current runners experienced boredom, but identified strategies to mitigate this, such as with current runner (aged 48):

> I used to just do a 10 km loop and just go in circles - the same loop, the same thing, [I] know my times, and I probably got bored of it. So now every week is something different. It keeps you motivated and keeps things interesting, and I don't get bored.

Including variation in running routes, trying different types of running, and engaging in social running events could stave off the monotony and boredom that some may experience. For example, one discontinued runner (aged 47) said, 'I guess, [I] get up in the morning and have a coffee and then try and get out the door, just get it out the way', reflecting the feeling of wanting it to 'get it out the way', rather than actively planning it as part of their day as something to look forward to. Some discontinued runners had 'a few different forms of exercise so that [you] don't feel that monotony' (discontinued runner, aged 47), or even started engaging in other forms of activity. For example, for some discontinued runners, if they had access to a bike, they tended to transfer to cycling, such as with one discontinued runner (aged 47):

> I think if I if I started again, I'd be almost starting from scratch again. And yeah, I can't be bothered doing that. I've got a bike so I've been sort of riding more than anything at the moment.

Physical and environmental factors

Physical and environmental factors played a significant role in both maintaining and discontinuing running. Current runners emphasised how running in new and scenic places influenced their enjoyment. A current runner (aged 59) spoke about their love of running in new places:

> I love running in new places. So whenever we travel, one of the best things I get excited about is getting up super early, say the first morning after we've arrived or whatever, and going for a run… I love the excitement of finding new routes and location. And I don't know, something good for me often happens on a run, like I discover a really kind of magical place or something. So it does actually have a spiritual level and significance for me as well that I can achieve a place of, you know, oneness

Another current runner (aged 42) highlighted the sense of relaxation and creativity, 'your mind starts relaxing…your perspective on life changes… you get out, and you have this creative flow of ideas.' Certain sceneries such as beaches or trails provided a sense of freedom that allowed a shift in focus from pace or distance to embracing the experience, such as with one current runner (aged 48): 'Especially on the trails, the kilometres just tick by… just enjoying yourself more rather than thinking about time.'

The opportunity to 'connect with nature' (current runner, aged 42) through running to connect with nature was cited as a potential avenue to enhance running enjoyment. This runner also went on to describe how running outdoors allowed them to escape modern life: 'but you know, [I] love getting out in nature, like down the beach or the ocean area

or up in the hills. I like just hearing the sounds of nature and getting away from modern life – it's good.'

Even some discontinued runners still acknowledged the mental benefits of running as an opportunity to enjoy nature: 'you can hear the birds, and see the sunrise… it's lovely,' (discontinued runner, aged 60) and 'I had a beautiful running track where I could see the sea back in England. It was very good for my mental health looking back, even though I didn't associate it with that,' (discontinued runner, aged 51). These insights underline the interaction between physical surroundings and the running experience.

Discussion

This study investigated the factors that influence long-term running engagement through the perspective of current and discontinued runners. To achieve this, reflections of seventeen current and eleven discontinued runners were analysed, which revealed five themes relating to prioritisation and value, people planning, progress and pleasure that should be considered to promote and support sustained running.

The decision to continue running seems to be reflected with prioritising running and considering it an important aspect of one's identity and of strong personal value. Those who prioritised running, felt running was part of their identity, and placed a high value on running, were more likely to discuss continued running engagement. According to Identity Theory (130), the role of identity becomes a powerful motivator to behaviour as the individual seeks to maintain consistency between their identity (e.g., 'I am a runner') and their behaviour ('I am a runner, therefore I run'). Current runners demonstrated this by aligning their actions with their self-concept as runners, which likely reinforced their commitment to running through both personal value and social identification (131, 132).

Identity is known to influence exercise behaviour in numerous studies (133-135), including findings from Strachan and colleagues (136), who found exercise identity was significantly correlated with more self-determined forms of motivation based on Self-determination Theory (44-46). Current runners who placed value in their running pursuits seemed to have a greater ability to align their actions with their intentions, ultimately assuming a 'runner identity' as both a personal and social identifier. The reflections of current runners align with the broader PA literature whereby the maintenance of PA is driven by the underpinning of an activity-related identity (134, 137, 138). This is consistent with Kwasnicka and colleagues' model, which highlights the role of maintenance motives in behaviour maintenance (77). For current runners, running appears to satisfy intrinsic motives such as enjoyment, self-determination, and identity congruence, all of which are essential for long-term maintenance (77). In particular, the strong identification with being a 'runner' aligns with the concept that behaviour maintenance is often supported by the integration of the activity into one's self-concept and values (77). These findings also echo the recent work of McCormick et al. (30), who identified that current runners, much like the participants in this study, placed significant value on their running pursuits identified having a greater ability to align their actions with their intentions. The concept of running becoming intertwined with one's identity reflects how running, like other chosen behaviours, serves as a form of self-expression (136). Interestingly, current runners also hinted at how others categorising them as 'runners' not only validated their self-perception, but also solidified their role as a member within the running community. Considering SDT, it is plausible for someone to value the outcomes of running (identified regulation), being a driving force in maintaining participation (30, 34,

92). Additionally, a runners' identity can be shaped by those around them, which can result in a stronger identity and increased running (139). These findings suggest that the development and maintenance of a running identity may be an important enabler of long-term running (135), but also warrants careful consideration of the complexities of shifting exercise identities throughout one's life.

Prioritising running was not only about balancing one's time, but about prioritising health. Current runners spoke in depth about running with others as an enriching experience, whereas discontinued runners often referred to training partners or groups being a form of accountability. The reflections of current runners agree with the findings of previous studies, where runners with stronger identities tend to seek opportunities to exert their self-beliefs by running (135, 139), thus seeing it as a priority in their lives. This willingness to adjust their schedules and commit to running, despite competing responsibilities, aligns with Kwasnicka's concept of self-regulation, where individuals employ conscious control strategies to overcome barriers to maintain behaviour (77). By using strategies such as planning and time management, current runners were able to maintain consistency in their running routines. This often involved making conscious, personal negotiations to integrate running into their day or week (77). Despite some challenges, the willingness to make the necessary adjustments to ensure continued running participation appears to rely on a belief that running is a priority within one's life (77).

Interestingly, guilt in relation to spending time running seemingly preceded running discontinuation but was not apparent among current runners. Feelings of guilt has been explored in the PA literature in relation to SDT, more often examined in the role it plays for motivations to be active. People who feel internally pressured to exercise may do so

to avoid feelings of guilt or shame, displaying a psychologically unhealthy dependence on PA (79). Ultimately, individuals who placed a low value on running and were unwilling to accept the tradeoffs involved with running seemed to discontinue.

Running was identified as an opportunity for connection among both current and discontinued runners. The benefits of finding a 'crew' or a running partner seemed to foster interpersonal connections that could counteract declining motivation. Social support and the encouragement of others served as a catalyst for running commitment, highlighting how those around us may unknowingly improve running self-efficacy (140). The importance of group alignment was recognised to provide benefit, especially when the group had shared values and goals. There are similarities between the attitudes expressed by current and discontinued runners in this study, and those described by Burke et al. (140) and McCormick et al. (30). Social support from others, whether in the form of members in a group, family and friends or professionals, effect the involvement, efficacy and affect towards PA. A group that aligned with ones' personal values seemed to offer a sense of belonging and connectedness that may be difficult to achieve without that shared purpose, ability or interest (30). Consistent with the literature, this sense of belonging when running with a group can account for greater perceptions of autonomy, competence and relatedness satisfaction towards running (141). In line with Kwasnicka's behaviour maintenance model, the presence of strong social support can serve as an important contextual influence that helps individuals maintain behaviour by providing emotional and social resources that individuals can use to navigate competing responsibilities and engage with the goal behaviour (77). The availability of support, whether through running groups or individual connections, likely contributes to the

maintenance of running by reinforcing feelings of relatedness, provide emotional resources, all contributing to a greater motivation to run. These findings suggest for the benefit of running with others and having strong support systems in promoting running continuation.

By planning ahead and setting aside time for running, individuals may be better able to establish and maintain a regular exercise routine, with competing demands on time and energy (142). One framework that helps explain the role of planning in activity adherence is the Health Action Process Approach (HAPA), which posits behaviour is the result of a complex interplay of behavioural intentions, planning and motivation (56, 57). Current runners tended to discuss pre-action planning, which sits in the 'volitional phase' of the HAPA, achieved by structuring their running routine around external responsibilities and considering potential barriers that may require them to adapt to such changes. Constant structure in routine, although desirable for some, may hinder the ability to progress from intention to action when faced with obstacles (56), possibly contributing to discontinuation. Bridging the gap between intending to run, and maintaining running behaviour, may therefore lie in the ability to plan appropriately and consistently.

Goal setting approaches varied, with discontinued runners tending to adopt a simpler, 'do-your-best' approach within the context of a short-term training focus (i.e., the next running session). When it comes to goal setting, Swann and colleagues (143) argue that learning goals align with the constructs of health behaviour change theories and strategies compared to the 'do-your-best' type of goal setting approaches. Current runners often integrated a long-term goal setting process that promoted personal challenge. According to Kwasnicka's model for behaviour maintenance, setting and

achieving incremental goals can support self-regulation strategies and the development of positive habits, which play a key role in maintaining behaviour over time (77, 144).

Organised mass running events can seemingly act as motivational tools which may help sustain engagement, while progress appears to motivate individuals to persist in their running endeavours. Participating in running events can be one of the central parts of a runner's journey. Interestingly, relying on running events to sustain motivation suggests that running continuation is not solely reliant on intrinsic or autonomous regulation. Despite many theorists' outlining the relationship between exercise adherence and intrinsic motivation (e.g., Ryan and Deci (45)), external motives such as an event may serve as an effective regulator for some long-term runners. Additionally, rather than perceiving an organised race as a 'motivator', it was often seen as a way of structuring their routine, and a reason for people to continue running - the event itself was simply a way to test the effectiveness of their training. This reflection aligns with historical evidence in supporting exercise adherence, whereby those who are intrinsically motivated to sustain a goal behaviour do so as a way to challenge themself (46, 79). Whether for personal growth, or physical improvement, progress fed motivation and may be a key influential factor in running maintenance.

Affect towards a health behaviour can be a critical part of people choosing to maintain it as part of a lifelong healthy lifestyle (77, 145). Positive affect and enjoyment are considered critical components of maintenance motives (77). Runners who derive enjoyment from the activity appeared more likely to continue running, as they experience regular gratification and satisfaction from the behaviour. In contrast, boredom in health behaviour can make it feel aversive, reducing the likelihood of long-term adherence (145).

The Affective-Reflective Theory (ART) by Brand and Ekkekakis (54) provides a valuable framework for understanding these dynamics, highlighting that both automatic and reflective affective responses to running can either promote or hinder behaviour maintenance. According to ART, exercise-related stimuli, such as the experience of running, trigger immediate affect-driven impulses, which can lead to either positive or negative associations with the activity (54). For example, current runners tended to have a positive response to running (e.g., feelings of accomplishment or happiness), leading to a greater likelihood of continuing and revisiting the behaviour over time. Conversely, discontinued runners noted more negative associations (e.g., discomfort or boredom) with running, leading to low affect, and making maintenance less likely.

Certain environments facilitated a positive running experience beyond pace and distance. Outdoor, natural environments can provide health benefits that extend from improved mood and self-esteem to restoring mental fatigue (146). This implies that the environment in which running occurs is not a backdrop to the activity, but an active contributor to the overall enjoyment and satisfaction of the runner. Within the ART framework, these positive environmental experiences can enhance automatic, positive affective responses which can reinforce an individual's motivation to continue running (54). By associating running with enjoyable environments, individuals may strengthen the immediate positive evaluations that encourage continuation of the behaviour. As a result, recognising and optimising the role of the environment can be valuable in sustaining running activity. When examining enjoyment towards exercise, it is evident that an individuals' affective response is known to influence the likelihood of future exercise behaviour (54). This approach may lead to greater reliance on impulsive valuation, where the immediate emotional response

to the prospect of not going for a run holds greater weight (54). By reducing reflexive impulses to not run, through increasing affect towards running, may be a driver to fostering lasting engagement.

Overall, interpretation of the findings aligned with existing theories around PA promotion whilst offering further insight into psychosocial factors specific to running maintenance. Factors such as social support and alignment with a running group played an important role in promoting a high value for running. When individuals had good social connections and felt a sense of alignment with a running community, they were more inclined to want to prioritise running. Effective planning through adaptable routines and goal setting also helped individuals manage the tradeoffs associated with running. By having flexible routines and clear goals, individuals appeared better able to balance their time commitments and make running a priority.

Despite adding valuable insights to what factors may impact running from both current and discontinued runners, it is worth acknowledging that there are some limitations that should be considered when interpreting these findings. As previously stated in the methods, no participants engaged in member checking which can be seen as a limitation in achieving ontological relativism as part of our paradigmatic assumption. As such, all data was interpreted and presented from the perspective of the research team. Further, four of the participants were known to the interviewer, and all participants resided in Australia which can limit the generalisability and of the findings. However, the rigorous and thoughtfully planned methodology can provide a level of confidence that themes are an accurate representation of participants perspectives' aligning with ontological relativism beliefs. Engaging discontinued runners to provide their lived experiences and

perspectives to running provided valuable insights that enriched our identified themes. The qualitative exploration to uncover barriers and enablers to running also enabled a rich insight that quantitative methods cannot capture.

Conclusion

The decision to continue running is related to prioritising running as an important aspect of one's identity. However, how much value was placed on running was influenced by good social connections, having a flexible routine, feeling a sense of progress through goal setting, and reflection on the benefits of running. This research also has practical implications, suggesting that interventions should target physical barriers to running maintenance and facilitate it through a psychological lens.

Chapter 4

Just Run: Development of a theory-based motivational online intervention for promoting ongoing running participation

This chapter describes the design and development of an intervention using the Intervention Mapping framework aimed at increasing ongoing running participation, *Just Run.* Work from this chapter has been accepted for publication in *Psychology of Sport and Exercise* (citation details below), and is included in Appendix 4.1. The formatting of this chapter has been kept consistent with the other chapters in the thesis. A signed Statement of Authorship form for the relative contribution of all authors to the accepted paper is included in Appendix 4.2. Chapter 5 of this thesis then explores the feasibility of conducting a randomised trial of *Just Run.*

Citation:

Blacket, C.T., Fuller, J.T., Bennett, H., Crozier, A.J., Dziano, J. K. and Arnold, J.B. *Just Run: Development of a theory-based motivational online intervention for promoting ongoing running participation.* Psychology of Sport and Exercise, 2024. 71, p. 102581.

Abstract

Running is a popular form of physical activity yet discontinuation is common. Interventions targeting physical activity adoption have shown modest effects, often with little translation into long-term participation, which may limit the health benefits available to the wider community. This paper details the development of a new online running intervention (*Just Run*) aimed at improving continuation of running activity in new runners through a motivational and psychological lens, including aspects of design, content, refinement, and usability testing. A six-step intervention mapping process was used to develop a theory-based online intervention using a mix of research designs. Key stakeholders including runners, coaches and relevant experts in physical activity and behaviour change provided valuable insight, feedback and refinement of the education to be delivered. The final *Just Run* intervention included ten modules delivered online over twelve weeks to promote ongoing running participation through videos, testimonials, and activities. Key themes identified through the literature and stakeholder engagement process related to goal setting, self-efficacy, intrinsic motivation, social support and overcoming barriers to running participation. Usability testing confirmed the quality and suitability of the education to the target population. *Just Run* has been developed with a range of stakeholders to address an area of unmet need in the adoption and promotion of running. *Just Run* is a robust online intervention that has been designed and pre-tested with positive feedback and unique insights from key stakeholders. Further investigation is required to support its implementation to the wider community.

Introduction

Finding the motivation to be physically active on a regular basis is one of the biggest barriers people face in improving their physical and mental health and well-being (147). For those who are physically active, running is amongst one of the most popular forms of physical activity (PA) worldwide. In the United States alone, 48.9 million people (approximately 14% of the population) were reported to run at least once in 2021 (148). Running is one of the most accessible, time-efficient forms of PA, with physical and mental health improvement (149) and sense of personal achievement (37) amongst the most common reasons people choose to run.

Despite its popularity and potential for improving health, there is a large proportion of people who discontinue running. Of those who get as far as participating in a running event, 30% stop running within nine months (14), with most people discontinuing within the first three months. Discontinuation of any physical activity, including running, has negative consequences for individuals, but also places strain on public health systems as it detracts from the protective health benefits associated with regular PA (5). This highlights the need for strategies to promote not only the adoption of running, but its ongoing participation.

Several psychological factors have been identified as determinants of physical activity. Perceived competence, enjoyment, motivation, self-efficacy, overcoming barriers, and social support are some common factors that have been examined in relation to behaviour change in physical activity (34, 150). Understanding the interplay of these psychological factors with PA engagement can inform interventions that will promote long-term running, with some recent promising integration of these factors in running

interventions have recently been published (151, 152). While previous research has predominantly focused on injury-related explanations for running discontinuation, targeting psychological factors to facilitate adoption and maintenance of running are equally vital.

Physical activity interventions have been explored through various approaches, including in-person and online delivery methods (153, 154). Online behaviour change interventions to support PA maintenance have shown promising outcomes in a number of health behaviour change studies (155), and online education has been shown to be protective against sustaining running-related injury (156). However, the effectiveness of an online intervention to promote ongoing running participation from a non-injury related perspective is unknown. Preventing premature discontinuation of running will rely on implementing and engaging appropriate behaviour change constructs and frameworks, adapted to the running population.

This chapter outlines the method of developing the *Just Run* intervention, drawing on the Intervention Mapping (IM) process (157). The six-step IM process is a problem- and theory-driven protocol that has been useful in several health-related behaviour change interventions. Crucially, our focus on an online delivery model was fundamental to our aim. This online emphasis was established from the outset to integrate advantages and nuances offered by the digital environment at the time of development. The aim of this study was to produce an online program for ongoing running participation in new runners using IM Steps 1 through 4, and develop an implementation plan (IM Step 5) that can inform a future randomised control trial to evaluate program efficacy (IM Step 6).

Method

Overview of development process

The development of the *Just Run* intervention involved an interdisciplinary team of researchers, clinicians and tertiary educators in behaviour change and PA participation, exercise psychology and physiology, physiotherapy, and injury prevention. The intervention was selected to be delivered online due to its cost-effectiveness, low participant burden and ability to target a broad population (158). Intervention development for *Just Run* involved a six-step systematic process following the IM framework (157) involving a needs assessment (Step 1), the identification of outcomes and change objectives (Step 2), program design (Step 3) and program production (Step 4). A program implementation plan (Step 5) and evaluation plan (Step 6) are outlined for future testing. Figure 4.1 provides an overview of the developmental processes in alignment with the IM steps. Ethical approval was granted by the University of South Australia Human Research Ethics Committee for the qualitative components (protocol number 203828) and pre-testing of the intervention development (protocol number 203978).

Step 1: Needs assessment

Needs assessment supported the development and implementation of a tailored intervention to effectively target running maintenance. First, a narrative literature review was completed using relevant search terms (i.e., running, motivation, engagement) in Embase, CINAHL, Web of Science, Sport Discus and Medline databases (Appendix 4.3) to establish normative needs. This identified relevant research and established applicable

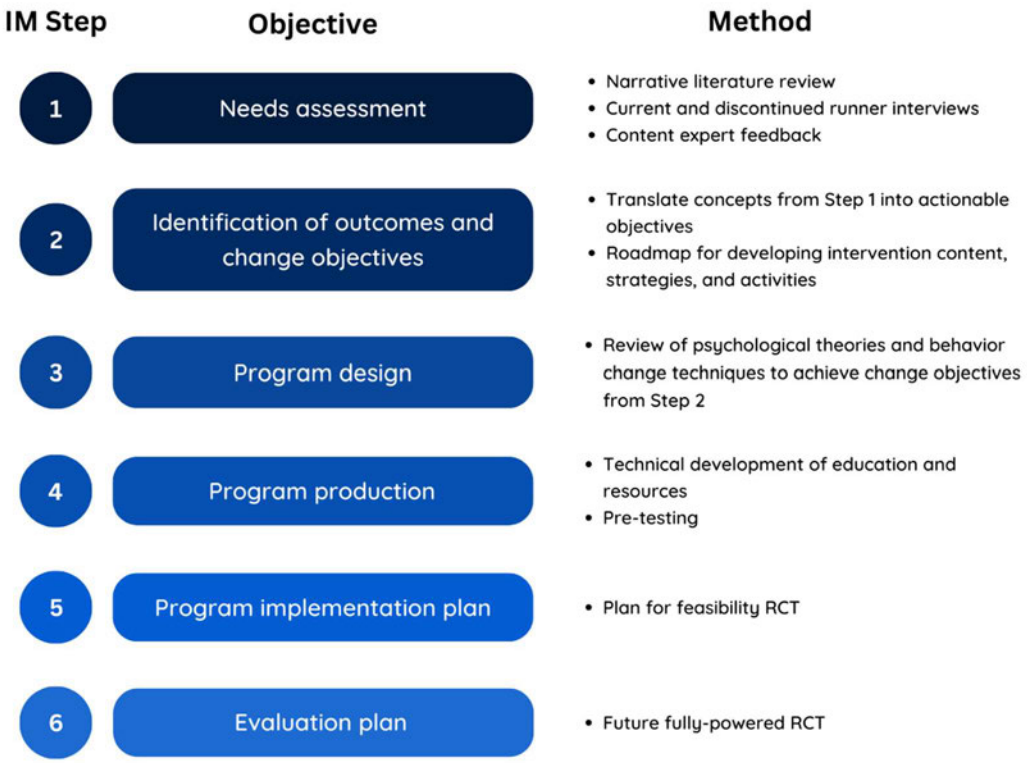


Figure 4.1 Developmental process of *Just Run* with Intervention Mapping steps, objectives and methods.

methodologies to determine how our intervention could best apply and integrate successful behaviour change components. Secondly, through interviews with both current recreational runners and those who discontinued running, we delved into the felt and expressed needs of individuals engaged in or considering running. This qualitative approach allowed us to capture participants' perceptions, challenges, motivations, and preferences related to sustaining a running routine. Regarding comparative needs, we contrasted these experiences and perspectives of current recreational runners with those who had discontinued running. This comparative analysis enriched our understanding of the distinct needs and challenges between these groups. Thirdly, we consulted with content experts to provide feedback and further insight into the constructs identified

through the review and interviews to further assess normative needs.

Literature review

Articles of interest included experimental and review papers that included at least one behaviour change theory or technique within a running or physical activity context. If there was uncertainty about the papers' relevance or applicability to our research aim, the wider research team was consulted to discuss suitability. Once we identified the studies, discussion amongst the research team then identified the most critical, relevant articles that could help shape the intervention. As a research team, it was deemed important to place greater weighting on running-specific and online studies due to the greater applicability to the target population.

Current and discontinued runner interviews

To further determine how the intervention would align with the needs of the target population, eighteen current recreational runners and eleven discontinued runners from Australia were recruited via advertisements posted on social media platforms to participate in semi-structured one-on-one interviews (refer to 'Interview Guide' from Chapter 3 in Appendix 3.3). We aimed to recruit participants from a broad range of ages, sex and running experience.

Expert consultation

Seven content experts were identified via the research team based upon their research in the realm of behaviour change and physical activity. Initial contact was made with these external experts to gauge interest in providing advice on the identified themes for the purpose of this study. A short 30-minute online meeting was then arranged with the seven experts who agreed to participate. Experts were informed of the aims of the project and

the current state of the intervention development. To guide these discussions, prompting questions were curated and individualised for each expert targeting topics regarding the practical application of their research to a running context, insight into applying the findings of their research into a digital platform, and potential digital delivery strategies that they recommend to ensure uptake and understanding. Following this consultation, some experts shared additional resources via email including relevant research articles or intervention activities, providing further assistance to frame the intervention development. To ensure transparency, follow-up communication was conducted when necessary to seek clarification on specific aspects of our approach.

Step 2: Identification of outcomes and change objectives

Through the needs assessment conducted in Step 1, the behaviours to be targeted within the intervention were identified. The subsequent focus was on translating these concepts into actionable change objectives. This involved examining how these interventions facilitated behaviour change approaches and activities, with particular focus on physical activity interventions or online interventions. The change objectives, derived from this synthesis of evidence and understanding, provided a roadmap for developing the intervention strategies. This process ensured that the intervention was theoretically grounded and tailored to the specific needs of novice and returning runners.

Step 3: Program design

Psychological theories and frameworks were reviewed to inform the theoretical methods that may help achieve the constructs and change objectives derived from the literature review, interviews and expert consultation in Step 1 and 2. Practical strategies using the Behaviour Change Wheel (BCW) (159) and BCT Taxonomy were reviewed to classify the

potential approaches. Application of these techniques in online behaviour change interventions were reviewed to ensure they could be implemented in this intervention design. Behavioural goals based on psychological theories and BCT strategies were selected that best aligned with each construct to address the influences of change. The order of education delivery was a critical development step discussed by the interdisciplinary research team and informed through the literature review, theory identification, interviews and expert consultation.

Step 4: Program production

Program production

The technical development of *Just Run* was undertaken over several months throughout 2020/21. The *Just Run* website was hosted on a purpose-built external Moodle site (E-Moodle) through the University of South Australia after different website layouts were investigated for the optimal way to present the information. Videos were selected to deliver majority of the education due to the capacity to engage viewers and communicate multiple BCTs seamlessly with real-world scenarios. Additional optional resources (e.g., activities, external sites, podcasts) were available to supplement knowledge and offer diverse learning opportunities at the participants' discretion. Video and activity content presented in portable document format [PDF] files were designed using Canva (Perth, Western Australia, AUS), an online graphic design platform, with video content uploaded edited on Panopto (Seattle, Washington, USA), and embedded onto the *Just Run* site. The primary researcher with several years' experience using Canva for a healthcare business was responsible for the design and development of all elements, which were then reviewed by the interdisciplinary team. A graphic designer with expertise in science

communication was consulted to review the accessibility, design and general aesthetics of the materials and site.

Each video targeted aspects of the primary and secondary psychological outcomes, including motivation, basic psychological needs, and self-efficacy to promote running participation. A range of animations, short interview clips, voice-overs, avatars and videos were incorporated throughout to ensure relevant, appealing and engaging materials. Closed captions were included on each video for accessibility. Videos were kept short to facilitate engagement and reduce the time burden for participants based on principles for maximising student learning (160).

Pre-testing

Expert researchers who were previously consulted in Step 1, as well as running coaches and recreational runners of various experience, age and sex were approached through purposive sampling to provide feedback on the intervention. In total, ten participants, including three running coaches, two experts and two current runners agreed to review the education and were provided a 3-week access period to the Moodle site housing the 10 modules. The two experts only provided feedback on their specific content area.

Pre-testing participants were requested to respond to a purpose-built feedback questionnaire (Appendix 4.4). The questionnaire was based on established user-experience surveys and recommendations (161) which included Likert scales for statements and open-ended questions regarding the site and education materials. Frequency and percentage (%) of respondents selecting each statement (e.g., “the activities were well presented with clear instruction on how to complete them”) were calculated and displayed graphically.

Step 5: Program implementation plan

The *Just Run* online intervention was comprehensively and systematically designed to address the complex factors that influence running, incorporating essential elements guided by expert consultation and feedback. The feasibility of implementing *Just Run* will be evaluated in a future two-arm feasibility randomised controlled trial (RCT) (protocol registration 203978). Feasibility outcomes will include adherence, retention, dropout rate, and determination of productive recruitment methods. Conducting feasibility work prior to a definitive trial is essential for identifying potential challenges, refining intervention components, and ensuring methodological soundness before testing efficacy (162). Researchers have further emphasised the importance of pilot and feasibility work to avoid costly failures and ensure the scalability of the intervention (162).

Step 6: Evaluation plan

Step 6 will involve investigating *Just Run* in a fully powered RCT, building on the feasibility study outcomes from Step 5. A fully powered RCT is beyond the scope of this PhD, and therefore Step 6 is designated as future potential work.

Results

Step 1: Needs assessment

Findings of literature review

Literature searching revealed several common themes critical in PA maintenance, with some supported by evidence specific to running. Among the twenty-six studies identified, fifteen specifically examined running behaviour, while the remaining eleven centered on general physical activity behaviour. Within these studies, we identified approximately twenty behaviour change techniques (BCTs) based on the BCT Taxonomy V1 (163). Goal

setting and planning (i.e., BCT 1.1 goal setting) (164), self-efficacy (i.e., BCT 15.3 focus on past success) (165), intrinsic motivation (i.e., BCT 2.4 self-monitoring of behaviour) (34) and social support (i.e., BCT 3.3 social support [emotional]) (166) were the most commonly cited factors contributing to PA maintenance (11, 167). The most influential theories used by studies to understand PA determinants were Social Cognitive Theory (168), Self-efficacy Theory (169), Self-determination Theory (47) and the Transtheoretical Model (126). These theories have been extensively researched and supported, providing a solid theoretical foundation for informing the design of our intervention and guiding strategies to address barriers and facilitators to sustained running participation. In addition, injury prevention education and strength training were behaviours specific to running that were identified as important and relevant to runners, despite not necessarily aligning with BCTs or theories. Important overarching themes emerging from these processes assisted the development of core constructs to behaviour. Overall, important themes emerging from these processes assisted the development of core constructs to behaviour.

Although not all identified studies were explicitly targeting behaviour change, most of the studies discussed these behaviour change techniques as potential antecedents to the health behaviour. This review identified promising BCT and theories that can influence PA behaviour, and highlighted the need for further investigation into the application of these factors into a novel intervention that addresses long-term running behaviour in new runners specifically.

Findings from the current and discontinued runner interviews

Qualitative interviews highlighted common barriers to running participation, in conjunction with key themes, including goal setting, placing a priority on running and social support as key enablers (Chapter 2). These findings are were used to guide intervention components targeted to runners specifically, and are consistent with a recent qualitative study (30).

Findings from expert consultation

Through expert consultation, previously unidentified constructs deemed important for behaviour maintenance including, self-compassion (i.e., having the compassion for oneself as we do for a friend, which can facilitate health behaviour (170)) habit formation (i.e., through repetition, behaviours gradually become routinised (171)), group dynamics (i.e., group identification is associated with greater running participation (166)) and overcoming cognitive barriers (i.e., reframing can reduce decisional struggle to exercise (172)).

Findings of needs assessment

Based on the comprehensive needs assessment conducted through a narrative literature review, interviews with current and discontinued runners, and expert consultations, common personal and environmental determinants were identified. Selected behaviour change techniques with the corresponding mechanism of action from the BCT Taxonomy (v1) (e.g., BCT Taxonomy 1.1 Goal setting [behaviour]) (163) are shown in Table 4.1 (see Appendix 4.5 for expanded descriptions of inclusion rationale).

Step 2: Identification of outcomes and change objectives

In Step 2, the behaviours identified in Step 1 were translated into actionable change objectives and core goals (Table 4.1). This involved aligning the identified behaviours with

target theoretical constructs such as autonomy, competence, self-efficacy, self-awareness, intrinsic motivation, and identity. For these objectives, a diverse set of BCTs (Michie, 2013) was carefully selected for each module. These BCTs were chosen based on their relevance to the targeted theoretical constructs and the overall goals of the intervention. The inclusion rationale for each BCT was defined, linking it to established psychological theories and empirical evidence. For example, instructional elements (BCT 4.1) were incorporated to enhance self-efficacy and competence in running, while self-incentive (BCT 10.7) and identification of self as a role model (BCT 13.1) were utilised to foster intrinsic motivation.

The general descriptions of implementations within each module were crafted to create a structured and scaffolded learning experience. For instance, the *'Your Guide to Just Run'* module introduced participants to physical activity guidelines and strength training recommendations to help build foundational knowledge and facilitate a sense of competence with being physically active. Throughout the process, the intervention was designed to be cohesive, with each module building upon the previous one, creating a logical and progressive content flow. Optional activities within each module were crafted to reinforce video content. This systematic approach ensured that the Just Run intervention is grounded in psychological theory and designed to be effective, engaging, and tailored to the needs of novice and returning runners.

Step 3: Program design

The interdisciplinary research team established the importance for each module to sequentially build on the previous module, starting with the most pertinent information (e.g., value identification) through to self-monitoring and more reflective modules (e.g.,

review running progress). A guide was developed to outline the ten modules, listing: (1) theoretical construct(s) targeted; (2) specific behavioural goal(s); (3) techniques targeted (BCT Taxonomy); (4) rationale: link between the theoretical constructs, goals, and techniques; and (5) the mode of delivery of each technique (e.g., video, resources and activities) (Table 4.1).

Table 4.1 Description and rationale of Just Run modules with reference to Behaviour Change Techniques (BCT) Taxonomy (v1) (163).

Module	Core Goals	Target Theoretical Constructs	BCT Taxonomy no.	Inclusion Rationale	General Description of Implementations
1. Your guide to Just Run	To promote autonomy & competence in running activity by imparting exercise knowledge, highlighting health benefits.	Autonomy; competence; self-efficacy	4.1. Instruction on how to perform the behaviour; 4.2. Information about antecedents	Enhancing understanding of running behaviour, with guidance, can boost self-efficacy towards physical activity (150).	First, participants introduced to PA guidelines. Next, participants encouraged to explore what makes PA enjoyable. Finally, a graded approach for injury prevention introduced.
2. FITT * training principles	To increase self-efficacy by informing individuals on FITT.	Autonomy; competence; self-efficacy	4.1. Instruction on how to perform the behaviour	Building awareness of running behaviours to promote competence to safely run (169, 173, 174).	First, participants introduced to training principles. Finally, tracking sheets provided to build awareness to structure and monitor running.
3. My values	To align running with personal values, & foster reflection on personal motives, distinguishing between autonomous & controlled motives.	Self-awareness; autonomy; identity; intrinsic motivation	10.7 Self-incentive; 13.1 Identification of self as role model; 13.5 Identity associated with changed behaviour	Self-incentive targets self-determined motivation through prompting individuals to consider how running can help them to achieve satisfaction & fulfilment of value-based goals (164). Exercise identity can facilitate more autonomous forms of regulation (77).	First, participants encouraged to reflect on values & self-identity. Next, avatars exemplify how running can promote alignment with values. Finally, participants write a letter to their future self, fostering running in harmony with values.
4. My running goals Part 1: Goal network Part 2: Action planning	To facilitate confidence to set & achieve goals. Promote awareness of individualised choices for sustainable running.	Self-regulation; self-efficacy; competence; intrinsic motivation	1.1 Goal setting (behaviour); 1.4 Action planning; 2.3 Self-monitoring of behaviour; 2.4 Self-monitoring of outcome(s) of behaviour	Goal setting fosters self-regulation towards maintaining running (175). Self-monitoring can assist in overcoming barriers & prevent relapse (77).	First, participants revisit values. Next, participants encouraged to create personal goal network, including core values & 'ideal self,' intermediate goals & subordinate strategies to successfully achieve goals. Finally, participants encouraged to use running action plan to manage setbacks.
5. Guide to self-compassion	To promote self-compassion choices with running. To challenge negative mindsets while encouraging decisions aligned with individual's best interest.	Competence; wellbeing; self-regulation; intrinsic motivation; self-efficacy	11.2 Reduce negative emotions; 15.2 Mental rehearsal of successful performance; 15.3 Focus on past success; 15.4 Self-talk	Self-compassionate choices can foster a sense of wellbeing (176). Reflecting on success can contribute to ongoing adherence (54).	First, participants learn about exercise self-compassion. Next, strategies to re-frame negative mindsets explored. Finally, prompt reflection on applying self-compassion in challenging situations discussed. A podcast link to 'The Academy of Imperfection' featuring Ben Crowe provided.
6. Building self-awareness as a runner	To raise awareness of supportive running patterns through reflecting on their behaviour & strategies for achieving their goals.	Autonomy; intrinsic motivation; competence; self-efficacy	1.5 Review behaviour goal(s); 2.4 Self-monitoring of outcome(s) of behaviour;	Through reviewing progress, people can continue with their current behaviour (providing a sense of competence), or modify their goal or behaviour to facilitate success (143). Individuals prompted to reflect on intrinsic goals to foster autonomy (177). Monitoring outcomes can enhance greater self-efficacy towards maintaining PA (178, 179).	First, self-awareness in running behaviour introduced. Next, participants prompted to review Strava data, exploring challenging & enjoyable runs. Finally, participants reflect on what makes certain runs more enjoyable.

Module	Core Goals	Target Theoretical Constructs	BCT Taxonomy no.	Inclusion Rationale	General Description of Implementations
7. Support for success Part 1: Healthy habits Part 2: Social support	To develop supportive habits, promote physical & social antecedents to running behaviour, & explore available support avenues through supportive relationships.	Intrinsic motivation; sustainability; relatedness; self-regulation	Part 1: 1.2 Problem solving; 7.1 Prompts/cues; 8.1 Behavioural practice/rehearsal; 8.3 Habit formation; 12.1 Restructuring the physical environment; Part 2: 3.1 Social support (unspecified), 3.2 Social support (practical), 3.3 Social support (emotional); 12.2 Restructuring the social environment	Problem solving to overcome current barriers can facilitate an increase in physical activity (180), assisting individuals to sustain the behaviour. Encouraging daily routines that include physical activity can facilitate successful behavioural regulation (181). Social support through finding suitable running groups or partners may assist individuals to maintain it (182).	First, the establishment of healthy habits & mechanisms for positive reinforcement outlined. Next, examples highlight the role of social supports in fostering success, accommodating both individual & group preferences. Finally, participants are guided through establishing habits. Additional resources (e.g., links for creating running routes, running groups & video by James Clear on effective habit formation) provided.
8. Overcoming my running barriers	To recognise challenges & barriers to running & boost self-regulation by promoting diverse tools & resources.	Competence; self-efficacy; autonomy; self-regulation; intrinsic motivation	1.2 Problem solving; 7.1 Prompts/cues	Problem solving to overcome current barriers can facilitate an increase in physical activity (180), assisting individuals to sustain the behaviour. Prompts/cues may help individuals associate the desired behaviour with a trigger in their environment to facilitate maintenance (180).	First, 'Capability, Opportunity & Motivation towards Behaviour' model (159) introduced to identify running barriers. Next, common barriers are addressed, featuring testimonials. Finally, participants provided a journaling activity to overcome barriers, & factsheets summarising strategies.
9. Review running progress	To review strategies & re-evaluate goals. Encourage reflection & adjustment as needed.	Self-efficacy; self-regulation	1.5 Review behaviour goal(s); 1.6 Discrepancy between current behaviour & goal	By prompting reflection on progress, participants can modify strategies, fostering a sense of self-efficacy (169). Reflecting on discrepancy between ones' goal and current behaviours may promote self-regulation & effort towards the goal behaviour (183).	First, participants prompted to reflect on progress & success. Next, past modules & activities summarised, encouraging revisiting useful education, reviewing goal achievement, and strategies for running maintenance. Finally, a podcast link on running progression included.
10. I am a runner	Encourage participants to align selves with new behaviour, building a runner's identity to support ongoing motivation.	Identity; competence; intrinsic motivation	13.1 Identification of self as role model; 13.5 Identity associated with changed behaviour	By fostering self-redefinition in line with new health behaviour (e.g., running identity) (136), individuals are likely to sustain running behaviour. Exercise identity has been associated with intrinsic motivation (184), capturing more autonomous forms of regulation (77).	First, short testimonials from runners sharing personal meaning of running presented. Next, examples of 'being a runner' highlighted. Finally, a short interview with a local parkrunner & link to the Australian documentary film 'I'm Not A Runner' provided.

* *PA*, physical activity; *FITT*, frequency, intensity, time [duration], type; *RPE,* Rating of Perceived Exertion

Step 4: Program production

Findings of program production

The final intervention included 10 modules delivered over 12 weeks, with a new module made available each week. The graphic designer identified opportunities to enhance accessibility features across the materials and the website, which included implementing a user-friendly navigation structure, a TabTopics interface, to facilitate easy browsing for individuals with varying levels of digital literacy. Videos summarising the preceding 6 weeks of content were delivered in week 6 and 12 to provide an opportunity for participants to revisit missed modules. Each module included an average of 1.5 videos, ranging from 1 – 5 per week. The average length of a video was 4:05 minutes, ranging from 2:26 to 6:39 minutes. There was an average of one activity per module (example shown in Figure 4.2), with additional resources such as podcasts, running groups and documentary films. It was expected that each module would take approximately 4 – 19 minutes per week over 12 weeks. Appendix 4.6 present the remaining additional resources included in *Just Run.*

Findings of pre-testing

Pre-testing participant feedback indicated a positive overall response to statements regarding the site and content (Appendix 4.7). High quality visuals, logical structure and topics, and the effectiveness of personal narratives and stories were commonly stated as enjoyable components of the education. Suggested areas of improvement with the decided outcome (e.g., adding clearer instructions for all activities) can be found in Appendix 4.7, with results used to revise future implementations of *Just Run*. The main threats to engagement and usability were identified and several improvements were made



Figure 4.2 Example of Action Plan activity.

regarding user experience, design, content development and technical performance. For example, to facilitate access to the activities and resources, documents could be downloaded in bulk at the beginning of enrolment. In addition, activities were integrated onto the online E-Moodle format wherever possible to improve the experience of those without convenient access to a printer or PDF editor. Access to the site may be requested by emailing the corresponding author.

Discussion

Just Run is one of the first theory-based online approaches to improve ongoing running participation from a psychological and motivational perspective. The aim was to design an online intervention using the IM process to support ongoing running in new runners.

Just Run was developed based on known approaches to exercise maintenance and adapted for the target population (new runners) following the IM framework. Although running is an accessible form of PA, discontinuation threatens the capacity for the known health benefits from regular participation to manifest, feeding into the rising tide of physical inactivity and chronic disease. Approaching running participation from a motivational and psychological lens through an online program was thus deemed necessary to enhance the potential and future reach of *Just Run.*

Final constructs to support the intervention aim stemmed from literature searching, interviews, and consultation with relevant experts and key stakeholder groups. The IM approach ensured the complexities of behaviour change could be systematically implemented, reported and replicated in the running context. The systematic approach used in the development of the present study was guided by previous intervention designs incorporating the IM process for weight loss maintenance (185) and physical activity and sedentary behaviour change (186). A key aspect of the *Just Run* design is the carefully scaffolded modules progressively building upon each other, offering a structured and guided learning journey to sustainable running.

The findings for promoting intrinsic motivation (45), goal setting (143), self-monitoring and coping planning (155), self-efficacy (169) and autonomy towards the behaviour (187) were key constructs shown to have an impact on long-term health behaviour engagement. This is consistent with Kwasnicka's behaviour maintenance model, which emphasises that self-regulation strategies, maintenance motives, and the role of supportive resources are critical for sustaining behaviour (77). *Just Run* incorporates these aspects by facilitating self-regulation through providing goal setting and self-

monitoring resources, and by encouraging maintenance motives like intrinsic motivation and autonomy. The needs assessment and identification of outcomes and change objectives in the present study revealed similar determinants and processes of change found in other intervention designs within health and running interventions (e.g., goal setting and self-monitoring behaviour) (151, 152, 185, 188). One construct, self-compassion, was a concept deemed critical in encouraging healthy behaviour maintenance towards intrinsic motivation. Evidence and advice from the experts also supported the role of self-compassion in the self-regulation of PA, but not necessarily associated with the amount of activity completed (189). Although self-compassion strategies alone may not influence running participation, feedback from stakeholders for *Just Run* indicated the self-compassion module was imperative to include. By incorporating psychological resources to promote self-compassion in sustaining behaviour, individuals may experience greater regulation of emotional responses and a greater ability to cope with setbacks, which contributes to behaviour maintenance (77). It is possible that within a broader psychological intervention, education to promote self-compassion may facilitate running adherence and maintenance in this population, suggesting it to be an important addition to this motivational intervention.

Previous online interventions targeting running behaviour have focused on injury-prevention strategies (156, 173, 188, 190). Only one of these studies outlined their intervention design using the IM approach (190). Considering the complexities of running behaviour, demonstrated in the logic models of the present study, it is questionable whether such interventions would have long term influence on running behaviour. Although demonstrating a level of effectiveness in preventing injury in this population,

these studies only address a small portion of the possible array of contributors to running and are unlikely to appropriately target the psychological and motivational tools to facilitate ongoing running participation. In line with Kwasnicka's model of behaviour maintenance, effective behaviour maintenance requires addressing not only physical factors, such as injury prevention, but also psychological and contextual factors that influence ongoing engagement (77). The integration of coping strategies for injury and other barriers in *Just Run* reflects this more comprehensive approach to running maintenance. Given the significant injury risk and prevalence in novice runners (13), interventions should not only aim to address how to prevent injury, but provide strategies on how to psychologically cope during such adversity, and continue to successfully integrate running throughout their lives. Furthermore, adherence to running programs in clinical trials have been poor, illustrating that the nature and design of the intervention should be carefully considered (191). *Just Run* effectively integrates all these factors, based on a comprehensive understanding of influences of health behaviour change, and unifies the physical and psychosocial aspects of running into a single intervention.

Addressing a critical gap, our intervention targets running maintenance through an online motivational lens. Prior online behaviour change attempts vary in success (153, 154, 192), but promising adherence in online running injury prevention studies (156, 190) highlight the feasibility of this design within the running community. Developing an online running intervention from a psychological and motivational lens that is both informative, not time-intensive and appealing were critical considerations for the design to promote adherence. Including educational videos with short interviews with runners, supporting activities and external resources were essential to the quality of the final product. The

estimated time commitment of *Just Run* is 4 – 19 minutes per week over 12 weeks, in what should be low burden to participants. This is consistent with other online interventions targeting this population (173, 185, 188).

Involvement of key stakeholders to inform, develop and refine the *Just Run* design was a strength of this intervention. Extensive international expert consultation and refinement to inform the final constructs and strategies assisted in ensuring the intervention was based on current recommendations. Usability testing demonstrated the promising translation of theories into the implementation of the online intervention. Limitations include the need for more extensive review, usability testing and implementation trials to inform future, large-scale rollout to test the feasibility of *Just Run* in a more applied setting. Furthermore, Kwasnicka and colleagues propose that behaviour maintenance is a dynamic process influenced by changing contexts and individual factors over time (77). Future adaptations of *Just Run* may benefit from incorporating elements that allow for the personalisation of the intervention, addressing the evolving needs of participants as they progress in their running journey. A comprehensive and systematic search was undertaken to inform our IM process, but this was not a formal systematic review and undertaking such a review might identify additional, relevant factors to consider for promoting running sustainability. Not exclusively focusing on running specific behaviour-change studies in our literature review could be viewed as a limitation. While the decision to review literature more broadly was made to ensure all relevant literature was used to inform the intervention, it may have also resulted in less directly applicable literature being used in its design. This potential limitation will be considered when interpreting the future feasibility of this intervention.

Further, including novice runners in the needs assessment and pre-testing could have provided additional insights. There is also a potential lack of generalisability of the intervention due to the runners within the stakeholder group residing in Australia, although many determinants of running behaviour that informed the intervention are consistent with previous findings from other countries such as the Netherlands (11, 12) and Spain (193).

Conclusion

In conclusion, this paper provides a comprehensive outline of the design and development of a novel online intervention to promote ongoing running participation in new runners. To the authors knowledge, no intervention has targeted this health problem following the IM process. The robust methodological approach allowed the integration of theory and stakeholder insights to ensure the *Just Run* intervention was appropriate and engaging whilst targeting key psychological and motivational outcomes. While up-to-date frameworks were used to guide intervention decisions, additional feasibility studies to observe changes in user engagement and experience, and randomised controlled trials to assess efficacy in maintaining PA participation will be valuable in understanding the success of this design.

Chapter 5

An online education program (Just Run) targeting motivation and psychological influences compared to basic advice in runners: A randomised, feasibility trial

Chapter 4 detailed the process of designing *Just Run* that encompassed findings from Chapters 2 and 3. Whilst steps 1 to 4 of the Intervention Mapping process were outlined, the next step was to test its implementation in the broader community, which aligns with Intervention Mapping step 5. As such, this chapter tests the feasibility of conducting an RCT of *Just Run* with a novice Australian running sample.

Abstract

Regular running elicits a myriad of physical and mental health benefits, yet discontinuation threatens the ability for individuals to reap these positive health outcomes. There is limited evidence from interventions promoting running maintenance from a motivational and psychological perspective. Therefore, using a two-arm parallel group randomised trial design, this study aimed to determine the feasibility of a 12-week online intervention (*Just Run*) comprised of evidence-based education and relevant behaviour change techniques versus basic physical activity and training advice (e.g., training principles), to promote running maintenance. Primary outcomes were feasibility based (recruitment, retention, and intervention engagement). Secondary outcomes included motivation, basic psychological needs, self-efficacy, benefits/barriers, wellbeing and running participation. Sixty adult novice runners were recruited, of which n = 16 and n = 17 completed outcomes at the 12-week follow-up for the intervention and control groups, respectively. Despite low-to-moderate engagement with the educational content (participant engagement ranged from 10.7% to 71.4%), 61.6% of participants agreed or strongly agreed that the education helped inform sustainable running behaviour in the future. Preliminary findings revealed large between group differences in change scores from baseline to week 6 for amotivation, favouring the control group (d = -0.81, 95% CI -1.52, -0.09) and large between group effect size for scheduling self-efficacy from baseline to week 12, favouring the control group (d = -0.89, 95% CI -1.60, -0.16). No changes in basic psychological needs, exercise benefits/barriers, and wellbeing were observed from baseline to the end of the 12-week intervention between groups. The proportion of participants who ran at least once per week during the 12 weeks was somewhat similar

between groups (intervention group varied between 29 to 50% compared to 14 to 54% for control). Lost to follow up rates suggest potential challenges with engagement. These findings reveal that *Just Run* is a feasible intervention, although modifications are required to optimise engagement, retention, and the long-term effects of the education on running maintenance.

Introduction

Running is a popular form of physical activity, with upwards of 64 million people participating annually in the United States alone (148). Regular running elicits a myriad of physical and mental health benefits (9, 149), making running appealing for many. Importantly, running even just once a week has been shown to reduce the risk of cardiovascular mortality by 30% (5). Despite these well-known benefits, many people struggle to maintain a consistent running routine. In fact, almost a third of those who start running do not continue for more than 6 months (11).

Individuals often commence running with specific objectives in mind, whether it be training for an event, or pursuing health goals such as weight management and improved cardiovascular fitness (30, 82). It is at this time that motivation is likely to be its highest (77). However, many struggle to sustain this level of motivation to continue running regularly. Often, what motivates someone to continue running differs from what prompted adoption (77). For example, finding personally meaningful reasons to run related to identity, values, relationships and enjoyment of the running experience, are known to motivate people to maintain their running (30). Such reasons align with more autonomous forms of motivation (194). Alternatively, runners who experience conflicting priorities, particularly work and family responsibilities, are less likely to be intrinsically driven and often struggle to continue running (30). Other factors such as injury, the environment (e.g., accessibility to safe places to exercise), and social support are also known to influence the decision to maintain running (12, 14, 30, 82). With conflicting priorities, the motivation to run can decrease, leaving the individual to rely on psychological skills such as self-regulation and stress management to combat the many barriers that may arise to

prevent running activity (77). Therefore, individuals must have the appropriate psychological resources to manage barriers that threaten running continuation.

Over the past decade, much of the research to address running maintenance has focused on providing injury prevention education to support safe running practices, with mixed results (123, 173, 190, 195-197). As the education provided to participants only focused on injury prevention, these interventions did not address the psychological mechanisms underlying running maintenance. As such, it is unlikely they influenced motivational or psychological capacities to support successful long-term participation. Simultaneously, interventions focusing on injury prevention are hampered by poor compliance (26). Beyond injury prevention, there is limited evidence for interventions promoting running maintenance from a motivational and psychological perspective. As one exception, Pereira and colleagues described the development of an educational intervention to promote sustained running behaviour using psychological theories, with initial indication of good acceptability and feasibility (188). Yet this trial included long-time runners, relied on self-reported running activity, and was based on a weight loss study, rather than developed specifically for runners (185). Given novice runners are at a higher risk of discontinuing than more experienced runners (14), it is critical that interventions target this population and address the running-specific barriers they may encounter to facilitate maintenance. Furthermore, those who previously ran as a form of activity and want to return are likely to require similar education to that of novice runners to successfully re-engage and maintain their running.

More examples of interventions targeting psychological and motivational skills exist in general physical activity (PA) settings (34, 198, 199). These interventions included a

range of theory-informed approaches and behaviour change techniques, with goal setting, self-monitoring of the behaviour and the importance of having autonomous motivation (e.g., self-determination) amongst key influences to PA maintenance (34, 198, 199). Indeed, the strategies highlighted, including goal setting and self-monitoring, appear to be integrated into popular online running tracking and prescription applications like Strava (www.strava.com/) and Couch to 5k (www.c25k.com/). Yet, whether these inclusions are effective is unclear as, to the author's knowledge, they have not been empirically evaluated. Given the thriving engagement with digital running technology (e.g., running applications, GPS enabled smartwatches) (82), researchers have a unique opportunity to develop accessible, evidence-based behaviour change interventions to support running maintenance.

Chapter 4 described the design and development of a 12-week online intervention, *Just Run,* aiming to develop motivational and psychological skills to promote long-term maintenance of running (200). *The Just Run* program was designed to support novice and returning recreational runners, developed in consultation with key stakeholders, and thoroughly tested by end consumers for usability. In addition to the successful approaches implied by previous PA interventions (34, 198, 199), the *Just Run* development process identified further behaviour change techniques informed by psychological theory and the health behaviour change literature. Further investigation is required to establish the feasibility and preliminary efficacy of *Just Run* prior to larger-scale testing and implementation in the community. Therefore, this study aimed to determine the feasibility of a 12-week online intervention (*Just Run*) comprised of evidence-based education and relevant behaviour change techniques versus basic

advice, to promote running maintenance. The effect of *Just Run* on motivation, basic psychological needs, self-efficacy, benefits/barriers and wellbeing was also explored.

Method

The following methods are described in line with CONSORT guidelines for reporting pilot and feasibility trials (summary in Appendix 5.1) and the TiDIER checklist (summary in Appendix 5.2). The trial was registered on the Australian New Zealand Clinical Trials Registry (ANZCTR 12622001064796). Ethical approval was granted by the University of South Australia Human Research Ethics Committee (protocol number 203978) and all participants provided informed consent prior to their involvement in the study (Appendix 5.3 and 5.4).

Trial design

A two-arm parallel group randomised controlled feasibility trial was conducted to achieve the study objectives. Notably, the full purpose of the study was not disclosed to participants: the study was promoted as a 'learn to run' program, rather than a motivational/psychological intervention. Participants were informed that they will receive either a condensed or extended version of the program, both delivered over 12 weeks. This approach was implemented to attempt to maintain blinding and reduce potential for resentful demoralisation in the control group (201). The *Just Run* study flow is presented in Figure 5.1.

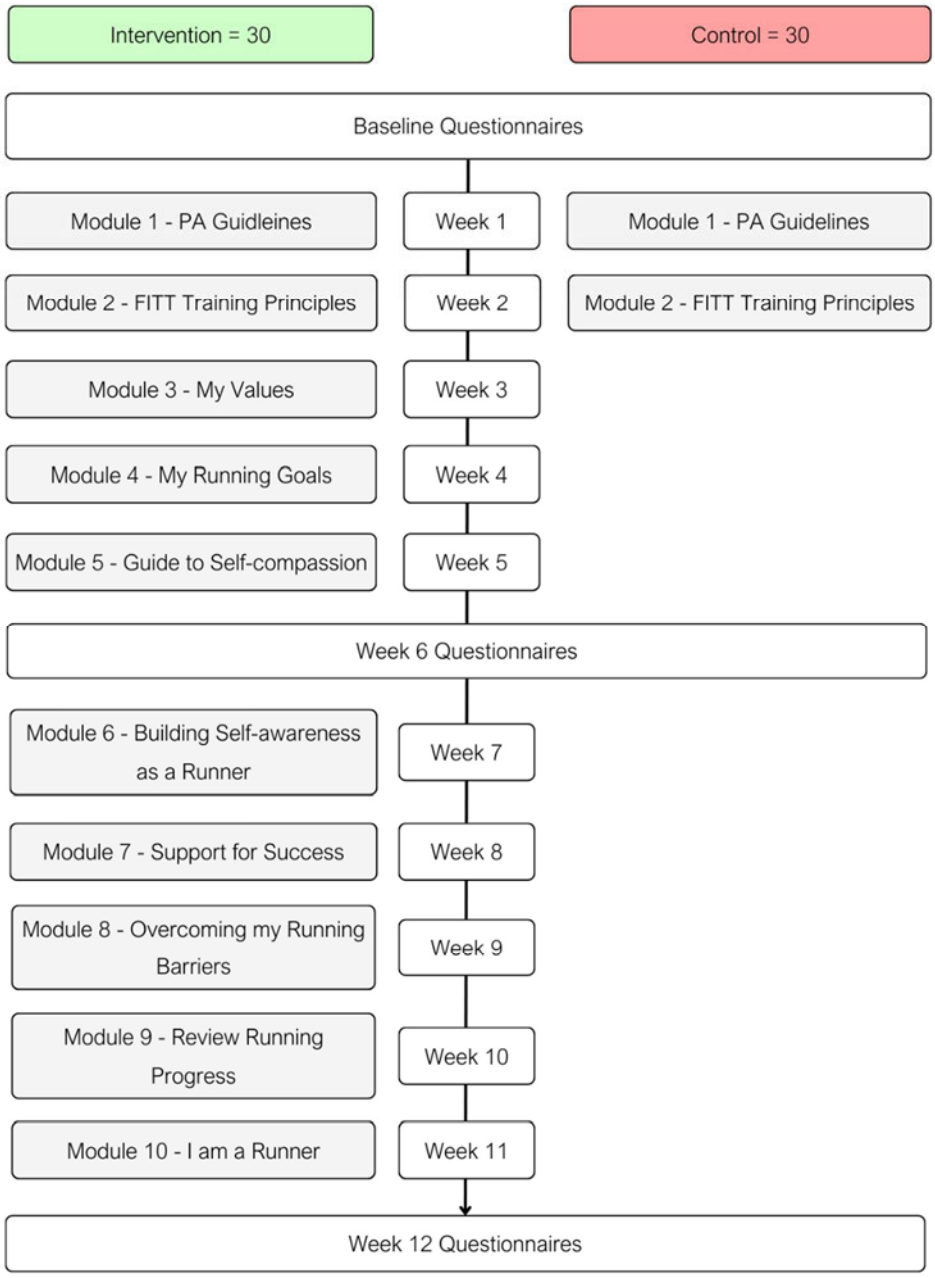


Figure 5.1 *Just Run* study flow with module labels.

Primary outcome: feasibility

This study was guided by Thabane and colleagues' framework to identify the feasibility outcomes (162). Feasibility outcomes included participant eligibility, recruitment rate intervention adherence (based on engagement with educational content), acceptability

of secondary outcomes, lost-to-follow-up and dropout. Participant recruitment rate (number enrolled per week and achievement of target sample size) and eligibility (proportion of those eligible versus total screened (%) was assessed by audit of study records after rolling recruitment was completed. Website analytics was used to assess intervention engagement and adherence, determined by the number and percentage of participants who viewed each video, and the number of downloads with additional educational content per module. Acceptability of secondary outcomes was assessed by the proportion of participants (%) who responded to secondary outcome questionnaires, assessed after the 6-and 12-week follow-up timepoints. Participants were considered lost-to-follow up based on non-completion of secondary outcomes (questionnaires) but did not formally withdraw from the study. Dropouts were defined as those who formally withdrew from the study. Participant experiences were also explored at the end of the study period to assess perceived benefits of, and recommendations to improve, the *Just Run* program. An optional 37-item exit feedback questionnaire was provided to intervention participants at the completion of their study involvement (Appendix 5.5). This questionnaire included a range of question types, including open-ended questions such as 'what information from the modules do you think will be the most helpful to improve your ability to maintain running going forward?', and 5-point Likert rating scales ('strongly disagree' to 'strongly agree') for items such as 'the education made me more confident to run' and 'the education taught me how to be self-compassionate as a runner' and were used to assess participants' experience of the quality, clarity, and benefit of the education.

Secondary outcomes: questionnaires and running activity

Participants responded to questionnaires related to the outcome measures at baseline, week 6 and week 12. Details of these secondary outcomes were used to assess the effect of the intervention on psychological factors relating to motivation and are described below.

Behavioural regulations in exercise

The Behavioural Regulations in Exercise Questionnaire, version 3 (BREQ-3) – a 24-item questionnaire – assesses the six regulations of motivation for exercise according to Self-determination Theory (SDT) (92). The questionnaire included four items per subscale for amotivation, external regulation, introjected regulation, identified regulation, integrated regulation and intrinsic motivation. As the measure was originally designed to assess general exercise motivation, for the purpose of the current study, the term 'exercise' was replaced with 'running' or 'run' where applicable. Participants were asked to respond to each item using a five-point Likert scale (0 = not true for me, to 4 = very true for me). BREQ-3 mean scores for each subscale were calculated. The use of the BREQ-3 has demonstrated good test-re-test reliability (ICC >0.78) (48), as well as good convergent (48, 94) and criterion validity (95).

Multidimensional self-efficacy in exercise

Self-efficacy for running was assessed using the 9-item Multidimensional Exercise Self-Efficacy Scale (MSES) (202). The MSES assesses task, coping and scheduling efficacy for exercise participation, which can quantify the level of confidence an individual has in completing a target behaviour under a range of circumstances (202). Participants were asked to rate "How confident are you that you can..." on a 0-10 Likert scale (0 = not at

all confident, to 10 = completely confident) for individual items such as "…run when you feel discomfort", "run when you lack energy", "include running in your daily routine", "arrange your schedule to include regular running". The term 'exercise(s)' was replaced with 'running' or 'run(s)' where applicable. Mean scores were calculated per self-efficacy domain, with higher scores demonstrating greater self-efficacy. The MSES has demonstrated good internal reliability (Cronbach α 0.76 – 0.95) and test-retest reliability (202).

Exercise benefits and barriers

Benefits and barriers to running was assessed using a modified Exercise Benefits/Barriers Scale (EBBS) (203). The original EBBS included 43 items, with 29 items assessing exercise benefits, and 14 items assessing barriers (203). However, recent examination into the reliability and validity of the measure proposed a revised, 26-item scale, assessing four domains of benefits (life enhancement, physical performance, psychological outlook and social interaction), and two domains of barriers (exercise milieu and time expenditure) towards exercise (204). The term 'exercise(s)' was replaced with 'running' or 'run(s)' where applicable. One item assessing exercise barriers was removed due to its inapplicability to a running context (item 21, 'Exercise facilities do not have convenient schedule for me'). Responses were reported using a four-point Likert scale, anchored by 1 (strongly agree) to 4 (strongly disagree). When assessing the items in the barrier subscale alone, scores were inversed scored. The combined benefits/barriers score consists of adding the total benefits and barriers scores together, where the barrier subscale is not inversed scored. The higher the score, the greater endorsement of that subscale (e.g., higher score for the barriers domain indicates greater perception of

barriers to the behaviour). For the combined score, the higher the total scale score, the more the individual understands the benefits of exercise. The revised EBBS demonstrated acceptable internal consistency (Cronbach α = 0.82), with adequate values for both benefits (α = 0.83) and barriers (α = 0.81) subscales (204).

Basic psychological needs in exercise

Basic psychological needs were measured using the 11-item Basic Psychological Needs in Exercise Scale (BPNES) (205). Meeting one's needs for autonomy, competence and relatedness can predict autonomous motivation, adaptive behaviours (e.g. running participation) and health (52). The BPNES assesses the three domains of autonomy, competence and relatedness satisfaction using a 5-point Likert scale (1 = *I don't agree at all* to 5 = *I completely agree*) for questions such as 'My relationships with the people I run with are very friendly' and 'I feel running is an activity which I do very well'. The term 'exercise(s)' was replaced with 'running' or 'run(s)' where applicable. Additional minor modifications to items were made to improve readability given the aforementioned word replacements. Mean scores for each domain were then calculated, where higher scores indicate greater fulfilment of that psychological need. BPNES has demonstrated good internal reliability (Cronbach α 0.79 – 0.89), adequate convergent and criterion validity (206) and excellent test-retest reliability (205).

Physical activity and health-related quality of life

The 12-Item Short-Form Health Survey, version 2 (SF-12v2) was used to assess mental and physical health status (207). The physical health-related domain included items assessing general health, physical functioning, role physical, and body pain. The mental health-related domain included questions related to vitality, social functioning, role

emotional and mental health. Two summary scores for physical and mental health domains were calculated using the weighted means of the eight domains. Higher scores represent better health status. The SF-12v2 has demonstrated good internal consistency (Cronbach α 0.72 – 0.89 (208)) and reliability in adult populations (r = 0.86 – 0.89 (207)).

Running activity

Running data were collected using Strava, an online tracking throughout the 12-week intervention period, with duration (mins), distance (kilometre), pace (min/km) and frequency (number of runs) for each participant recorded per week. Participants were also asked to self-report their running activity for the past 7 days at weeks 6 and 12 and indicate whether their device was used to record every run during that week. This procedure was followed to verify recorded runs were appropriately captured and logged on Strava.

Participants were prompted to complete an injury report whenever they experienced an injury during the study period. Questions were adapted from the weekly Garmin-RUNSAFE Running Health Study Questionnaires (80), e.g., 'During your time in the study, have you had a musculoskeletal injury or have you experienced a problem to muscles, tendons or bones that is fully or partly caused by running?', followed by questions relating to whether this injury is new or existing, the anatomical location affected, and how long this injury has impacted their ability to run. The number of injuries recorded per group and percentage of participants impacted was recorded for each injury location.

Participants

For rolling recruitment, social media advertisements and contact with running groups across Australia (e.g., local parkrun social media pages, Running Mums Australia, Riot

Runners, and Trail Running South Australia) were used. Paid Facebook advertising through the University of South Australia media channel (total spend $250.00) was used to target the intended population online across Australian capital cities, excluding Adelaide. Potential participants registered their interest by completing an initial screening questionnaire hosted by REDCap (Appendix 5.4). Potentially eligible participants were then followed up via telephone with the primary researcher to confirm they met the inclusion criteria, were interested in participating, and to then obtain verbal informed consent. Inclusion criteria were (1) aged between 18 and 64 years of age, (2) previously ran as a form of regular physical activity, or interested in starting to run, or currently running but with less than 3 months of running experience, (3) owned a Global Positioning System (GPS) enabled smartphone and/or a smartwatch capable of tracking basic running metrics, (4) willing to use a running activity application (Strava) to upload running activity and allow the primary researcher to follow their profile to track running activity, (5) not currently injured or undergoing rehabilitation for an injury which may make it difficult to run, (6) answered 'No' to all Stage 1 questions within the Exercise and Sport Science Australia Adult Pre-Exercise Screening System (209), indicating no known diseases or symptoms of disease which may heighten the risk of an adverse event due to running, or receive appropriate medical clearance from a relevant practitioner, and (7) had regular internet access for the course of the study. Participants were not eligible if they (1) had a medical condition or injury that restricted them from running, (2) had a running coach, or (3) were currently following a guided running training program (e.g., Couch to 5 km).

Randomisation

An online randomisation tool (Sealed Envelope (Ltd.)) was used to randomise participants to either the control or intervention group (allocation ratio 1:1). Random permuted blocks, with several block sizes (4, 6 and 8), were used to ensure groups were balanced periodically.

Intervention summary

The intervention was delivered via external Moodle (e-Moodle) sites hosted by the University of South Australia. After providing informed consent and undergoing randomisation, participants were contacted via email to complete baseline questionnaires via REDCap online survey software (210). Participants were also enrolled into the e-Moodle system by the researcher, and sent their confidential login details to access either the site containing the *Just Run* intervention or the basic education (control) site to ensure blinding of conditions between groups. Both intervention and control groups received the same first two modules delivered in weeks 1 and 2, introducing participants to physical activity guidelines and basic strength training recommendations. Short summary videos were also delivered to both groups in weeks 6 and 12 to prompt participants to complete questionnaires at these timepoints. Both groups could access the site throughout the duration of the study. Following the first two weeks, those allocated to the intervention group received new modules made visible weekly. The final intervention included 10 modules delivered over 12 weeks. These modules addressed topics known to influence exercise participation and motivation, targeting various aspects of motivation, psychological needs and self-efficacy to promote running maintenance (for intervention and *Just Run* site details, see Blacket et al. 2024 (200)). A video overview of the

intervention condition can be accessed here, whilst an overview of the control condition can be accessed here or via email request to the author. Those allocated to the control group received the first two modules in weeks 1 and 2. For the following ten weeks, participants in the control group could access the site but no new education was provided. Participants were informed that those who complete the study will go into the draw to win a $500, $250 or $100 electronic gift card as an honorarium.

Measuring running activity

Participants from both groups were required to track their running activity throughout the 12 weeks using a smartphone or smartwatch, allowing duration (mins), distance (kilometre), pace (min/km) and frequency (number of runs) to be recorded. All running activity was required to be uploaded onto Strava (Strava 2009, Strava Inc.), an online running tracking application, and sent to the primary researcher at the cessation of the intervention period. Research has indicated that most GPS sport watches and mobile devices are a valid and feasible method to measure running distance and training load (211-213).

Sample size

As a feasibility study, it is recommended to have a minimum of twelve participants per group (214). However, we aimed to recruit sixty participants (thirty per group) to conform to more recent recommendations for estimating pilot randomised controlled trial (RCT) sample size (215) and establishing feasibility (216). This would also allow for extra precision in estimating effect sizes for secondary outcomes. Recruitment was estimated to take nine months, equating to recruiting an average of 1.8 people per week.

Data analysis

Primary outcome: feasibility

Descriptive statistics (frequencies, proportions, means and standard deviations [SD] as appropriate) were used to examine the outcomes related to study feasibility.

Secondary outcomes: questionnaires and running activity

All data were analysed using SPSS Statistics (version 28.0). Data were initially screened for missing values. When participants failed to respond to items for an entire variable or subscale, or isolated items within a subscale, data were not replaced, and the participant was excluded for analysis (i.e., on that variable). Due to rates of participants lost to follow, the original plan for an intention-to-treat analysis was changed to per-protocol to allow for preliminary assessment of the effect of the intervention on the secondary outcomes, whilst reporting of feasibility outcomes remained unchanged. Between-group differences in change scores from baseline to week 6 and week 12 were assessed with standardised mean difference (Cohen's *d*) effect sizes, expressed with 95% confidence intervals. Standardised mean differences were calculated by dividing the mean difference by the pooled standard deviation (SD). The mean difference was calculated as the mean pre-post change in the intervention group, minus the mean pre-post change in the control group. The threshold for a small change was considered to be 0.20 – 0.49, medium change as 0.50 – 0.79, and large change as > 0.79 (217).

Differences in mean (SD) training characteristics, including running duration (mins), distance (kilometre), pace (min/km) and frequency (number of runs) were assessed between groups. Injuries reported across both groups were also explored according to the number of reports per location of injury (n [%]).

Results

Participant eligibility

Advertising on social media directed people to the initial online screening questionnaire occurred for two weeks from 4 July - 17 July 2022. A total of 464 people completed the initial screening questionnaire between 29 June and 24 July 2022. Of these respondents, 85.6% met the inclusion criteria. From this screening process, the main reason for exclusion was due to respondents indicating they had been running for more than three months (n = 37, 7.8%). Of those who met the initial inclusion criteria, a further 105 people were called but could not be contacted to confirm eligibility, equivalent to 22% of those who completed the screening questionnaire. Lastly, 223 people (48.1%) met the inclusion criteria, but were not contacted to confirm eligibility due to the targeted sample size already being achieved. Potential participants were contacted consecutively based on their original expression of interest time and date. Exclusion with reasons is listed within Figure 5.2.

Recruitment rate

A total of 60 people who met the inclusion criteria on the initial screening were contacted to confirm eligibility and gain consent before being enrolled into the study. In total, 165 calls across twenty days (8.25 calls/day) between 5 July and 23 August 2022 were made to eligible participants, resulting in higher than anticipated recruitment (3 participants recruited per day). Recruitment was completed once the final participant had completed their baseline questionnaire (4 September 2022).

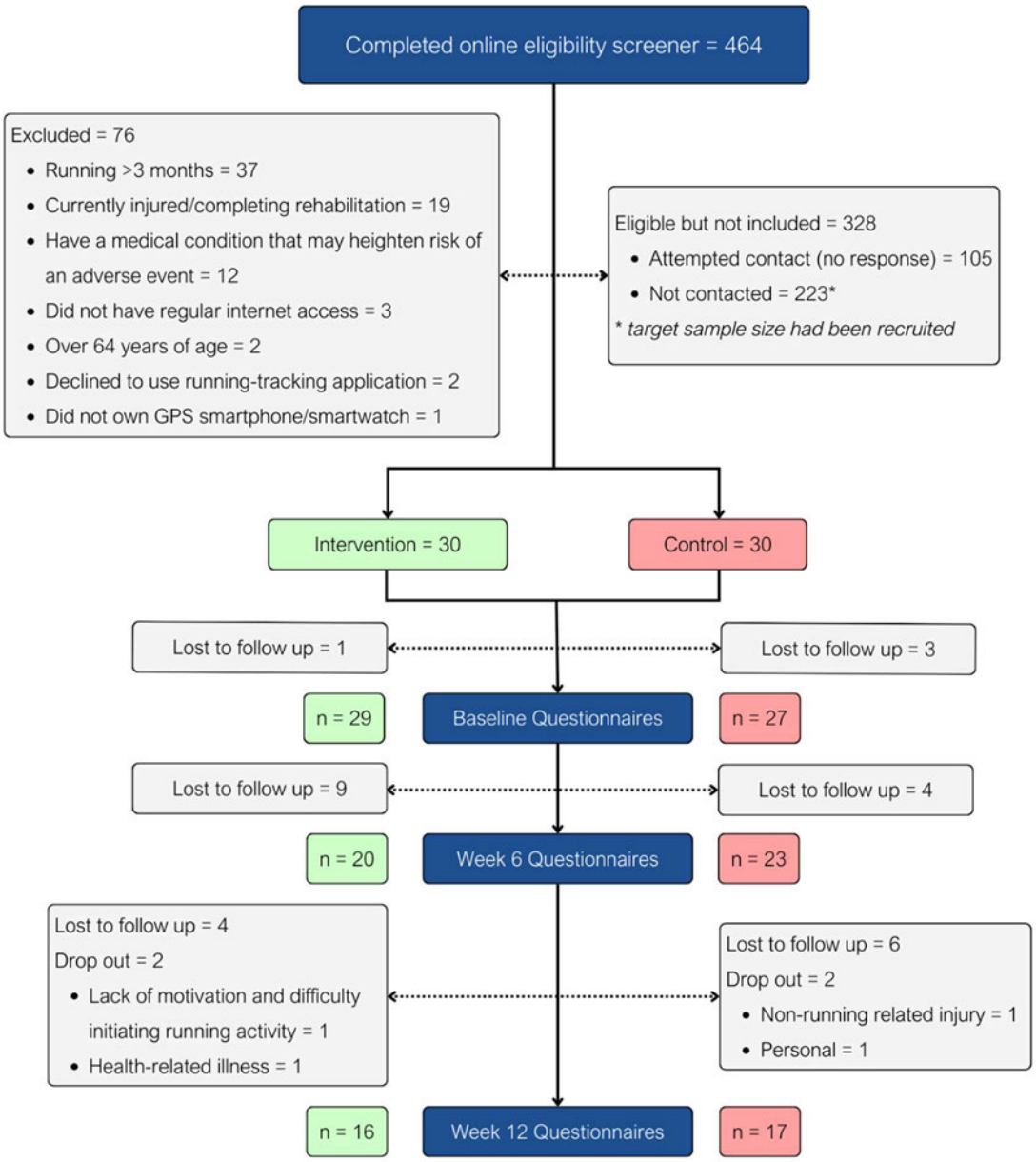


Figure 5.2 Participant flow diagram.

Baseline characteristics

Baseline characteristics are shown in Table 5.1. Characteristics were similar between groups, with both groups including participants with similar distribution of running experience their baseline questionnaire (4 September 2022).

Table 5.1 Participant characteristics.

Baseline characteristics		Control*	Intervention^
Mean age [years] (SD)		42.5 (11.3)	41.2 (8.9)
Female n (%)		23 (76.7)	21 (70.0)
Male n (%)		7 (23.3)	9 (30.0)
Running experience n (%)	< 3 months	5 (16.7)	5 (16.7)
	Previous[a]	18 (60.0)	18 (60.0)
	No experience	7 (23.3)	7 (23.3)

*n = 27. ^ n = 29. [a] previously ran as a form of physical activity, but no longer participated at time of recruitment.

Primary outcome: feasibility

Data were collected between 29 June 2022 and 2 February 2023. Recruitment occurred between 29 June and 4 September 2022.

Intervention adherence

Analysis of the engagement with the education, based on viewership, revealed varying degrees of participation across the modules (Table 5.2 and Figure 5.3). Engagement with the educational videos ranged from 10.7% to 71.4%, whilst engagement with the optional videos was much lower (7.1%) over the intervention period. Module 2, “FITT Training Principles”, demonstrated the highest viewership (71.4%). This was followed by module 1 (“Physical Activity Guidelines”), modules 4 and 5 (“My Running Goals: Goal Network” and “Guide to Self-compassion”). Conversely, some modules, such as module 9 ("Review Running Progress") and module 7 (“Support for Success: Social Support”) had much less viewership. When considering participation from the control group with the basic training education (modules 1 and 2, “Physical Activity Guidelines” and “FITT Training Principles”), less than half (44.4% and 14.3% respectively) viewed the videos (Table 5.3).

Table 5.2 Number of views and percentage (%) of intervention group who viewed videos.

Module	Video	Views (n [%])*
1	Physical Activity Guidelines	13 (46.4)
2	FITT Training Principles	20 (71.4)
3	My Values	7 (25.0)
4	My Running Goals: Action Planning	7 (25.0)
	My Running Goals: Goal Network	8 (28.6)
5	Guide to Self-Compassion	8 (28.6)
6	Monitoring my Running	5 (17.9)
7	Support for Success: Healthy Habits	4 (14.3)
	Support for Success: Social Support	3 (10.7)
8	Overcoming my Running Barriers	5 (17.9)
	(Optional) Family	2 (7.1)
	(Optional) Sickness and injury	2 (7.1)
	(Optional) Tiredness	2 (7.1)
	(Optional) Weather	2 (7.1)
	(Optional) Work	2 (7.1)
9	Review Running Progress	3 (10.7)
10	I am a Runner	4 (14.3)

FITT frequency, intensity, time and type. *Views by distinct IP address (n), with % based on n = 28 (n = 2 drop out)

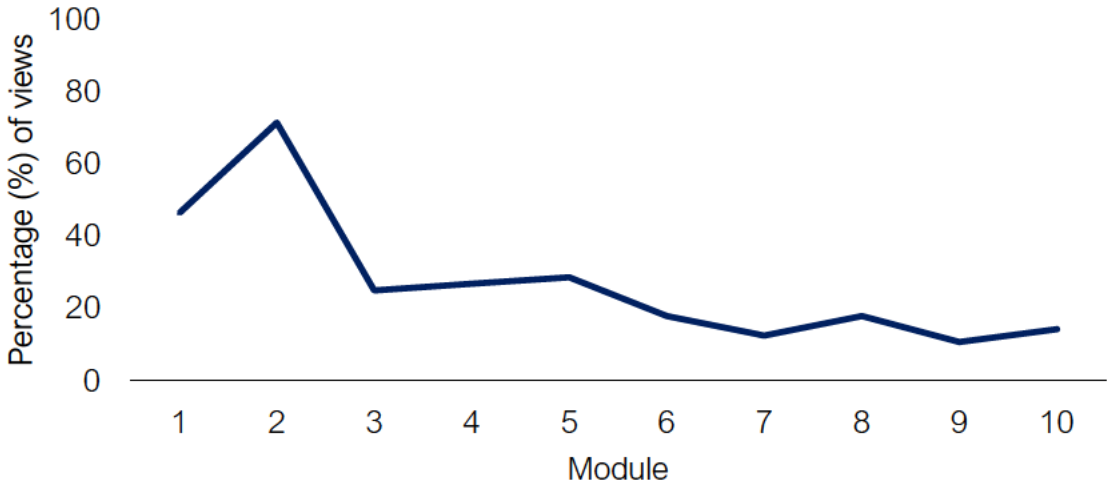


Figure 5.3 Percentage of video views across modules.

In addition to video content, varying levels of engagement were seen with the optional educational material/resources across modules (Table 5.3). The highest engagement in these optional materials was observed for modules 1 ("Physical Activity Guidelines") and 2 ("FITT Training Principles"). Across all modules, the low number of downloads suggests that most participants exclusively viewed the video content, rather than the optional educational material. Notably, participants showed a decline in engagement towards the end of the intervention period, particularly seen in module 9 ("Review Running Progress").

Acceptability of secondary outcomes

The acceptability of secondary outcomes was reflected in participant completion rates of the questionnaires (Table 5.4). At baseline, three participants in the control group and one from the intervention group did not complete the questionnaires, and thus were considered lost to follow up. Across both control and intervention groups, a substantial proportion of participants completed the questionnaires in week 6 (66.7% and 76.7% for the intervention and control group respectively). A total of 33 participants were lost to follow up across both groups between baseline and week 12.

Table 5.3 Number of downloads of additional educational items (mean per item).

Module	Content (number of items)	n of downloads (mean per item)
1	Physical Activity Guidelines (5)	83.0 (16.6)
2	FITT Training Principles (3)	40.0 (13.3)
3	My Values (4)	34.0 (8.5)
4	My Running Goals (9)	60.0 (6.7)
5	Guide to Self-Compassion (6)	18.0 (3.0)
6	Monitoring my Running (5)	15.0 (3.0)
7	Support for Success (19)	16.0 (2.7)
8	Overcoming my Running Barriers (9)	18.0 (2.0)

Module	Content (number of items)	n of downloads (mean per item)
9	Review Running Progress (3)	0.0 (0.0)
10	I am a Runner (2)	5.0 (2.5)

FITT frequency, intensity, time and type.

Table 5.4 Number of participants who completed secondary outcome questionnaires (n [%]).

Questionnaire	Group	Baseline	Week 6	Week 12*
BREQ-3	Con	27 (90.0)	23 (76.7)	17 (60.7)
	Int	29 (96.7)	20 (66.7)	16 (57.1)
BPNES	Con	27 (90.0)	23 (76.7)	17 (60.7)
	Int	29 (96.7)	20 (66.7)	16 (57.1)
EBBS	Con	27 (90.0)	23 (76.7)	17 (60.7)
	Int	29 (96.7)	20 (66.7)	16 (57.1)
MSES	Con	27 (90.0)	23 (76.7)	17 (60.7)
	Int	29 (96.7)	20 (66.7)	16 (57.1)
SF-12	Con	27 (90.0)	23 (76.7)	17 (60.7)
	Int	29 (96.7)	20 (66.7)	16 (57.1)

* % at week 12 calculated based on n = 28 per group (between control n = 2 drop out, intervention n = 2 drop out between week 6 and 12). BREQ-3, *Behavioural regulations in Exercise Questionnaire, version 3;* BPNES, *Basic psychological needs in exercise scale;* EBBS, *Exercise benefits/barriers scales;* MSES, *Multidimensional self-efficacy scale*; Con, *control;* Int, *intervention.*

Drop out

No participants dropped out between baseline to week 6. Between weeks 6 and 12, participants from both the control (n = 2) and intervention (n = 2) groups withdrew from the study. The reasons for withdrawal included non-running related injury (n = 1), personal reasons (n = 1), lack of motivation and difficulty initiating running activity (n = 1), and

health-related illness (n = 1). Of those who withdrew, all but one had indicated previous running experience, with one having no running experience at baseline.

Participant experience

Access to the site was usually via laptops/desktops (40.0%), 20.0% through mobile devices, and 40.0% accessing the content from both devices. Most participants (80.0%) did not encounter technical difficulties, whilst 20.0% indicated some difficulty watching videos on their mobile device. Participant feedback (exit feedback) indicated an overall positive experience. Module 4, "My Running Goals", was reported to be the most beneficial module by 42.9% of participants. Notably, all participants from the intervention group who completed and engaged with the content indicated that no module should be removed, suggesting the entire program was well-received. Opinions on the study duration were divided, with over half (61.6%) agreeing or strongly agreeing that 12 weeks was an appropriate length of time, while 30.8% were unsure and 7.7% indicating a 'neutral' response. Over half (53.8%) of participants regarded videos to be of high quality, while 61.6% of participants agreed or strongly agreed that there was a clear link between videos and resources. Confidence and goal achievement were reported positively, however, opinions on the overall appropriateness were evenly split, with 46.2% stating it was 'just right', while 46.2% being unsure. Participants indicated a varied engagement pattern, reporting they accessed the education monthly (38.5%), daily (30.8%), or fortnightly (30.8%). Exit feedback responses are included in Appendix 5.5.

Secondary outcomes: questionnaires and running activity

Analysis of secondary outcomes revealed several large between-group differences. Specifically, in the amotivation construct of the BREQ-3 at week 6, a decrease in

amotivation scores for the intervention group was observed, coinciding with an increase for the control group (*d* = -0.81 [-1.52, -0.09]) (Table 5.5). The MSES also revealed a large between-group difference in the scheduling self-efficacy subscale at week 12 (*d* = -0.89 [-1.60, -0.16]), driven by an increase in scores in the control group, and a decrease in the intervention group (Table 5.6). The EBBS showed a large between group difference in both the barriers construct at week 6 (*d* = 0.85 [0.13, 1.56]) and the combined benefits/barriers score at week 6 (*d* = -0.90 [-1.61, -0.18]) (Table 5.7).

Whilst not statistically significant, some additional between-group differences were observed. Notably, these were seen in the week 6 introjected construct of the BREQ-3 (*d* = 0.61 [-0.09, 1.31]), and week 12 external (*d* = -0.59 [-1.28, 0.11]), and integrated constructs (*d* = 0.57 [-0.13, 1.27]). The EBBS benefits construct also revealed a moderate between-group difference at week 6 (*d* = -0.55 [-1.24, 0.15]). Small between-group differences were also seen across a number of domains across all secondary outcome questionnaires, but with large confidence intervals that call for caution when interpreting. These were observed in the BPNES constructs of autonomy (*d* = 0.40 [-0.30, 1.08]) and competence (*d* = 0.41 [-0.28, 1.10]) at week 12 (Table 5.8), and both the physical (*d* = -0.27 [-0.99, 0.45]) and mental component (d = 0.42 [-0.30, 1.15]) of the SF-12v2 at week 12 (Table 5.9).

Running participation varied between groups, and throughout the study period (Table 5.10 and Figure 5.4). More than half of participants logged at least one run a week for three of the twelve weeks in the control group. Conversely, there was only one week where half of participants recorded a run in the intervention group (week 4). The percentage of the intervention group who ran each week varied between 28.6 to 50.0%,

whereas the control group showed greater variability in their running frequency from 14.3 to 53.6%, with a notable decline in frequency in the final four weeks (from 0.85 runs/week in week 9 to 0.31 runs/week in week 12) (Figure 5.5). On average, both groups recorded a similar average duration per run (25 mins 34 sec, and 26 mins 0 seconds for control and intervention participants, respectively) (Figure 5.6). The average distance recorded per run was also similar in control (2.98 km) and intervention participants (2.95 km) (Figure 5.7). Only 1 intervention participant experienced a running-related injury (foot-related) during the study, whilst 4 control participants experienced an injury (Appendix 5.6). However, of these, 2 did not attribute their injuries to running activity (ankle-related and knee-related injuries), whilst 2 reported the injury was caused in-part due to running (foot-related and hip-related injuries).

Table 5.5 BREQ-3 (mean [SD]) scores for control and intervention group at baseline, week 6 and week 12 with mean change from baseline and effect sizes. [a]

BREQ-3 construct[a]	Group^	Baseline	Week 6			Week 12		
		Mean (SD)	Mean (SD)	Δ from baseline (mean [SD])	Between group difference ES (Cohens *d* [95% CI])	Mean (SD)	Δ from baseline (mean [SD])	Between group difference ES (Cohens *d* [95% CI])
Amotivation	Con	0.82 (0.72)	0.90 (0.73)	0.08 (0.44)	-0.81 (-1.52, -0.09)*	0.83 (0.62)	0.01 (0.52)	-0.44 (-1.12, 0.26)
	Int	1.08 (0.81)	0.84 (0.62)	-0.23 (0.32)		0.83 (0.49)	-0.25 (0.68)	
External	Con	1.18 (0.73)	1.04 (0.70)	-0.13 (0.69)	-0.49 (-1.18, 0.20)	1.21 (1.06)	0.03 (1.03)	-0.59 (-1.28, 0.11)
	Int	1.13 (0.34)	0.72 (0.45)	-0.40 (0.34)		0.72 (0.47)	-0.41 (0.18)	
Introjected	Con	2.59 (1.23)	2.37 (1.18)	-0.22 (0.85)	0.61 (-0.09, 1.31)	2.50 (1.23)	-0.09 (0.74)	0.14 (-0.54, 0.83)
	Int	2.19 (1.05)	2.48 (0.72)	0.30 (0.84)		2.20 (0.84)	0.02 (0.69)	
Identified	Con	2.59 (0.94)	3.03 (0.81)	0.44 (0.72)	-0.07 (-0.76, 0.61)	2.79 (0.86)	0.21 (0.88)	0.24 (-0.45, 0.92)
	Int	2.88 (0.72)	3.27 (0.86)	0.39 (0.65)		3.30 (1.13)	0.43 (0.99)	
Integrated	Con	1.59 (0.75)	2.07 (0.98)	0.49 (0.48)	-0.03 (-0.71, 0.65)	1.88 (0.92)	0.29 (0.37)	0.57 (-0.13, 1.27)
	Int	2.20 (1.12)	2.67 (1.13)	0.47 (0.56)		2.83 (1.13)	0.63 (0.74)	
Intrinsic	Con	2.22 (1.06)	2.68 (0.98)	0.46 (0.64)	0.14 (-0.54, 0.82)	2.62 (1.01)	0.40 (0.68)	0.45 (-0.25, 1.14)
	Int	2.56 (1.17)	3.11 (1.09)	0.55 (0.65)		3.27 (1.08)	0.70 (0.68)	

^ control n = 17, intervention n = 16. * 95% confidence interval does not overlap with zero. ES effect size. BREQ-3, behavioural regulation in exercise questionnaire, version 3. [a] Note: lower scores indicate lower endorsement of that regulation, and vice versa. For example, lower scores in more controlled forms of regulation (amotivation, external and introjected regulation), with higher scores in autonomous forms of regulation (identified, integrated and intrinsic regulation) generally indicate greater overall autonomous motivation.

Table 5.6 MSES scores for control and intervention group at baseline, week 6 and week 12 with mean change from baseline and effect sizes. [a]

MSES domain	Group^	Baseline	Week 6^			Week 12		
		Mean (SD)	Mean (SD)	Δ from baseline (mean [SD])	Between group difference ES (Cohens d [95% CI])	Mean (SD)	Δ from baseline (mean [SD])	Between group difference ES (Cohens d [95% CI])
Task	Con	15.35 (6.55)	17.76 (6.13)	2.41 (5.04)	-0.31 (-1.00, 0.38)	15.41 (5.28)	0.06 (5.83)	0.18 (-0.51, 0.86)
	Int	19.38 (3.69)	20.38 (3.20)	1.00 (3.83)		20.31 (3.38)	0.94 (3.87)	
Coping	Con	9.06 (4.62)	10.00 (5.04)	0.94 (5.70)	0.19 (-0.50, 0.87)	11.06 (6.19)	2.00 (7.51)	0.22 (-0.46, 0.91)
	Int	12.75 (5.76)	15.00 (7.44)	2.25 (8.28)		16.44 (6.10)	3.69 (7.64)	
Scheduling	Con	13.35 (4.45)	12.82 (6.82)	-0.53 (8.82)	-0.16 (-0.84, 0.53)	18.06 (4.52)	4.71 (5.96)	-0.89 (-1.60, -0.16)*
	Int	17.38 (4.82)	15.56 (6.39)	-1.81 (7.05)		16.31 (6.74)	-1.06 (7.03)	

^ control n = 17, intervention n = 16. MSES, multidimensional self-efficacy in exercise scale. * 95% confidence interval does not overlap with zero. ES effect size. [a] Note: higher scores indicate greater self-efficacy in that domain.

Table 5.7 Exercise benefits/barriers scale for control and intervention group at baseline, week 6 and week 12 with mean change from baseline and effect sizes. [a]

EBBS	Group^	Baseline	Week 6^			Week 12		
		Mean (SD)	Mean (SD)	Δ from baseline (mean [SD])	Between group difference ES (Cohens d [95% CI])	Mean (SD)	Δ from baseline (mean [SD])	Between group difference ES (Cohens d [95% CI])
Benefits	Con	36.65 (8.72)	36.47 (8.98)	-0.18 (6.33)	-0.55 (-1.24, 0.15)	34.94 (8.57)	-1.71 (6.51)	-0.28 (-0.97, 0.41)
	Int	36.25 (7.88)	32.75 (7.62)	-3.50 (5.74)		32.50 (7.27)	-3.75 (7.96)	
Barriers	Con	10.59 (3.41)	8.94 (2.84)	-1.94 (2.84)	0.85 (0.13, 1.56)*	9.53 (2.55)	-1.06 (3.54)	-0.23 (-0.91, 0.46)
	Int	10.25 (2.91)	10.88 (2.78)	0.62 (3.20)		9.94 (3.17)	-0.31 (2.89)	
Benefits/barriers	Con	55.76 (8.61)	57.53 (9.04)	1.76 (6.81)	-0.90 (-1.61, -0.18)*	55.12 (9.05)	-0.65 (6.82)	-0.38 (-1.07, 0.31)
	Int	56.00 (7.48)	51.88 (8.23)	-4.12 (6.25)		52.56 (5.97)	-3.44 (7.81)	

^ control n = 17, intervention n = 16. EBBS, exercise benefits/barriers scale. * 95% confidence interval does not overlap with zero. [a] Note: The higher the score, the greater endorsement of that subscale (e.g., higher scores for the barriers domain indicates greater perception of barriers to the behaviour). For the combined benefits/barriers subscale, the higher the total scale score, the more the individual understands and perceives the benefits of exercise.

Table 5.8 BPNES (autonomy, competence, relatedness) for control and intervention group at baseline, week 6 and week 12 with mean change and effect sizes. [a]

BPNES domain	Group^	Baseline	Week 6			Week 12		
		Mean (SD)	Mean (SD)	Δ from baseline (mean [SD])	Between group difference ES (Cohens d [95% CI])	Mean (SD)	Δ from baseline (mean [SD])	Between group difference ES (Cohens d [95% CI])
Autonomy	Con	8.18 (6.25)	8.65 (4.12)	0.47 (5.66)	0.05 (-0.63, 0.74)	8.94 (4.63)	0.76 (4.83)	0.40 (-0.30, 1.08)
	Int	7.50 (2.58)	8.25 (3.30)	0.75 (4.54)		10.06 (3.30)	2.56 (4.19)	
Competence	Con	6.00 (5.04)	6.35 (3.66)	0.35 (6.27)	0.15 (-0.53, 0.84)	5.94 (5.51)	-0.06 (5.97)	0.41 (-0.28, 1.10)
	Int	5.88 (3.30)	7.06 (3.07)	1.19 (4.39)		8.00 (4.20)	2.13 (4.57	
Relatedness	Con	12.59 (4.27)	13.76 (2.56)	1.18 (4.20)	0.17 (-0.52, 0.85)	13.76 (2.28)	1.75 (3.64)	0.14 (-0.54, 0.82)
	Int	10.19 (4.85)	12.06 (2.95)	1.88 (4.16)		11.94 (2.59)	1.75 (3.64)	

^ control n = 17, intervention n = 16. BPNES, basic psychological needs in exercise scale. [a] Note: higher scores indicate greater fulfilment of that psychological need.

Table 5.9 SF-12v2 for control and intervention group at baseline, week 6 and week 12 with mean change from baseline effect sizes.[a]

Component	Group^	Baseline	Week 6^			Week 12		
		Mean (SD)	Mean (SD)	Δ from baseline (mean [SD])	Between group difference ES (Cohen's *d* [95% CI])	Mean (SD)	Δ from baseline (mean [SD])	Between group difference ES (Cohen's *d* [95% CI])
Physical component	Con	32.95 (4.16)	32.03 (5.92)	-0.93 (5.13)	-0.15 (-0.86, 0.57)	33.12 (4.76)	0.17 (3.97)	-0.27 (-0.99, 0.45)
	Int	33.66 (4.64)	31.98 (6.33)	-1.68 (5.20)		32.60 (4.66)	-1.06 (5.14)	
Mental component	Con	28.15 (11.36)	31.44 (12.37)	3.30 (8.22)	-0.13 (-0.85, 0.59)	25.03 (5.68)	-3.12 (10.91)	0.42 (-0.30, 1.15)
	Int	29.22 (10.13)	31.38 (10.35)	2.17 (9.19)		30.77 (8.32)	1.55 (11.07)	

^ Control n = 16, Intervention n = 14. [a] Note: higher scores represent better health status in that domain.

Table 5.10 Participants who ran during the intervention (n [%]).

Week	Control [a]	Intervention [b]
1	13 (46.4)	8 (28.6)
2	14 (50.0)	11 (39.3)
3	13 (46.4)	9 (32.1)
4	10 (35.7)	9 (32.1)
5	10 (35.7)	14 (50.0)
6	14 (50.0)	13 (46.4)
7	12 (42.9)	12 (42.9)
8	15 (53.6)	10 (35.7)
9	11 (39.3)	9 (32.1)
10	10 (35.7)	11 (39.3)
11	7 (25.0)	11 (39.3)
12	4 (14.3)	9 (32.1)

[a] n = 28 (n = 2 drop out), [b] n = 28 (n = 2 drop out)

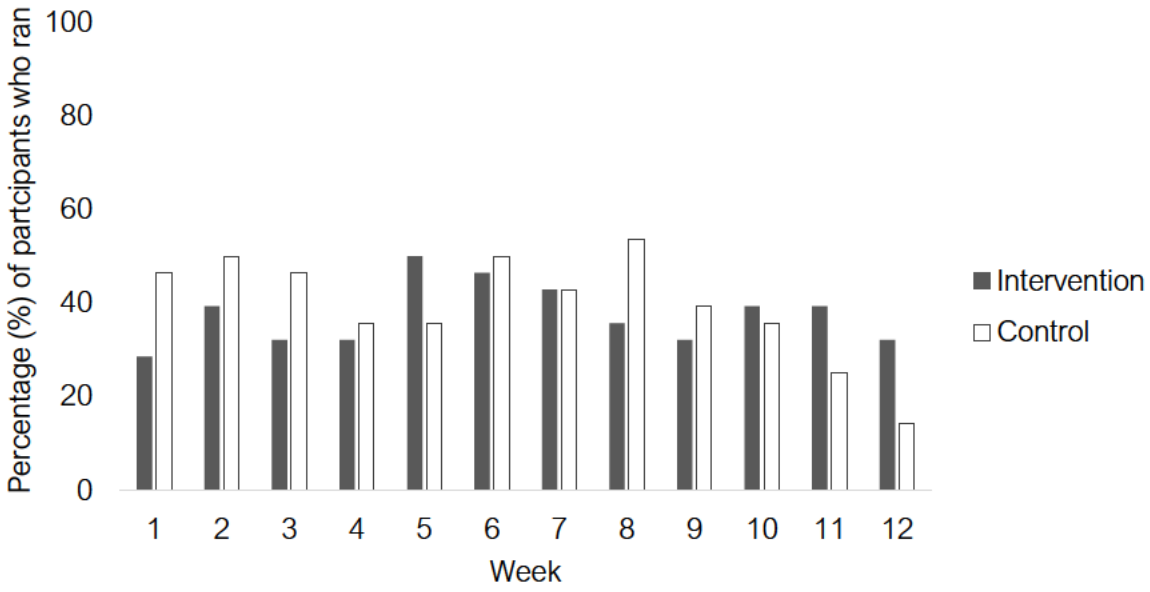


Figure 5.4 Percentage of participants who recorded running activity each week throughout the intervention period.

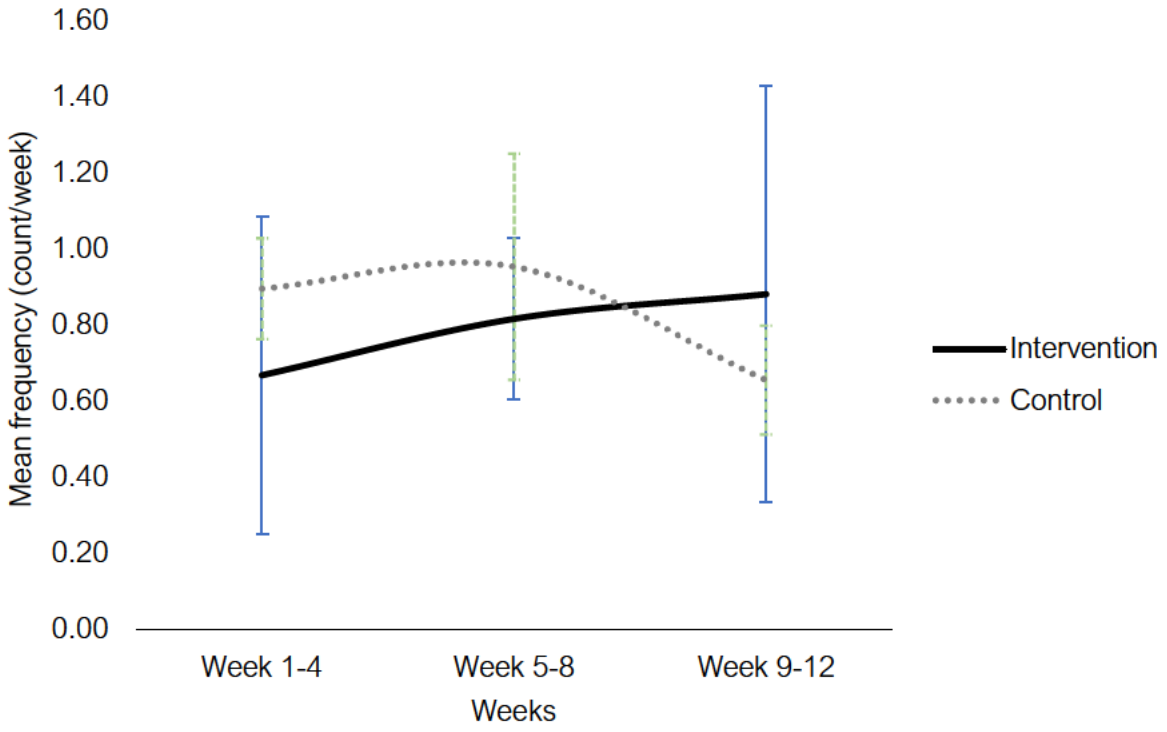


Figure 5.5 Mean running frequency (count/week).

Note: standard deviation (SD) for intervention shown as blue line. SD for control shown in green dotted line.

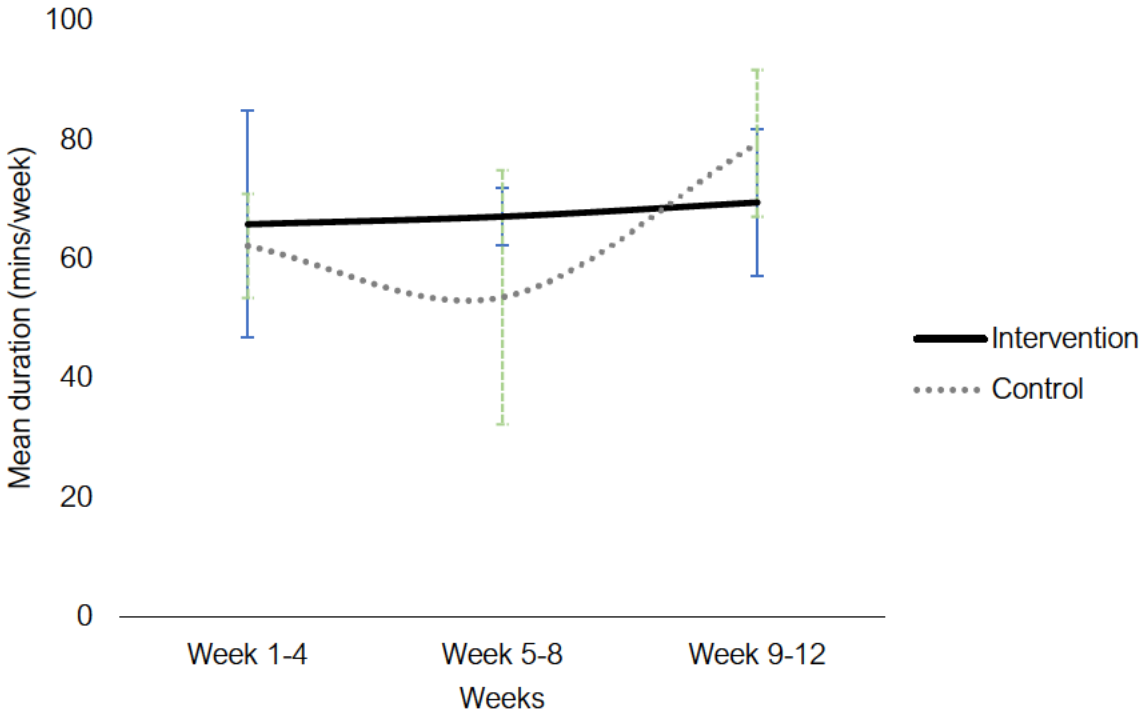


Figure 5.6 Mean running duration (mins/week).

Note: standard deviation (SD) for intervention shown as blue line. SD for control shown in green dotted line.

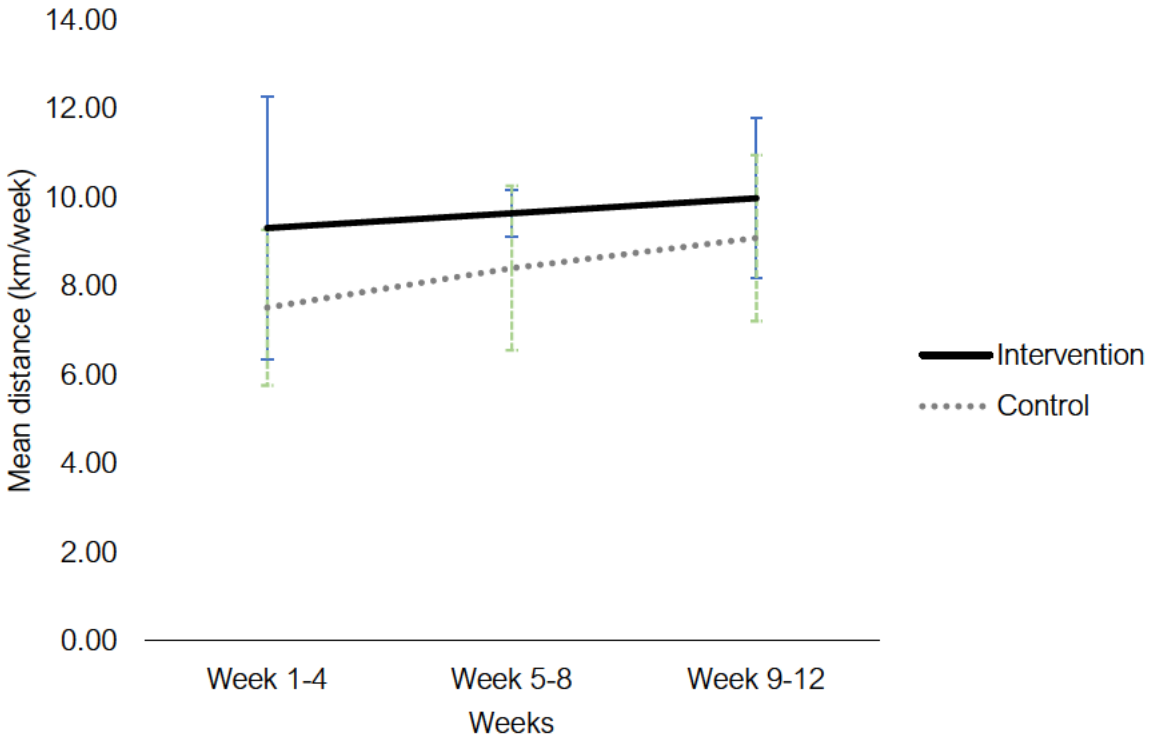


Figure 5.7 Mean running distance (km/week).

Note: standard deviation (SD) for intervention shown as blue line. SD for control shown in green dotted line.

Discussion

Summary of main findings

This study reports on the feasibility of an online running education program (*Just Run*). This study is the first, to the author's knowledge, to assess the feasibility of an online, motivational intervention targeted towards new and novice runners – a group prone to high rates of discontinuation. Recruitment targets were successfully met within two months, with a high proportion of interested participants eligible to participate. Despite relatively low completion rates of outcome measures and low-to-moderate engagement with the educational material, participants reported high levels of satisfaction with the program. Secondary outcomes revealed large between-group differences in a number of variables across timepoints, namely in amotivation, scheduling self-efficacy, barriers, and

benefits/barriers combined. Several other small and moderate between-group differences were observed in variables across outcome measures but warrant caution when interpreting their effect sizes due to wide confidence intervals. Running participation was low across groups, averaging less than one run per week. Overwhelming expressions of interest during recruitment suggests the usefulness and appeal of *Just Run*. Poor engagement and relatively low numbers of intervention completion suggests modifications to intervention design and delivery may be required to improve engagement.

Primary outcome: feasibility

Recruitment

The time required to recruit the target sample size took less time than originally anticipated. We expected to recruit an average of 1.8 people per week, taking approximately 9 months. However, it took only 49 days to recruit the target sample (3.0 participants recruited per day), indicating our original estimation may have been conservative. Additionally, the overwhelming response underscores the appropriateness of recruitment methods and the high demand for interventions to assist with behaviour change to facilitate engagement in running. Our actual recruitment phase is similar to that of an app-based feasibility study to promote walking/running behaviour, whereby enrolment of 23 participants into their study (from which 122 individuals indicated interest in participating) took 44 days (218). The success of the social media recruitment strategy was likely responsible for the large number of individuals completing the online eligibility screening questionnaire, which can be common with PA-related research (219). This allowed us to quickly identify and contact apparently eligible participants. Moreover, the

financial incentive to participate, although contingent upon continuing in the study, may have also generated greater interest. However, due to the volume of responses to the screening questionnaire and nature of this feasibility study within a PhD, not all those who appeared eligible were able to be contacted. Nonetheless, it is evident that advertising through social media platforms is an effective recruitment strategy that should be included in future trials of *Just Run.* Adequate resourcing to facilitate screening of all potential participants may offer a possible method of recruitment for other online PA interventions.

Intervention adherence

Adherence to the intervention, based on participant engagement with the videos for each module, declined throughout the 12 weeks. While 71.4% of participants viewed the education in module 2 ("FITT Training Principles"), only 14.3% did so for the final module ("I am a Runner"). Adherence to *Just Run* was considerably higher when compared to another running education study, whereby engagement with the online education reduced rapidly, with just 16.7% completing the final four educational modules of the 6-week intervention (188). However, participants in the Pereira study were able to progress through the educational modules at their discretion, making direct comparisons to *Just Run* challenging. Potentially identifying the scheduled release of content used in *Just Run* may be a superior methodological approach for engagement. In a separate investigation evaluating the feasibility of a virtual 12-week running education program, Bramblett and colleagues (220) reported 74.0% did not complete the program. These adherence challenges also reflect those reported in broader digital physical activity research, with Marques et al. (185) reporting a 37.5% drop in adherence after one month in a lifestyle behaviour change intervention. In fact, physical activity interventions frequently

experience large (e.g., greater than 50%) dropout (221). While the adherence in the present study was comparable to existing literature, the trend of reduced adherence underscores the importance for intervention designers to explore additional strategies that mitigate poor engagement. Despite *Just Run* demonstrating a better adherence than previous running interventions, it is conceivable that incorporating additional approaches, such as personalisation (222) or artificial intelligence-driven strategies (223), may enhance adherence in future *Just Run* adaptations.

Acceptability of secondary outcomes

Completion of questionnaires decreased considerably in both intervention and control groups at both follow up timepoints. For intervention participants, completion of the five questionnaires (BREQ-3, BPNES, EBBS, MSES, SF-12) declined from baseline (96.7%) to week 12 (57.1%). This decline raises concerns about potential factors that contribute to participant engagement and retention. One explanation may be due to the burden of completing all questionnaires together (sum of 81 questions) at multiple timepoints across the 12 weeks. However, it is possible that participants became less interested in the intervention, which aligns with the reduced education engagement in latter weeks. An attempt to mitigate this burden was done by ensuring no new educational content was delivered in weeks 6 and 12 when the surveys were completed. The reduced completion over time suggests additional reinforcement or incentive strategies should be considered for future trials.

Participant experience

Overall, participants reported *Just Run* as user-friendly and informative. Of the 13 intervention participants who completed the exit feedback survey, 100% affirmed the

usefulness of all modules and advocated for their retention within the program. However, caution is warranted in these results, due to the selectivity of responses. Additional insight could be obtained from those who did not complete the intervention. Yet, despite a decline in overall engagement, it is plausible that the content interacted with by participants was perceived as valuable. Notably, 'My Running Goals' was identified as the most beneficial module, supported by 61.6% of participants expressing strong agreement or agreement regarding its efficacy in aiding goal setting and achievement. This aligns with literature suggesting that goal setting, within a supportive framework as *Just Run* aimed to do, can foster a transition from controlled/extrinsic regulations to more autonomous motives for physical activity (34).

Secondary outcomes: questionnaires and running activity

Motivation

Motivation towards running shifted towards more autonomous regulations (identified, integrated and intrinsic regulation) over the 12 weeks in both groups, indicating a positive shift towards greater internalisation of the activity. This transition likely reflects increases in maintenance motives (e.g., behaviour enjoyment, satisfaction with outcomes, self-determination, identity aligning with running) alongside increases in self-regulation (e.g., skills, coping strategies to manage/overcome barriers) towards running (77).. Kwasnicka highlights the importance of these self-regulation strategies, particularly coping mechanisms and planning, in ensuring the long-term maintenance of behaviour (77). By fostering these elements, *Just Run* promoted psychological resilience and adaptability, contributing to participants' ability to internalise running into their daily lives (77).

In the present study, amotivation was the only subscale that demonstrated a large between-group difference at week 6. This difference appeared to be driven by a reduction in score for the intervention group. One potential explanation for this could be the specific content or approach of the intervention. It is possible that the educational components targeting intrinsic motivation and self-regulation provided participants with new insights or skills that helped them address underlying sources of amotivation. For example, as the intervention included strategies for overcoming common barriers to exercise, or fostering a more positive mindset towards physical activity, participants may have felt more equipped to tackle feelings of indifference or lack of motivation. This reduction in amotivation can also be viewed through the lens of the Affective-Reflective Theory, where participants who developed more positive affective associations with running may have been more likely to reduce negative automatic responses towards running, and replace them with more positive reflective evaluations about their engagement in the activity (54). Whilst a positive trend in amotivation was observed, further exploration of the mechanisms driving this effect could provide valuable insights for refining future interventions. This would ensure education and techniques are implemented to foster reductions in controlled regulations and amotivation coincide with increases in intrinsic regulation, aligning with motives that promote running maintenance.

Self-efficacy

While overall measures of self-efficacy were not different between groups, a large between-group difference in scheduling self-efficacy at week 12 was observed. This difference appears to be primarily driven by a notable increase in scheduling self-efficacy scores from baseline to week 12 in the control group, coinciding with a decrease in the

intervention group. However, increases were observed in both task and coping efficacy in the intervention group across all timepoints, whereas such improvements were not mirrored in the control group. Closer review of these trends reveals scheduling differences between the groups may be due to the control group starting with a relatively lower baseline score in the scheduling domain (13.25 [4.45]) compared to the intervention group (17.38 [4.82]), leaving more room for improvement over the course of the study. As such, improvements in the control group may simply be due to maintaining involvement in a longitudinal study that involved the self-organisation or exercise. Another potential explanation could be related to the nature of the intervention itself. While *Just Run* aimed to enhance overall self-efficacy through goal setting, self-monitoring, social support, and self-regulation to overcoming barriers, it may have inadvertently placed less emphasis on scheduling-specific skills. Kwasnicka emphasises that behaviour maintenance is contingent on the availability of resources, both internal (e.g., self-efficacy) and external (e.g., social support), to manage challenges that arise during behaviour maintenance (77). This highlights the need for future iterations of *Just Run* to potentially place more focus on scheduling self-efficacy to support running maintenance (77). Previous literature has found that interventions promoting recreational physical activity which included elements of feedback on past or others' performance and vicarious experience increased self-efficacy, whilst barrier identification was associated with lower levels of self-efficacy (224). The absence of personalised feedback and guidance for participants to reflect on their previous experiences within *Just Run* may have inadvertently influenced the capacity for improving self-efficacy levels. Overall, these findings demonstrate the importance of considering the specific components of self-

efficacy targeted by interventions and their potential impact on running maintenance. Future *Just Run* trials should consider including additional content which focuses on strategies targeted at all domains of self-efficacy. Further assessment of long-term changes in self-efficacy is also warranted.

Exercise benefits and barriers

Several notable differences emerged between groups regarding the perceived benefits and barriers to running. A large between-group effect size was observed for perceived barriers of running at week 6. Surprisingly, this change was mostly driven by scores of the control group, who reported a decrease in the barriers subscale score from baseline to week 6, indicating lower perceived barriers to running. This was accompanied by increase in perceived barriers score of running in the intervention group across the same period. Whilst unexpected, these results are somewhat consistent with a previous study which found a large between-group effect size in perceived barriers post-12 week exercise intervention in mothers compared to their daughters (225). However, this prior study failed to use a true control condition, making it difficult to determine change in perceived barriers was a result of participating in an exercise intervention. Yet the decrease in perceived barriers of the control group in the current study suggest further exploration is needed of potential factors underlying this trend. In the context of *Just Run,* it is plausible to consider the education provided in the intervention inadvertently heightened recognition of barriers to running among participants in the intervention group only. *Just Run* prompted participants in the intervention group to consciously reflect on their barriers, and establish strategies to manage and overcome them, consistent with Kwasnicka's behaviour maintenance model, which stresses the importance of identifying

and addressing barriers to maintain behaviour through self-regulation and environmental adjustments (77). This may, in turn, have increased attention to their personal challenges with running, reflecting an increase in perceived barriers over time. It seems possible that, given the control group were not exposed to this level of self-reflection concerning their barriers, that these participants may have perceived fewer barriers to running.

No appreciable between-group differences were observed for the benefits subscale throughout the study. However, both control and intervention groups decreased scores in the perceived benefits of running over the study period. Compared to the current study, which found control and intervention groups scored 34.94 (SD = 8.57) and 32.50 (SD = 7.27) respectively in the benefits subscale at week 12, previous studies have reported notably higher scores in this subscale, being 61.69 (SD = 14.79) (226), 92.71 (SD = 8.30) (225) and 89.3 (SD = 11.6) (227). This result may be explained by several factors, including the questionnaire in the present study orienting participants to consider only the benefits/barriers perceived for running specifically. This specification may have contributed to more critical evaluation of the benefits running provides, compared to their reflections of broader benefits of general exercise. Another alternative explanation of the current study's findings may be due in part to participant characteristics, whereby these previous studies used the questionnaire in a clinical population (226), in females (225) and in nurses (227). It is a worthwhile consideration that these populations may have perceived benefits of exercise to a greater extent due to factors specific to their respective contexts (e.g., those working in the health industry may regularly counsel patients on the value of exercise, and thus have a heightened opinion on exercise-related health benefits). Importantly, prior research in active females has demonstrated significant

increases in PA coupled with no changes in scores of perceived benefits after a 12 week intervention, suggesting that individuals can increase physical activity participation without consciously valuing the benefits provided (225). Moreover, a 12-week follow up is unlikely to capture longer term changes that may have shown continued behaviour change and a greater perception of the benefits of running. Furthermore, participants in *Just Run* tended to run less than once per week, and whilst this aligns with the dosage required to reduce risks of all-cause mortality (5), perhaps running once per week is not enough for individuals to appreciate the personal benefits of running in people's lives.

Basic psychological needs

The satisfaction of basic psychological needs is integral to individual's ability to thrive and maintain optimal health, and thus are important in the context of running continuation (228). While no notable differences between groups were observed in basic psychological needs, the intervention group reported an increase in autonomy, competence and relatedness from baseline to week 12. Similarly, control participants improved in autonomy and relatedness, but not competence. Kwasnicka's behaviour maintenance model highlights that the satisfaction of these psychological needs can reinforce maintenance motives, such as enjoyment and identity, which are essential for long-term engagement in running (77). As the intervention addressed autonomy and relatedness, it helped foster a supportive environment that may have contributed to some participants' running adherence. Consistent with previous research (229), results of the current study revealed that satisfaction of basic psychological needs occurred with increases in more autonomous forms of motivation towards running. Other findings have shown relatedness had the strongest impact on three-month exercise maintenance, whilst autonomy was a

stronger predictor of maintenance at six months (230). Interestingly, competence – the psychological need that did not improve in the control group – has been found to play a mediating role in the relationship between intrinsic motivation and PA at six month follow-up in one study assessing need satisfaction and PA (231). Similar to previous research in levels of PA and need satisfaction (229, 231), our findings demonstrated that an increase in competence satisfaction aligned with increases in running volume in the intervention group. Although limited research has assessed need satisfaction in running specifically, there is initial evidence to suggest autonomy and competence satisfaction support individuals' ability to persevere during challenging training sessions (232). However, it is unknown whether these findings are associated with actual changes in training characteristics, self-determination, or even if they persist long-term. When interpreting the results for need satisfaction and running maintenance, it is important to note that the present study did not conduct analysis on the direct effects for need satisfaction on running maintenance. Therefore, further investigation as to whether need satisfaction influences running maintenance beyond 12 weeks is warranted.

Physical activity and health-related quality of life

Between-group differences in mental and physical components of the SF-12v2 were small, nor were there any meaningful changes in either group throughout the study period. This was somewhat unexpected, as previous literature has found that running can improve physical health (9), mental health (149) and is associated with a lower likelihood of depression (233). A recent investigation into *parkrun*, the weekly community 5 km running initiative, found regular participation supported positive wellbeing (234). While *Just Run* did not yield the same wellbeing improvement, the characteristics of *parkrun* as

a community event should be considered. The *parkrun* initiative encourages consistent and structured engagement through its weekly timed events, continuing well beyond the 12-week intervention period of the current study. This prolonged exposure and regular participation could allow for greater adaptation and improvement in wellbeing outcomes. Furthermore, the social and achievement opportunities of *parkrun* could contribute to its effectiveness in promoting wellbeing (31, 117, 234). The Affective-Reflective Theory (ART) suggests that positive affective experiences, such as those derived from social interaction and achievement during exercise, can reinforce reflective evaluations and increase the likelihood of future engagement in running (54). The communal aspects of *parkrun* may evoke stronger positive affective responses compared to individual online programs, potentially accounting for differences in wellbeing outcomes. The sense of community inherent in *parkrun* may create a more conducive environment for positive changes in wellbeing compared to *Just Run* as an individual, online-based intervention. Additionally, people may be more inclined to adhere to a running routine when it involves a communal event like *parkrun*, where they feel accountable to others and derive enjoyment from the experience itself, beyond just the health benefits (117). This sense of enjoyment could contribute to sustained engagement, and ultimately greater improvements in wellbeing. Whilst participants were encouraged to try *parkrun* in *Just Run,* ultimately the lack of the physical social support and community engagement could explain the smaller observed effects on wellbeing. However, there remains promising potential of online interventions to be coupled with engagement in community-based running initiatives as means to positively impact wellbeing.

A worthwhile consideration of wellbeing in the present study was the lower overall physical and mental health scores compared to those reported previously in interventions and cohort studies. For example, baseline physical and mental component scores in runners from one prospective study was 55.9 (SD = 2.2) (235), which is notably greater compared to 32.95 (SD = 4.16) for controls and 33.66 (SD = 4.64) for intervention groups at baseline in *Just Run.* In fact, scores from those in the present study mirror the scores of individuals with diagnosed mental illness (236), potentially indicating a different tool (e.g., the Depression Anxiety Stress Scale (237)) may have been more useful suited in detecting changes in mental health in this sample. Whilst eligibility screening assessed self-rated physical health, with a particular focus on cardiovascular disease risk factors, little attention was paid to the mental health status of those included. It is possible that these results are an artefact of the socioeconomic climate during the study period and associated widespread coronavirus (COVID-19) implications. Research has indicated that runners were not immune to the impacts of COVID-19, with one study finding a significant inverse relationship between the number of COVID-related deaths in their local country, and psychological wellbeing in over 7800 runners from 86 countries during the pandemic (238). This highlights the significance of COVID-19 impacting individual health markers, even in runners, who are often observed to be physically and psychologically healthier than the general population (239). Similarly, the most recently comparable SF-12 scores in the existing literature compared to the current study appear to be in a cohort of people with long COVID-19 (240). Since similar wellbeing scores seem to not occur elsewhere or in other contexts, the possible interference of COVID-19 with factors external to the study itself (e.g., individual circumstances) may have influenced these

findings. Results for mental health scores may therefore need to be interpreted with caution, and may not be completely generalisable in the post-COVID era. Given these mixed results, further investigation is warranted.

Running activity

Running activity across both groups was low, with no meaningful between-group differences observed. Both groups averaged less than one run or 66 minutes of running per week. These values are lower than those observed by Hespanhol and colleagues (2018), who explored online tailored injury prevention advice on running behaviour in Dutch recreational trail runners (156). In their study, both the intervention and control groups maintained a higher average frequency of running sessions per week (2.5 runs/week) over their 6-month intervention period. However, despite their higher frequency of running, the incidence of injury was markedly elevated, with 36.5% to 39.4% of participants reporting an injury during the intervention. Despite the novice status of *Just Run* participants, who are at higher risk of injury compared to recreational runners (13), substantially lower injury incidence rates were reported (3.7 – 3.85%). However, this may be explained by the shorter observation period and comparatively lower running volume of those in *Just Run*. In a separate study investigating a 13-week graded training program for novice runners aiming to decrease injury occurrence, authors prescribed both control and intervention groups to run three times per week, while progressing running duration across the study period (241). Yet justification for this decision was absent, and the program was not preventive for sustaining an injury in both groups (20.3 – 20.8% injury incidence). This finding is important, as injury often serves as a major setback coinciding with running discontinuation, and can leave the runner with a reduced sense of autonomy

that can interfere with their ability to self-regulate the injury successfully and return to running safely (174). The low injury occurrence among *Just Run* participants suggests that commencing running once per week may be a viable starting point for novice runners from both an injury prevention and running maintenance standpoint. However, although the findings for secondary outcomes should be considered preliminary, a lack of observed benefit for some outcomes (e.g., mental health) suggests greater running activity could be required for these benefits to be realised.

An additional aspect to consider regarding running participation is in relation to the Physical Activity Guidelines, which recommend adults accrue between 150 – 300 minutes of moderate intensity activity per week. It is evident that participants in this study were not meeting these recommendations solely through their running participation. It seems possible that these results reflect the participants targeted, being novice runners. By including novice runners, it is somewhat unsurprising that running participation remained lower than current activity recommendations. Whilst strategies in the intervention aimed at supporting novice runners through developing consistent routines, coping strategies and habits that facilitate more frequent running engagement may require more time than the study period permitted. Additional time may be required for these strategies to translate into sustainable behaviour changes being implemented. Importantly, however, the purpose of this study was not to solely increase participant running volume. Rather, to target the important antecedents of behaviour change. For example, improvements in autonomous motives towards running (identified, integrated and intrinsic regulation), increased autonomy and competence perception, improved coping self-efficacy, alongside reductions in amotivation and external motives towards running observed

across the study period is an encouraging finding that are suggestive of the presence of maintenance motives and self-regulation towards running. Despite these promising results, future research directed at addressing running motivation may consider the need to highlight additional strategies that promote translation of these skills into other forms of activity that may help people achieve the recommended activity levels, and therefore the associated health benefits.

Limitations

A notable limitation of this study is the high rate of participants lost-to-follow up, suggesting potential challenges with engagement. *Just Run* may have imposed a substantial burden on participants, impacting their ability or willingness to continue. While feedback was garnered from participants, further investigation into the reasons for non-engagement through exploration with potential future participants and the impact of study design considerations is warranted. A diminishing schedule of education (e.g., from weekly into monthly) with small doses of education over a longer period could mitigate poor adherence. Low completion of secondary outcome measures at weeks 6 and 12 suggests caution is warranted when interpreting these findings, albeit they were included to indicate preliminary estimates of intervention effects. One important limitation is the absence of a priori feasibility and acceptability criteria within the study design. In feasibility work, it is recommended to set clear thresholds to systematically determine the feasibility of an intervention (162a, 242). Without such criteria established in advance, it becomes more difficult to assess the success of the study systematically. Future feasibility studies should set and report these criteria to provide a clearer framework for determining study success and participant engagement.

It is worthwhile noting that modifying questionnaires (BREQ, BPNES, MSES, EBBS) generally requires re-validation of the new version, which was not completed. However, the modifications were minor and similar to the original versions in context, from general physical activity to running. Regardless, future iterations should endeavour to validate questionnaires specific to a running context. Lastly, the implementation of basic training advice, and ongoing monitoring of the control group may have been enough to cause a change in behaviour, leading to an increase in psychological outcomes. As such, the between-group effect sizes may not truly reflect the impact the intervention has in a real-world community setting. Assessing the impact of *Just Run* without providing continuous monitoring of a control group, for example, may likely be a more ecologically valid comparison. Addressing these limitations is crucial for refining the research and intervention design, enhancing participant support, and improving strategies to ensure the feasibility of such an intervention.

Conclusion

Just Run demonstrated a feasible approach to recruitment, however, refinement of study design and delivery may enhance the acceptability and engagement, improving effectiveness in the community. Preliminary findings suggest *Just Run* improved autonomy and competence perception, and coping self-efficacy, whilst reducing amotivation and external motives towards running, suggestive of the presence of maintenance motives and self-regulation towards running. With further development, *Just Run* may provide a useful tool to increase running participation in novice runners.

Chapter 6

Discussion

The preceding chapters of this thesis have explored underlying motivations behind running participation. Building upon existing literature, these chapters explored not only the quantitative aspects of motivation, but also delved into the qualitative influences, providing novel perspectives of the drivers of running participation and maintenance in novice and recreational runners. This chapter will summarise the main findings of the four original studies and provide an overall synthesis of the implications of these combined results. It will highlight the key contributions of the work presented in this thesis, and finally, future research directions related to running motivation will be discussed.

Summary of key findings

The overarching aim of this thesis was to explore the motivation and psychological influences of running and understand how these can support the maintenance of the behaviour, allowing individuals to gain the health benefits of regular, long-term running. This aim was addressed using a combination of research methodologies. The key findings and relationship of each study in relation to the thesis aims are depicted in Figure 6.1.

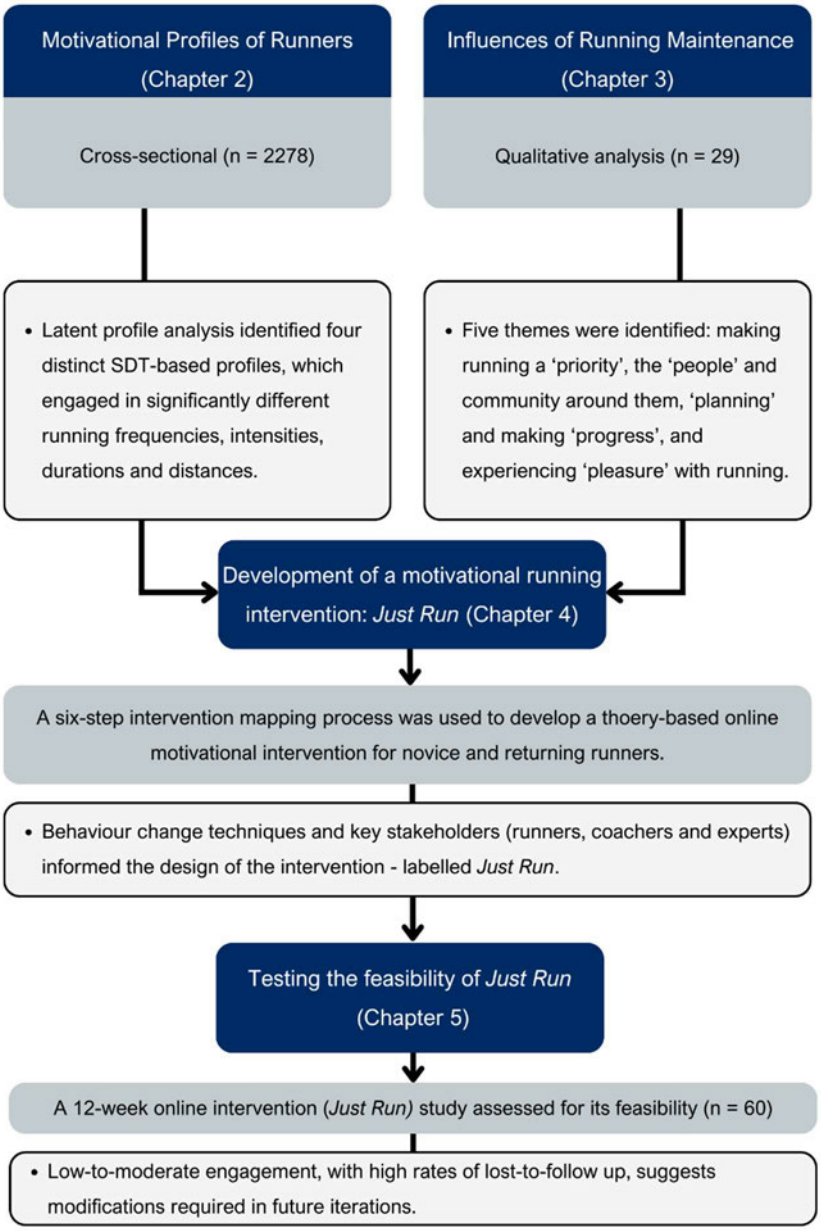


Figure 6.1 The key findings and relationship of each study in relation to the thesis aims.

Motivation and running behaviour

Study 1 (Chapter 2) aimed to determine whether motivational 'profiles' existed in a large sample of runners from the Garmin-RUNSAFE study. Motivation towards running was assessed according to the six regulations of Self-determination Theory (SDT) (46, 79). Differences in training characteristics measured via Global Positioning System (GPS)-enabled smartwatches were compared between profiles. Latent profile analysis identified four distinct motivational profiles, labelled 'balanced engagers', 'autonomous achievers', 'reluctant runners' and 'controlled engagers'. These profiles were distinct, and represented the unique motivational interplay experienced by runners. Over 90% of the sample fit within three of the four profiles, being 'autonomous achievers', 'balanced engagers' and 'controlled engagers', with remaining participants aligning with the 'reluctant runner' profile. 'Autonomous achievers', 'balanced engagers' and 'controlled engagers' were characterised by high levels of more autonomous forms of motivation towards running, given their higher scores in identified, integrated and intrinsic regulations compared to other regulation types. The 'autonomous achievers' profile structure appeared to align with the optimal motivational attributes for sustained physical activity engagement (89). 'Balanced engagers', alongside 'controlled engagers', shared high levels of autonomous motivation, whilst 'controlled engagers' simultaneously scored higher than other profiles in controlled forms of motivation (amotivation, extrinsic, and introjected regulation). Conversely, 'reluctant runners' reported lower overall motivation towards running, with identified regulation as the predominant construct. These runners also tended to report less years of running experienced than other profiles.

Furthermore, each profile exhibited unique training characteristics. The largest differences were observed between the 'reluctant runners' and 'autonomous achievers' profiles across all

training characteristics (frequency, intensity, duration, and distance), with 'autonomous achievers' running more frequently, for longer durations and distances, and at a faster pace to 'reluctant runners'. 'Balanced engagers' and 'controlled engagers' shared similar training characteristics, whilst 'reluctant runners' accumulated the least amount of weekly running volume overall. These findings highlighted the importance of considering motivational orientations when designing interventions to promote running engagement.

This study presented an investigation into motivational profiles amongst a large cohort of runners. Uncovering the distinctive motivational orientations of the four profiles, especially the 'reluctant runner' profile, revealed characteristics typical of novice runners with less experience and low motivation to engage in running. From a public health perspective, these insights not only enrich the current understanding of the multidimensional nature of motivation, but also suggest the potential for physical activity interventions to target specific motivational orientations to enhance adherence to healthy lifestyle practices.

Qualitative insights from current and discontinued runners

In Study 2 (Chapter 3), a qualitative analysis examined factors contributing to running maintenance of current and discontinued recreational runners. Guided by ontological relativism, thematic analysis identified five main themes influencing the decision to run: making running a priority, running with like-minded people, having flexible running plans, goal-oriented progress, and finding pleasure in running through recognising the personal and health benefits enhanced the appeal of running. The decision to continue to run seemed to align closely with whether running was deemed an important aspect of one's identity, and something of strong personal value, hence considering running a priority in their life. These findings revealed a previously unrecognised nexus between the perceived importance of running to one's identity and

personal value, and the pivotal role of prioritisation in sustaining running throughout one's life. Moreover, this research showed an important dichotomy between the experiences of current and discontinued runners. While both groups faced barriers that threatened their running maintenance, current runners described how they were able to navigate these challenges by implementing supportive strategies, allowing them to adapt their goals and schedules to ensure running continued to integrate into their lives.

These findings extend beyond the realm of recreational running, offering insight into the broader behaviour change and exercise psychology literature. By exploring the interplay of internal and external factors that underpin individuals' decisions to continue or discontinue in their running endeavors, this research provides a compelling basis for developing targeted interventions aimed at enhancing running maintenance and fostering sustainable behaviour change. In doing so, this work not only deepens the understanding of the complex motivational factors driving human behaviour, but also paves the way for the development of innovative strategies to promote lasting engagement in physical activity and well-being.

Developing an online educational tool to promote running maintenance

In Study 3 (Chapter 4), an Intervention Mapping (IM) process was used to guide the development of a theory-based intervention to improve running maintenance in new and returning runners through a motivational and psychological lens. Steps 1 through 4 of the IM process were employed to ensure the complexities of behaviour change could be systematically designed, implemented and tested for a running context in *Just Run*. A key strength of the intervention was its user-centered design, informed by extensive stakeholder engagement and usability testing.

Drawing upon insights from literature (step 1), a number of key constructs were deemed critical to address running maintenance, including intrinsic motivation, goal setting, self-monitoring, self-efficacy, and autonomy. Notably, the inclusion of self-compassion, habit formation, group dynamics and overcoming cognitive barriers emerged as pivotal components to be included through expert consultation. The identified constructs in step 1 allowed for the outcomes and change objectives to be developed in alignment with behaviour change techniques and theories (step 2). The program was then designed (step 3) and produced (step 4), with each of the 10 modules including educational videos, interactive activities, and external resources to promote sustained engagement in running activities without imposing undue burden on participants. Notably, positive pre-testing with runners, coaches, and experts (step 5) indicated an engaging, accessible, and suitable intervention to target running maintenance. By synthesising evidence-based strategies with stakeholder input and expert consultation, *Just Run* was developed, in turn offering a novel solution to navigating the challenges novice and returning runners face in pursuit of running maintenance.

Assessing the feasibility of a randomised controlled trial exploring online motivational education in new and returning runners

Finally, Study 4 assessed the feasibility of conducting a 12-week randomised controlled trial (RCT) of the designed intervention, compared to basic training advice in novice runners. Recruitment targets were successfully met quicker than anticipated, taking just 44 days to recruit 60 participants. Despite moderate engagement with the education (35.7% to 71.4% across the 12 weeks), participant experiences were largely positive, with a high number of participants highlighting education around goal setting (e.g., “My Running Goals”) to be particularly beneficial to their running journey. The decline in completion of outcome measures,

particularly at week 12, suggests potential challenges with compliance and engagement. However, both intervention and control groups demonstrated a shift towards more autonomous regulations (identified, integrated and intrinsic regulation) for running over the 12 weeks. Those in the intervention group saw greater improvements in autonomy and competence perception, coping self-efficacy and reductions in external motives towards running compared to the control group. Further refinement of the intervention to improve retention are recommended to inform a future fully powered RCT.

Overall message

Together, these findings form a consistent message: the decision to run, and most importantly, continue to run, is shaped by a multifaceted interplay of psychological and motivational factors. Central to running maintenance is the recognition that the decision to engage in and sustain running is not static, but rather a dynamic process influenced by a multitude of internal and external factors that continues throughout one's lifespan. The identification of distinct motivational profiles and the qualitative exploration of current and discontinued runners' experiences identified the multidimensional nature of running motivation and how this influenced running behaviour. The development of a motivational-based running education program, and the assessment of the feasibility of this intervention were conducted to understand how to practically address the identified motivational and psychological determinants of running. Furthermore, this research demonstrated an important link between motivation and the way individuals choose to engage in running. Despite preliminary *Just Run* evidence suggesting that modifying psychological determinants does not lead to immediate changes in running behaviour, further refinement of this intervention (through IM Steps 5 and 6) could facilitate more permanent shifts in running engagement. Additionally, longer study duration, with a

diminishing schedule of education (e.g., from weekly into monthly) with small 'booster' doses of education could provide participants with longer-term support during the initial months of their running journey. Overall, the findings further demonstrate the inherent complexity of behaviour change processes, and serves as a reminder that altering behaviour is inherently challenging, and not immediate.

The findings of this thesis have provided valuable and novel insight into the factors influencing running maintenance from a largely unexplored lens of exercise psychology. In essence, this research represents a pivotal step towards acknowledging the full potential of running as a tool for health promotion. By promoting the effect of motivation and psychological skills to drive running maintenance, individual health outcomes may not only improve, but also facilitate active living and well-being within communities, enhancing the quality of life for many individuals.

Key contributions

The culmination of this work provides a comprehensive examination of running maintenance from a motivational and psychological perspective, a relatively under-explored area. Whilst previous studies have explored maintenance in general physical activity, limited consideration has been given to running-specific maintenance, especially from a psychological perspective. The studies within this thesis interrogated the seemingly 'simple and accessible' behaviour of running through a psychological lens, allowing the antecedents governing running behaviour to be more thoroughly understood and addressed.

Contributions to the literature

This research has made significant contributions to the literature in running maintenance and motivation in several ways. For the first time in the published scientific literature, runners were clustered based on their individual Self-determination Theory-based motivational orientations

towards running (Chapter 2). Importantly, these profiles were shown to align with distinct, GPS-measured training characteristics, further illuminating the role that motivation plays in how people run. Training data was collected through Garmin Connect software, a global purpose-built training tracking software, allowing for accurate training characteristics to be captured from a large sample of runners. This novel approach not only provided a deeper insight into the psychological drivers behind running behaviour, but also offers valuable guidance for intervention designers to tailor approaches to target running maintenance according to individual differences in motivational orientation.

Furthermore, this research fills a gap in the literature by exploring the perspectives of discontinued recreational runners on running maintenance. This population has not, to the researcher's knowledge, previously been engaged to explore perspectives on running maintenance. The findings from this study provided insights into the problems many have in maintaining running from a unique perspective, offering a more comprehensive understanding of the factors influencing running maintenance.

The development and feasibility of an online, motivational intervention to running maintenance was explored. Many previous physical activity behaviour change interventions had not employed an intervention mapping approach in their design, nor assessed their feasibility with an RCT. The incorporation of key stakeholders to inform, develop and refine the *Just Run* intervention was a notable strength of this research. The process undertaken to ensure the alignment of each educational module with established theories, behaviour change techniques, and expert recommendations allowed *Just Run to* be tailored to novice and returning runners. Unlike existing interventions, this study used an established framework to structure the intervention design process. This approach ensured the theoretical soundness of the

intervention, enhancing its theory-based practical feasibility to address the motivational factors relevant to running maintenance. Moreover, the extensive international expert consultation further contributed to the intervention's robustness, ensuring it was grounded in current, best-practice recommendations that a literature review alone may not have captured. Pre-testing demonstrated the successful translation of theories into the implementation of the online intervention, highlighting its potential effectiveness in real-world settings. Overall, *Just Run* represented a new, unique and innovative contribution to the literature by providing a theory-driven approach to designing interventions specifically targeted at promoting running engagement.

Contributions to theory

Finally, the findings reported in this thesis provide new insights into motivation and other psychological factors associated with running maintenance and represents a significant contribution to understanding running motivation and how it can be addressed. Collectively, the studies showed how (a) motivational orientations reflect how individuals choose to engage with running, (b) that current and discontinued runners frequently experience barriers to running engagement, but have different behavioural outcomes (e.g., continue to run, or stop running), and (c) interventions utilising behaviour change techniques could facilitate progress towards running maintenance.

In the context of running maintenance, the thesis findings support the constructs of self-efficacy theory by highlighting the importance of self-efficacy in running maintenance. By exploring the barriers and enablers to running, factors that impacted individuals' confidence in their ability to maintain their running routine aligned with elements of vicarious experiences, (e.g., ensuring

social support through finding like-minded runners), and previous experiences (e.g., such as past success with achieving running-related goals).

The findings of this thesis also contribute knowledge to the transtheoretical model by providing insights into the factors influencing individuals' progression (or regression) through these stages in the context of running maintenance, particularly in comparing the perspectives of current and discontinued runners.

This research contributes to the theoretical understanding of behaviour maintenance by providing empirical evidence that enriches the theoretical frameworks proposed by Kwasnicka and colleagues (77). Analysis and exploration of motivational and psychological factors associated with running engagement offered an understanding into the dynamic nature of behaviour maintenance. Engaging with current and discontinued runners (Chapter 3) allowed the exploration of maintenance motives, resources, self-regulation and habit formation that informed features of *Just Run.* Based on Kwasnicka's behaviour maintenance model (77), the qualitative study specifically engaged with those who were able to sustain the 'new behaviour' of running, and those who reverted to the 'prior behaviour' of not running. By examining both current and discontinued runners, this research highlighted the role of maintenance motives, such as intrinsic motivation and enjoyment, in promoting running adherence, while also emphasising the importance of self-regulation, habits, and resources. These factors were critical to the design of the *Just Run* intervention, particularly in providing education relevant to scaffolding running habits and promoting psychological resilience in the face of barriers.

The findings from this thesis align with Kwasnicka's identification of the five key themes that influence behaviour maintenance: maintenance motives, self-regulation, resources, habits, and contextual influences (77). For instance, *Just Run* targeted these elements by promoting self-

regulation strategies, helping runners identify personal motives, and fostering habit formation towards successful running engagement over time. The intervention aimed to help individuals to create sustainable habits, with a strong focus on self-regulation skills such as planning, goal setting, and coping with barriers, all of which are factors highlighted by Kwasnicka as essential for long-term behaviour maintenance. Additionally, the importance of social support within ones' personal and running community was identified by current runners as a key resource in maintaining running, reflecting Kwasnicka's emphasis on having appropriate resources to sustain behaviour change.

Moreover, the behaviour maintenance model (77) focus on the role of resources, both internal (e.g., motivation, psychological resilience) and external (e.g., social support, environmental factors), was reinforced by this research, as it was evident that current runners successfully maintained their running due to a greater access to resources, whether through supportive environments or personal coping mechanisms. In contrast, discontinued runners often struggled due to limited resources and weaker support systems, highlighting the need for interventions to target these areas more effectively.

The qualitative study, in particular, provided an opportunity to explore the dichotomy between those able to sustain running, and those who reverted to their prior behaviour of not running. This mirrors Kwasnicka et al.'s concept of the oscillation between 'new behaviour' and 'prior behaviour,' as the runners in this study who were able to sustain their engagement discussed factors that align with greater self-regulation, stronger maintenance motives, and more accessible resources, compared to those who discontinued. These findings support and expand on Kwasnicka's framework by offering concrete examples of how these theoretical constructs play out in the real-world context of running maintenance.

Finally, this thesis not only confirms Kwasnicka's behaviour maintenance model, but also extends it by illustrating how the framework can be applied in specific interventions targeting novice runners. By focusing on behaviour maintenance rather than just behaviour initiation, this work enriches the understanding of how long-term engagement in running can be supported through structured psychological interventions, such as *Just Run*, that address maintenance motives, provide self-regulation tools, and strengthen psychological resources. This offers a more holistic approach to running maintenance, demonstrating how Kwasnicka's theoretical constructs can be operationalised to combat physical inactivity and promote long-term health behaviour change.

Practical implications

Together, this research provides valuable insights and serves as a foundation to practically address running maintenance. Firstly, the recognition of distinct motivational profiles among runners underscores the importance of identifying what motivates an individual to engage in running, and that what motivates one to run may explain their training choices (Chapter 2). These findings provide evidence for health professionals and coaches to consider the role of motivation in how a client or athlete engages in running. Identifying an individuals' motivational orientation towards running may help explain their engagement with the program or prescription. As such, appropriate strategies that align with the athlete's current motivation could help optimise training outcomes that promote maintenance motives, and help progress an individual's running volume as motivation becomes more autonomous.

Secondly, the qualitative findings (Chapter 3) hold practical implication for the promotion of running maintenance. Uncovering how the 'people' who one runs with, and the running community around them, 'planning', making 'progress', and experiencing 'pleasure' with

running influenced how much an individual saw running as a priority in their lives clearly demonstrates key constructs that can be targeted by runners and coaches. For example, coaches may facilitate training sessions where runners can 'self-seed' within the group, allowing them to run with others that share similar training paces, rather than completing the session alone. Runners can also be encouraged to recognise the importance of monitoring progress through appropriate goal setting, as well as seeking appealing running routes to find pleasure in their running experience. These practical applications can extend beyond running maintenance alone, offering potential for intervention designers to apply these same principles to promoting maintenance of other forms of activity.

Thirdly, the development of an online educational intervention represents a tangible step that intervention designers can consider adapting towards addressing the motivational and psychological barriers that may hinder individuals from initiating and maintaining a running routine. By incorporating evidence- and theory-based principles, this intervention offered a structured approach to empowering new runners and equipping them with the necessary tools to overcome obstacles and maintain their running engagement. Moreover, intervention designers should consider involving stakeholders, including runners, coaches, and experts in physical activity and behaviour change in the intervention development process to ensure approaches are optimal to the needs and challenges faced by individuals within the running community. Importantly, acknowledging the excess interest from individuals wanting to participate in *Just Run* indicates an obvious opportunity to target this population, whilst also recognising the need to address factors that optimise engagement and adherence to online interventions. If these factors are addressed, interventions like *Just Run* could effectively promote sustained engagement and potentially maximise its impact on a wider scale.

Furthermore, the integration of smartwatches and online platforms like Strava presents an opportunity to scale these findings, and personalise advice based on individual performance data. By leveraging this avenue, intervention designers may not only tailor training plans to align with users' fitness levels and goals, but also incorporate motivational and educational content tailored to training trends at minimal operating costs due to the online nature of such approach. This personalised application has the potential to enhance long-term engagement by providing runners with relevant and timely support, guidance, and encouragement throughout their running journey. Through harnessing the power of smartwatch data and app-based platforms, interventions can offer an adaptive framework that addresses individuals' unique needs and preferences, thereby facilitating running maintenance from a psychological and motivational perspective.

Limitations

Several limitations warrant consideration in interpreting the findings from the studies within this thesis. While the cross-sectional study in Chapter 2 offered unique insight into the motivational orientations of a large sample of runners, collecting data on motivation and training characteristics at a single time point does not allow for observing changes in these variables overtime. Without baseline measures, it becomes challenging to determine whether observed training patterns and motivational orientations are consistent, or merely reflect a snapshot of current training and motivations as part of a more fluctuating engagement landscape. Additionally, the sample composition from the Garmin-RUNSAFE study limits the generalisability of the findings to broader populations of runners. The homogeneity of the sample, being predominantly middle-aged European males, may restrict the applicability of the findings to other running communities with different demographics, motivations, and training habits.

It is important to acknowledge that different qualitative perspectives in thematically analysing the current and discontinued interviews could potentially lead to varying interpretations, especially considering the absence of member checking in this study. Without the validation of participant perspectives, there is a risk that the interpretations presented may not fully capture the richness and complexity of the data. By adhering to ontological relativism, there remains a possibility of overlooking alternative interpretations or perspectives that may have been clearer from other qualitative paradigms. For instance, another paradigm that was considered appropriate was a constructivist approach. Adopting a constructivist perspective in this thematic analysis may have meant a greater focus on finding individuals' specific socio-cultural contexts, such as social dynamics and cultural norms, that informed their experiences and perspectives of running maintenance. It is therefore important to recognise the inherent subjectivity in the interpretation of qualitative data, and the potential for different perspectives to return alternative understandings of the data.

The proportion of incomplete secondary outcomes in *Just Run* raise concerns about potential biases introduced by missing data and the representativeness of the remaining sample. This attrition also underscores potential challenges with participant compliance and engagement with the intervention. The limited engagement with *Just Run* may indicate that the intervention imposed a substantial burden on participants, impacting their ability or willingness to continue participating. Furthermore, while feedback was obtained from participants, further exploration into the reasons for non-engagement is warranted. Understanding the factors contributing to low engagement can inform future intervention refinement and strategies to enhance participant adherence. Additionally, the implementation of basic training advice and ongoing monitoring of the control group may have inadvertently influenced behaviour change, leading to potential

distortion of the observed effect sizes between the intervention and control groups. This suggests that the observed effects may not solely be attributable to the intervention itself but could also reflect the influence of other unknown or unmeasured factors.

Overall, whilst the research within this thesis centered around the constructs and underpinnings of SDT, it is important to acknowledge the plethora of psychological theories and behaviour change models that offer complementary insight into human behaviour. Each theory brings its own sets of constructs and mechanisms that enrich the understanding of individual, social and environmental factors that influence behaviour, and thus are likely to contribute to the discussion of running maintenance. While a myriad of evidence-based theories offer important perspectives to behaviour change in physical activity contexts, the work in this thesis could only include some, acknowledging that not all available theories were integrated. Nevertheless, there is significant overlap among many of these psychological and behaviour change theories, and the author has endeavoured to think broadly, and be guided by the most relevant theories for the purposes of this research. Recognising that running maintenance can be explored and addressed from a number of perspectives is important when considering how the data in this thesis was interpreted.

Future directions

This body of work is also a precursor for several avenues of future research. Optimising approaches to address motivation in runners is essential if individuals and public health systems are to maximise the benefits of long-term running engagement. Intervention designers should explore alternative intervention formats and strategies aimed at enhancing participant engagement and retention in online interventions.

Integrating the *Just Run* education with established platforms could change the way runners approach their training by personalising experiences based on individual motivations. Real-time motivational prompts could provide dynamic, context-specific motivation and running feedback based on already available data analytics of Strava and Garmin. This data could be used to deliver immediate, actionable advice through audio prompts (e.g., via headphones during a run), or short educational videos. For example, the ASICS Runkeeper app (Asics, Chuo Ward, Kobe, Hyogo, Japan, 2008) already offers a functionality, labelled 'Guided Workouts' where users receive audio prompts that provides motivation, encouragement and guidance during running activity. *Just Run* could enhance such technology through tailoring motivational prompts that align more closely with the individual's motivation orientations and preferences with their running activity. Understanding and optimising the link between motivation, training (e.g., running distance) and physiological metrics (e.g., heart rate, ratings of perceived exertion) measured in many devices could allow for more sophisticated motivational advice and training prescription that could facilitate running maintenance from a both physical and psychological perspectives.

Just Run offers a unique opportunity for the future of promoting recreational running maintenance. It is essential to consider elements that may enhance how users engage with the

program, and leverage both social and physical interactions that *Just Run* affords. Increasing social interaction within the online environment of *Just Run* could facilitate social connectedness with other users. Integrating social features such as discussion forums, real-time chat functions or including external groups on other more widely used social media platforms (e.g., Facebook, Strava, WhatsApp) could serve as virtual spaces where runners could share their experience and seek support from others to help in their running journey. Given the evidence for social support in both general behaviour change and running engagement, future *Just Run* iterations should endeavour to incorporate these interactive strategies (243).

Incorporating in-person meetups and promoting engagement in running groups amongst users could also enhance the sense of connection with other runners. Given the evidence for the plethora of benefits community-based running events provide (e.g., parkrun) (166, 234), it is expected that such inclusion would offer an element of social support that online-only interventions cannot provide. These meetups could be organised to coincide with local parkruns, leveraging an already successful running initiative that can further expose individuals to a larger running community.

If new or modified versions of existing interventions such as *Just Run* can improve running maintenance in the short-term, studies of longer duration (e.g., beyond 12 months) would be warranted to identify the enduring effects of motivational interventions on running maintenance. Through the application of these evidence-based and stakeholder-informed practical approaches, practitioners, policymakers, and educators can play a pivotal role in promoting running engagement and facilitating the enduring adoption of this health-enhancing behaviour among diverse populations.

Conclusion

Many individuals experience a ‘lack of motivation’ to engage in running on a regular basis. Yet, the role of motivation in running maintenance has largely been overlooked. This thesis has demonstrated that motivation plays a role in running participation. Specifically, motivation appears to relate to individuals’ engagement or discontinuation running. Individuals who exhibited higher levels of intrinsic motivation demonstrated greater consistency and enthusiasm in their running activities, whereas those with lower levels of motivation tended to struggle with adherence and commitment to their running routines. This highlights the role of motivation in shaping the trajectory of individuals' running behaviour and underscores the importance of targeted interventions aimed at bolstering intrinsic motivation to promote sustained engagement and enjoyment in running. Future research using longitudinal approaches to assess shifts in motivation and training choices will expand the knowledge base of the role of motivation over time. Capitilising on multifaceted interventions that use psychological and behavioural strategies may support engagement and maintenance of running and physical activity amongst broader public health efforts to promote active communities.

Chapter 7

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Chapter 8

Appendices

Appendix 3.1 Consolidated criteria for reporting qualitative studies (COREQ).

No. Item	Guide questions/description	Explanation	Reported on Page #
Domain 1: Research team			
Personal characteristics			
1. Interviewer	Which author/s conducted the interview?	All individual semi-structured interviews were conducted by the primary researcher (CB).	63
2. Credentials	What were the researcher's credentials? E.g. Ph.D, M.D.	CB, PhD candidate JF, PhD JA, PhD HB, PhD AC, PhD	Reported here in Appendix 3.1
3. Occupation	What was their occupation at the time of the study?	CB, PhD candidate, Clinical Exercise Physiologist JF, Senior lecturer JA, Senior lecturer HB, Lecturer AC, Senior lecturer	Reported here in Appendix 3.1
4. Gender	Was the researcher male or female?	CB and AC are female, and JF, JA and HB are male	Reported here in Appendix 3.1.
5. Experience and training	What experience or training did the researcher have?	CB is an Accredited Exercise Physiologist and has completed training courses to establish an	Reported here in

		understanding of qualitative research, with further advice provided by AC and AM who are researchers in sport and exercise psychology with experience in qualitative research.	Appendix 3.1.
Relationship with participants			
6. Relationship established	Was a relationship established prior to study commencement?	The principal researcher (CB) had established contact with four current runners who were approached to gather an initial interest in participating.	Reported here in Appendix 3.1.
7. Participant knowledge of the interviewer	What did the participants know about the researcher? E.g., personal goals, reasons for doing the research	Participants were informed of the background and aims of the study before the interview and were emailed a participant information sheet prior to the interview. Participants were also informed of the interviewer's running experience.	Reported here in Appendix 3.1.
8. Interviewer characteristics	What characteristics were reported about the interview/facilitator? E.g. bias, assumptions, reasons and interested in the research topic	CB explained her interest in the research area and that this study formed part of a PhD, with result to inform a larger randomised controlled trial. CB has competed in numerous running events	Reported here in Appendix 3.1.

		and has coached a small number of athletes.	
Domain 2: Study design			
Theoretical framework			
9. Methodological orientation and Theory	What methodological orientation was stated to underpin the study? E.g. grounded theory, discourse analysis, ethnography, phenomenology, content analysis	An ontological relativism paradigm underpins this study. This is described in our methodology within the manuscript.	60
Participant selection			
10. Sampling	How were participants selected? E.g., purposive convenience, consecutive, snowball	A purposive sampling technique was used to select a representative sample from those who expressed interest in participating. A snowball design was then used, where participants were encouraged to consider friends/family who may be interested in participating. A larger number of discontinued runners interested in participating were coming from the Eastern states of Australia (New South Wales, Victoria predominantly). An attempt was then made to recruit discontinued runners from elsewhere in Australia, given the potential relation to COVID-19 related	62 and here in Appendix 3.1.

		restrictions affecting these runners.	
11. Method of approach	How were participants approached? E.g., face-to-face, telephone, mail, email	An advertisement was posted on social media onto three of the researcher's personal social media pages. A sponsored advertisement through University of South Australia's business team was also posted on Facebook. If interested, participants were prompted to email the primary researcher or University of South Australia Clinical Trial Facility.	63 and here in Appendix 3.1.
12. Sample size	How many participants were in the study?	In total, 29 participants were in the study (18 current runners, 11 discontinued runners).	65.
13. Non-participation	How many people refused to participate or dropped out? Reasons?	Eight people were interested and provided the participant information sheet but did not confirm an interview time. Five participants were ineligible for the discontinued runner group as they stopped running over >12 months ago. No other participants refused to participate or dropped out.	Reported here in Appendix 3.1.
Setting			

14. Setting of data collection	Where was the data collected? E.g., home, clinic, workplace	All data was collected via Zoom calls.	63
15. Presence of non-participants	Was anyone else present besides the participants and researchers?	An experienced qualitative researcher (AM) supervised the pilot interviews and initial four interviews to ensure appropriate guidance and methodological alignment. All other interviews were conducted without anyone else present.	63
16. Description of sample	What are the important characteristics of the sample? E.g. demographic data, date	The final sample consisted of 18 current recreational runners (11 male, 7 female, mean age 40.9 years) and 11 discontinued runners (3 male, 8 female, mean age 41.3) from across Australia. These are described in Tables 2 and 3.	66-67
Data collection			
17. Interview guide	Were questions, prompts, guides provided by the authors? Was it pilot tested?	To facilitate the line of questioning and ensure consistency, an interview guide was developed. The guide was developed through a systematic process that began with a brainstorming session to generate a pool of potential questions, which were categorised into themes such as	Page 223; Interview Guide in Appendix 3.4

		motivation, previous running experience, discontinued running, and education. Questions were organised from general to specific, with probing questions, to facilitate a natural flow during interviews. The guide was refined through pilot testing with a small group of participants to ensure clarity and relevance, resulting in the final version used for data collection. The questions from the guide underwent initial pilot testing with both a current and discontinued runner. This allowed us to gather feedback on the appropriateness of the questions. Subsequent refinements were made based on feedback and discussions with the research team. The final guide included questions such as 'what motivates you to run?', 'what impacts your motivation?' and 'what obstacles may make it difficult for you to go for a run?' (Appendix 2).	

18. Repeat interviews	Were repeat interviews carried out? If yes, how many?	No repeat interviews were carried out.	Reported here in Appendix 3.1.
19. Audio/visual recording	Did the research use audio or visual recording to collect the data?	All interviews were visually and audio recorded.	Reported here in Appendix 3.1.
20. Field notes	Were field notes made during and/or after the interview or focus group?	Yes, notes were made during data collection.	Reported here in Appendix 3.1.
21. Duration	What was the duration of the interviews or focus group?	The mean duration was 47 mins (SD = 7 mins), ranging from 36 minutes and 1 hour 6 minutes.	65-66
22. Data saturation	Was data saturation discussed?	Yes, however data collection was deemed complete once recruitment strategies were exhausted.	Reported here in Appendix 3.1.
23. Transcripts returned	Were transcripts returned to participants for comment and/or correction?	Yes, transcripts were cleaned and sent to participants via email to provide an opportunity to review not only the accuracy of the transcripts, but encouraged to provide additional data and insight.	60
Domain 3: Analysis and findings			
Data analysis			

24. Number of data coders	How many data coders coded the data?	CB and AC independently coded the first 20% and discussed the data to establish themes and subthemes. CB then independently coded all interviews.	65
25. Description of the coding tree	Did authors provide a description of the coding tree?	A coding tree can be provided upon request to the corresponding author.	Reported here in Appendix 3.1.
26. Derivation of themes	Were themes identified in advance or derived from the data?	Themes and subthemes emerged from the data.	69-81
27. Software	What software, if applicable, was used to manage the data?	Otter.ai (Los Altos, California, USA) was used to transcribe and clean the audio files. Transcripts were then uploaded to NVivo (QSR International 2020), where analysis took place.	64
28. Participant checking	Did participants provide feedback on the findings?	No, participants did not provide feedback but the published paper will be sent to all participants.	88
Reporting			
29. Quotations presented	Were participant quotations presented to illustrate the themes/findings? Was each quotation identified? E.g. participant number	Yes, participant quotes are included throughout the manuscript. Quotes are presented by identifying whether the client was a current or discontinued runner, followed by their age e.g.,	Reported here in Appendix 3.1.

		discontinued runner (aged 47).	
30. Data and findings consistent	Was there consistency between the data presented and the findings?	Yes, all data presented is an interpretation from the raw data (transcribed interviews), with direct quotes used throughout.	Reported here in Appendix 3.1.
31. Clarity of major themes	Were major themes clearly presented in the findings?	Yes, throughout the 'Findings' section, five main themes were identified.	69-81
32. Clarity of minor themes	Is there a description of diverse cases or discussion of minor themes?	Yes, minor themes are also described for each main theme.	69-81

Appendix 3.2 Ethics Approval

From: no_reply@unisa.edu.au
Sent: Thursday 27 May 2021 4:38 PM
To: Chloe Blacket, John Arnold, Joel Fuller, Hunter Bennett, Alyson Crozier, Human Ethics
Subject: Application Approved.

Dear Applicant,

Re: Ethics protocol " Barriers and enablers of running participation of regular and discontinued runners: a qualitative analysis" (Application ID: 203828)
Thank you for submitting your ethics protocol for consideration. Your protocol has been considered by the E1 Committee Review Group.
I am pleased to advise that your protocol has been granted ethics approval and meets the requirements of the National Statement on Ethical Conduct in Human Research. Please note that the E1 Committee Review Group's decision will be reported to the next meeting of the Human Research Ethics Committee for endorsement.
Please regard this email as formal notification of approval.
Ethics approval is always made on the basis of a number of conditions detailed at http://www.unisa.edu.au/res/forms/docs/humanresearchethics_conditions.doc; it is important that you are familiar with, and abide by, these conditions. It is also essential that you conduct all research according to UniSA guidelines, which can be found at http://www.unisa.edu.au/res/ethics/default.asp
Please note, if your project is a clinical trial you are required to register it in a publicly accessible trials registry prior to enrolment of the first participant (e.g. Australian New Zealand Clinical Trials Registry http://www.anzctr.org.au/) as a condition of ethics approval.

Best wishes for your research.
Executive Officer
UniSA's Human Research Ethics Committee CRICOS provider number 00121B

This is an automated email and cannot be replied to. Please direct your query to humanethics@unisa.edu.au.

Appendix 3.3 Participant information sheet

University of South Australia
Allied Health & Human Performance

PARTICIPANT INFORMATION SHEET

Barriers and enablers of running participation of regular and discontinued runners: A qualitative analysis

Research Team

PhD Candidate:	**Miss Chloe Blacket**
Email:	chloe.blacket@mymail.unisa.edu.au
Principal Supervisor:	**Dr John Arnold**
Email:	John.Arnold@unisa.edu.au
Phone:	(08) 8302 1329
Co-Supervisor:	**Dr Joel Fuller**
Email:	joel.fuller@mq.edu.au
Co-Supervisor:	**Dr Hunter Bennett**
Email:	Hunter.Bennett@unisa.edu.au
Co-Supervisor:	**Dr Alyson Crozier**
Email:	Alyson.Crozier@unisa.edu.au

What does my participation involve?

You are invited to participate in this research investigating the barriers and enablers to running participation conducted through the Alliance for Research in Exercise, Nutrition and Activity (ARENA) Research Centre at the University of South Australia.

This Participant Information Sheet aims to inform you of this research project, the processes involved, and what your participation in the study will involve if you decide to take part in this project. We encourage you to read the information carefully, and to ask questions about anything you don't understand or want to know more about.

Participation in this research is completely voluntary. If you do not wish to take part, you do not have to. If you decide to take part and later change your mind, you are free to withdraw your responses from the project for up to 2 weeks after interview completion before they are de-identified and eligible for inclusion in the project. If you decide you would like to participate in this project, you will be asked to provide verbal consent at the beginning of the interview. By consenting, you are telling us that you have read and understand this Participant Information Sheet, consent to take part in the research project and to the use of your information as

described, to have the interview audio recorded and understand that all data will be treated as confidential and used only for the purposes of this research project.

This project will explore the barriers and enablers to running in many different people from a range of running backgrounds, demographics and experiences. We aim to explore reasons for stopping running, not including injury, illness or pregnancy, in adults aged 18-65 years old. You may be eligible for participation but be excluded purely based on similarities very close to that of other participants. This does not discount the value of your running experiences. We are very appreciative of your interest in participating and hope this does not deter you from applying to participate in future studies.

What is the purpose of this research?

The aim of this study is to explore and understand the reasons behind why people no longer run. This project will form part of Miss Chloe Blacket's PhD thesis.

What does participation in this research involve?

Your participation will involve a one-on-one interview via Zoom (online conferencing application). You will be asked a series of questions related to your experience with running, such as how you started running and what factors influenced your running participation and non-participation. The interview will last approximately 40 minutes at a time convenient for you. You will need to have downloaded or have access to the Zoom application and be connected to a reliable internet source. The interview will be audio recorded. We require your microphone to be switched on. Turning on your camera is preferred but optional and video footage will not be analysed.

Possible Benefits: All participants who are eligible and complete an interview will receive an honorarium of a $20 VISA gift card as reimbursement for their time. This gift card will be sent electronically to the participant's nominated email address once the interview is complete. Additionally, we hope that sharing your experiences may help you to reflect on your unique running journey and factors in your life that may contribute to the continuation or discontinuation of running. Your participation may help to inform a future study for new and regular runners, health professionals and researchers to help promote lifelong exercise.

Possible risks: It is not anticipated that there are any risks to participation in this study.

What will happen to my results/information?

Basic information such as your name, email address and/or phone number will be collected for the sole purpose of contacting you. Verbal consent to participate will be obtained at the outset of the interview, and audio recorded for documentation. During the interview, the researcher may make extra notes on an interview protocol form. Responses to interview questions will not be

linked to your identity. The audio recording of the interview will be deidentified, (e.g. Female, 38yrs, discontinued runner) and retained in a confidential password protected folder on the UniSA ARENA server accessible only by the research team without accompanying identifiable information. Likewise, transcription files will be kept in a confidential password protected folder on the UniSA Server accessible only by the research team, where it will be kept for five years upon completion of the project. Transcriptions will be used for data analysis when all interviews are complete. All records containing personal information, such as that obtained when initially made to contact you, will remain confidential and no information which could lead to identification of any individual will be released unless required by law.

This study forms part of a PhD thesis. Data collected from this study may be used for further analysis within the larger thesis if necessary, for which separate ethics approval will be sought. While all data collected will be de-identified, participants can elect to be contacted in the future for participation in future studies that may follow on from this one. Contact details of participants will be saved on the UniSA server in a confidential file separate from data collected from participants. Results are intended to be disseminated via thesis publication, journal article, research papers and conference presentation. Participants will be informed when disseminated results become available. Participants can also elect to receive a copy of the final report of this study if desired.

This project has been approved by the University of South Australia's Human Research Ethics Committee (Protocol #203828). If you or third parties have any ethical concerns about the project or the way it is conducted please contact the Executive Officer of UniSA HREC in the first instance, email: humanethics@unisa.edu.au or ph: 8302 3118. If you have any questions regarding the study, please contact Chloe Blacket at chloe.blacket@mymail.unisa.edu.au.

3.4 Interview Guide

INTERVIEW GUIDE

Interviewee: Discontinued / Current *Please circle*

Age:

Gender:

Interviewer: Miss Chloe Blacket

Date:

Survey sections completed:

[ ] 1A: Introduction

[ ] 1B: Verbal Consent and Protocol Summary

2. Discontinued Runner

[ ] 2A: Motivation

[ ] 2B: Previous Running

[ ] 2C: Discontinued Running

[ ] 2D: Education

3. Current Runner

[ ] 3A: Motivation

[ ] 3B: Previous Running

[ ] 3C: Discontinued Running

[ ] 3D: Education

Other topics discussed

Topic	Brief Comments

Post-interview comments

1A. Introduction

Thank you again for participating in our study exploring factors that contribute to your running participation/experience. We aim to understand what may have promoted or hindered your running participation. Our study does not aim to evaluate your fitness or performance, rather we are trying to understand what factors are important in long-term running participation. This study will help to inform an intervention to help running behaviour in new runners.

Do you have any further questions about this study at this time?

1B. Verbal consent to participate and protocol summary

To assist our interview today, we would like to audio record this conversation. Only the researchers involved in this project will have access to the recording. To participate in this study, we require your verbal consent. By giving your verbal consent to participate in this study, you acknowledge that:

1. The required procedures and time involved have been explained and any questions you have pertaining to the study have been answered to your satisfaction.
2. You have read the Participant Information Sheet and have been given the opportunity to discuss the information and your involvement in the study.
3. You understand that your involvement and identity is strictly confidential and no information that reveals your identity in any way will be revealed.
4. You understand that you can withdraw from the interview at any time up until 2 weeks after the interview, whereby all responses will become anonymous and eligible for inclusion in the dataset.
5. You understand that your participation in completely voluntary and you are not under any obligation to consent.
6. You consent to the audio recording of the interview including all your responses, which will be stored securely for at least five years upon completion of the project and manuscript publication in a confidential folder on the UniSA server accessible only by the research team.

7. You understand that transcription data will be securely stored for at least five years upon completion of the project and manuscript publication in a confidential folder on the UniSA server accessible only by the research team.
8. You consent to the use of information disclosed in the interview for the purpose of this research and possible future research for which further ethical approval may be obtained.

We have planned this interview to last approximately 30-40 minutes. During this time, we have several questions we would like you to answer.

Do you consent to participating in this study?

Yes, I consent to participating in this study.

No, I do not consent to participating in this study.

Participation in future studies (end of interview)

Would you be interested in participating in future studies aiming to promote running participation?

Yes, I consent to the research team keeping my contact information and agree to be contacted by the research team for participation in future studies.

No, I do not want the research team keeping my contact information for future study involvement.

Would you like to receive a copy of the final report after completion of this study?

Yes, I would like to receive an email with the final report of this study.

No, I do not wish to receive the final report of this study.

DISCONTINUED RUNNER

2A. MOTIVATION

1. Tell me about your running experience?
2. Tell me about what initially got you into running?
    a. Probe: Why did you start running?
3. What motivated you to run?
    a. Probe: Why did that motivate you?
    b. Probe: Why was that a motivating factor for you?
    c. Probe: Why was that important for you?
4. What impacted your motivation to run?
    a. Probe: What increased your motivation?
    b. Probe: What reduced your motivation?
5. Did your motivation change during your time running?
    a. Probe: Explain how and why your motivation changed?
6. Can you tell me some things about running that either made it enjoyable or not enjoyable?
    a. Probe: Can *you give an example of when you felt that way?*
7. What obstacles or barriers did you face that made it difficult to go for a run?
    a. Were there any times you overcame instances when you were less motivated to run

2B. PREVIOUS RUNNING

8. When you were running, how did you fit running into your schedule?
    a. Probe: How did you fit a run into your day/week?
    b. Probe: Would you consider running was a 'habit'/regular activity for you, and why or why not?
    c. Probe: Were there any ways to ensure you always had time available for running?
9. Did you have any specific goals related to your running?
        i. Probe: What was/were your running goals?
        ii. Probe: How supported did you feel in your running goals?

10. Thinking back to when you were running (FITT):
    d. How often were you running in a typical week?
    e. How long did each run tend to go for (km/metres/hours/minutes)?
    f. How long were you running regularly/[answer from previous] for? (days/months/years)?

2C. DISCONTINUED RUNNING

11. Tell me about the reasons why you decided to stop running?
    a. Probe: Can you explain more about that?
12. What do you believe influenced your decision to stop running?
    a. Probe: Can you provide an example?
13. How do you feel about running now?
    a. Probe: How do you feel about running since you stopped?
    b. Probe: What do you think about when you see other people running?
14. Was there any type of support you had with your running?
    a. Probe: Can you give an example of how this/they supported your running?
    b. Probe: What support *do you believe would have helped you continue running?*

2D. EDUCATION

15. What do you wish you knew about running that might have helped you continue?
    a. Probe: What information would have helped you continue running?
16. What do you believe is the most important factor that would help someone continue running?
    b. Probe: Which running-related factor do you believe will have the most influence on continued participation
    c. Probe: What would you tell someone to do if they were looking to start running?
17. What would have been a useful way for you to receive information about running when you started?
    d. Probe: What are you more likely to learn from?
18. If a running coach or health professional was to deliver a 12-week course about how to help people continue to run throughout their life, what would you expect to be included in the course?
19. How often would you like to access information to help you continue running?

20. What kind of monitoring or follow-up would you expect during the 12-week course?

CURRENT RUNNER

3A. MOTIVATION

- Tell me about what initially got you into running?
    - *Probe: Why did you start running?*
- What motivated you to run *initially*?
    - *Probe: Why did that motivate you?*
    - *Probe: Why was that a motivating factor for you?*
    - *Probe: Why was that important for you?*
- What do you think motivates you to run *now?*
    - *Probe: Why does that motivate you?*
    - *Probe: Why is that a motivating factor for you?*
    - *Probe: Why is that important for you?*
- What impacts your motivation?
    - *Probe: What improves your motivation?*
    - *Probe: What reduces your motivation?*
- Can you tell me some things about running that either make it enjoyable or not enjoyable for you?
    - *Probe: Can you give an example of when you felt that way?*
- What obstacles or barriers do you face that may make it difficult to go for a run?
    - *Probe: Are there any times you overcame instances when you were less motivated to run (then follow up with how)?*

3B. CURRENT RUNNING

- Why do you choose to fit running into your life?
- *How* do you fit running into your life?
    - *Probe: Would you consider running habitual for you, and why?*
    - *Probe: How do you fit a run into your day/week?*

- *Probe: What strategies or prompts do you have in place to remind you to run or to ensure you always had time available for running?*
- *Probe: Has this always been the case?*

- Thinking about your running, (FITT):
  - How often are you running (days per week/fortnight/month)?
  - How long does each run tend to go for (km/metres/hours/mins)?
  - How long have you been running regularly/[answer from previous] for? (days/months/years)?
- Do you have specific goals related to your running?
  - *Probe: What was/were your running goals?*
  - *Probe: How supported do you feel in your running goals?*

3C. DISCONTINUED RUNNING

- Can you tell me about a time when you discontinued running for a period of time, have come close to or considered discontinuing?
  - *Probe: Explain more about that time*

3D. EDUCATION

- Thinking back to when you started running, are there things you wish you knew more about?
  - *Probe: Are there strategies or information about running that you know now, that you didn't when you were running? If so, what?*
- What do you believe is the most important factor for someone to run and continue running?
  - *Probe: Which running-related factor do you believe will have the most influence on continued participation*
  - *Probe: What would you tell someone to do if they were looking to start running?*
- Where do you get most of your information about running from?
  - *Probe: Who do you go to about your running questions?*
  - *Probe: Who influences your running the most?*
  - *Probe: Think about people you might follow on social meeting, athletes, other runners in your circle?*
- What would be a useful way for you to receive information about running?

    - *Probe: What are you more likely to learn from?*
- How often would you like to access information to help you continue running?
- If a running coach or health professional was to deliver a 12-week course about how to help people continue to run throughout their life, what would you expect to be included in the course?
- What kind of monitoring or follow-up would you expect during the 12-week course?

Appendix 4.1 Published article titled: *Just Run: Development of a theory-based motivational online intervention for promoting ongoing running participation*

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Just Run: Development of a theory-based motivational online intervention for promoting ongoing running participation

Chloe T. Blacket [a,*], Joel T. Fuller [b], Hunter Bennett [a], Alyson J. Crozier [a], Jenelle K. Dziano [c], John B. Arnold [a]

[a] Alliance for Research in Exercise, Nutrition and Activity (ARENA), Allied Health & Human Performance, University of South Australia, Australia
[b] Department of Health Sciences, Faculty of Medicine, Health and Human Sciences, Macquarie University, Sydney, Australia
[c] Centre for Heart Rhythm Disorders, University of Adelaide, South Australia, Australia

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ABSTRACT

Running is a popular form of physical activity yet discontinuation is common. Interventions targeting physical activity adoption have shown modest effects, often with little translation into long-term participation, which may limit the health benefits available to the wider community. This paper details the development of a new online running intervention (*Just Run*) aimed at improving continuation of running activity in new runners through a motivational and psychological lens, including aspects of design, content, refinement, and usability testing. A six-step intervention mapping process was used to develop a theory-based online intervention using a mix of research designs. Key stakeholders including runners, coaches and relevant experts in physical activity and behavior change provided valuable insight, feedback and refinement of the education to be delivered. The final *Just Run* intervention included ten modules delivered online over twelve weeks to promote ongoing running participation through videos, testimonials, and activities. Key themes identified through the literature and stakeholder engagement process related to goal setting, self-efficacy, intrinsic motivation, social support and overcoming barriers to running participation. Usability testing confirmed the quality and suitability of the education to the target population. *Just Run* has been developed with a range of stakeholders to address an area of unmet need in the adoption and promotion of running. *Just Run* is a robust online intervention that has been designed and pre-tested with positive feedback and unique insights from key stakeholders. Further investigation is required to support its implementation to the wider community.

1. Introduction

Finding the motivation to be physically active on a regular basis is one of the biggest barriers people face in improving their physical and mental health and well-being (Herazo-Beltrán et al., 2017). For those who are physically active, running is amongst one of the most popular forms of physical activity (PA) worldwide. In the United States alone, 48.9 million people (approximately 14% of the population) were reported to run at least once in 2021 (Statista, 2022). Running is one of the most accessible, time-efficient forms of PA, with physical and mental health improvement (Oswald et al., 2020) and sense of personal achievement (Evans, 2020) amongst the most common reasons people choose to run.

Despite its popularity and potential for improving health, there is a large proportion of people who discontinue running. Of those who get as far as participating in a running event, 30% stop running within nine months, with most people discontinuing within the first three months (Bertelsen et al., 2017). Discontinuation of any PA, including running, has negative consequences for individuals, but also places strain on public health systems as it detracts from the protective health benefits associated with regular PA (Pedisic et al., 2020). This highlights the need for strategies to promote not only the adoption of running, but its ongoing participation.

Several psychological factors have been identified as determinants of PA participation. Perceived competency, enjoyment, motivation, self-efficacy, overcoming barriers, and social support are some common factors that have been examined in relation to behavior change in PA (Pereira et al., 2021; Teixeira et al., 2012). Understanding the interplay of these psychological factors with PA engagement can inform interventions that promote long-term running, with some recent,

* Corresponding author. University of South Australia, Allied Health and Human Performance, GPO Box 2471, Adelaide, SA 5001, Australia.
E mail address: chloe.blacket@mymail.unisa.edu.au (C.T. Blacket).

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promising integration of these factors in running interventions having recently been published (Johnson et al., 2020; Tsai et al., 2021). While previous research has predominantly focused on injury-related explanations for running discontinuation, targeting psychological factors to facilitate adoption and maintenance of running are equally vital.

Physical activity interventions have been explored through various approaches, including in-person and online delivery methods (Favieri et al., 2022; Marcus et al., 2007). Online behavior change interventions to support PA maintenance have shown promising outcomes in a number of health behavior change studies (Schroé et al., 2020), and online education has been shown to be protective against sustaining running-related injury (Hespanhol et al., 2018). However, the effectiveness of an online intervention to promote ongoing running participation from a non-injury related perspective is unknown. Preventing premature discontinuation of running will rely on implementing and engaging appropriate behavior change constructs and frameworks, adapted to the running population.

This paper outlines the method of developing the *Just Run* intervention, drawing on the Intervention Mapping (IM) process (Bartholomew-Eldredge et al., 2016). The six-step IM process is a problem- and theory-driven protocol that has been useful in several health-related behavior change interventions. Crucially, our focus on an online delivery model was fundamental to our aim. This online emphasis was established from the outset to integrate advantages and nuances offered by the digital environment at the time of development. The aim of this study was to produce an online program for ongoing running participation in new runners using IM Steps 1 through 4, and develop an implementation plan (IM Step 5) that can inform a future randomized control trial to evaluate program efficacy (IM Step 6).

2. Methods

2.1. Overview of development process

The development of the *Just Run* intervention involved an interdisciplinary team of researchers, clinicians and tertiary educators in behavior change and PA participation, exercise psychology and physiology, physiotherapy, and injury prevention. The intervention was selected to be delivered online due to its cost-effectiveness, low participant burden and ability to target a broad population (Verhagen et al., 2014). Intervention development for *Just Run* involved a six-step systematic process following the IM framework (Bartholomew-Eldredge et al., 2016) involving a needs assessment (Step 1), the identification of outcomes and change objectives (Step 2), program design (Step 3) and program production (Step 4). A program implementation plan (Step 5) and evaluation plan (Step 6) are outlined for future testing. Fig. 1 provides an overview of the developmental processes in alignment with the IM steps. Ethical approval was granted by the University of South Australia's Human Research Ethics Committee for the qualitative components (protocol number 203828) and pre-testing of the intervention development (protocol number 203978).

2.2. Step 1: Needs assessment

Needs assessment supported the development and implementation of a tailored intervention to effectively target running maintenance. First, a narrative literature review was completed using relevant search terms (i.e., running, motivation, engagement) in Embase, CINAHL, Web of Science, Sport Discus and Medline databases (Supplement 1) to establish normative needs. This identified relevant research and established applicable methodologies to determine how our intervention could best apply and integrate successful behavior change components. Secondly, through interviews with both current recreational runners and those who discontinued running, we delved into the felt and expressed needs of individuals engaged in or considering running. This qualitative approach allowed us to capture participants' perceptions, challenges, motivations, and preferences related to sustaining a running routine. Regarding comparative needs, we contrasted these experiences and perspectives of current recreational runners with those who had discontinued running. This comparative analysis enriched our understanding of the distinct needs and challenges between these groups. Thirdly, we consulted with content experts to provide feedback and further insight into the constructs identified through the review and interviews to further assess normative needs.



Fig. 1. Developmental process of Just Run with Intervention Mapping steps, objectives and methods.

2.2.1. Literature review

Articles of interest included experimental and review papers that included at least one behavior change theory or technique within a running or PA context. If there was uncertainty about the papers' relevance or applicability to our research aim, the wider research team was consulted to discuss suitability. Once we identified the studies, discussion amongst the research team then identified the most critical, relevant articles that could help shape the intervention. As a research team, it was deemed important to place greater weighting on running-specific and online studies due to the greater applicability to the target population.

2.2.2. Current and discontinued runner interviews

To further determine how the intervention would align with the needs of the target population, eighteen current recreational runners and eleven discontinued runners from Australia were recruited via advertisements posted op social media platforms to participate in semi-structured one-on-one interviews (Supplement 2). We aimed to recruit participants from a broad range of ages, sex and running experience.

2.2.3. Expert consultation

Seven content experts were identified via the research team based upon their research in the realm of behavior change and PA. Initial contact was made with these external experts to gauge interest in providing advice on the identified themes for the purpose of this study. A short 30-min online meeting was then arranged with the seven experts who agreed to participate. Experts were informed of the aims of the project and the current state of the intervention development. To guide these discussions, prompting questions were curated and individualized for each expert targeting topics regarding the practical application of their research to a running context, insight into applying the findings of their research into a digital platform, and potential digital delivery strategies that they recommend to ensure uptake and understanding. Following this consultation, some experts shared additional resources via email including relevant research articles or intervention activities, providing further assistance to frame the intervention development. To ensure transparency, follow-up communication was conducted when necessary to seek clarification on specific aspects of our approach.

2.3. Step 2: Identification of outcomes and change objectives

Through the needs assessment conducted in Step 1, the behaviors to be targeted within the intervention were identified. The subsequent focus was on translating these concepts into actionable change objectives. This involved examining how these interventions facilitated behavior change approaches and activities, with particular focus on PA and online interventions. The change objectives, derived from this synthesis of evidence and understanding, provided a roadmap for developing the intervention strategies. This process ensured that the intervention was theoretically grounded and tailored to the specific needs of novice and returning runners.

2.4. Step 3: Program design

Psychological theories and frameworks were reviewed to inform the theoretical methods that may help achieve the constructs and change objectives derived from the literature review, interviews and expert consultation in Step 1 and 2. Practical strategies using the Behavior Change Wheel (BCW) (Michie et al., 2011) and BCT Taxonomy were reviewed to classify the potential approaches. Application of these techniques in online behavior change interventions were reviewed to ensure they could be implemented in this intervention design. Behavioral goals based on psychological theories and BCT strategies were selected that best aligned with each construct to address the influences of change. The order of education delivery was a critical development step discussed by the interdisciplinary research team and informed through the literature review, theory identification, interviews and expert consultation.

2.5. Step 4: Program production

2.5.1. Program production

The technical development of *Just Run* was undertaken over several months throughout 2020/21. The *Just Run* website was hosted on a purpose-built external Moodle site (E-Moodle) through the University of South Australia after different website layouts were investigated for the optimal way to present the information. Videos were selected to deliver majority of the education due to the capacity to engage viewers and communicate multiple BCTs seamlessly with real-world scenarios. Additional optional resources (e.g., activities, external sites, podcasts) were available to supplement knowledge and offer diverse learning opportunities at the participants' discretion. Video and activity content presented in portable document format [PDF] files were designed using Canva (Perth, Western Australia, AUS), an online graphic design platform, with video content uploaded edited on Panopto (Seattle, Washington, USA), and embedded onto the *Just Run* site. The primary researcher with several years' experience using Canva for a healthcare business was responsible for the design and development of all elements, which were then reviewed by the interdisciplinary team. A graphic designer with expertise in science communication was consulted to review the accessibility, design and general aesthetics of the materials and site.

Each video targeted aspects of the primary and secondary psychological outcomes, including motivation, basic psychological needs, and self-efficacy to promote running participation. A range of animations, short interview clips, voice-overs, avatars and videos were incorporated throughout to ensure relevant, appealing and engaging materials. Closed captions were included on each video for accessibility. Videos were kept short to facilitate engagement and reduce the time burden for participants based on principles for maximising student learning (Brame, 2016).

2.5.2. Pre-testing

Expert researchers who were previously consulted in Step 1, as well as running coaches and recreational runners of various experience, age and sex were approached through purposive sampling to provide feedback on the intervention. In total, ten participants, including three running coaches, two experts and two current runners agreed to review the education and were provided a 3-week access period to the Moodle site housing the 10 modules. The two experts only provided feedback on their specific content area.

Pre-testing participants were requested to respond to a purpose-built feedback questionnaire (Supplement 3). The questionnaire was based on established user-experience surveys and recommendations (Schrepp, 2015) which included Likert scales for statements and open-ended questions regarding the site and education materials. Frequency and percentage (%) of respondents selecting each statement (e.g., "the activities were well presented with clear instruction on how to complete them") were calculated and displayed graphically.

2.6. Step 5: Program implementation plan

The *Just Run* online intervention was comprehensively and systematically designed to address the complex factors that influence running, incorporating essential elements guided by expert consultation and feedback. The feasibility of implementing *Just Run* will be evaluated in a future two-arm randomized controlled trial (RCT) (protocol registration ACTRN12622001064796). Feasibility outcomes will include adherence, retention, dropout rate, and determination of productive recruitment methods.

2.7. Step 6: Evaluation plan

Step 6 will involve investigating *Just Run* in a fully powered RCT, building on the feasibility study outcomes from Step 5. The aim will be to test the effectiveness of the refined version of the *Just Run* intervention on sustained running. The anticipated outcomes will align with the sustainability of running participation, capturing motivation, wellbeing, basic psychological needs (autonomy, competence, and relatedness), and self-efficacy. The RCT will align with CONSORT guidelines (Eldridge et al., 2016) with the protocol to be prospectively registered with the Australian New Zealand Clinical Trials Registry.

3. Results

3.1. Step 1: Needs assessment

3.1.1. Findings of literature review

Literature searching revealed several common themes critical in PA maintenance, with some supported by evidence specific to running. Among the twenty-six studies identified, fifteen specifically examined running behavior, while the remaining eleven centered on general PA behavior. Within these studies, we identified approximately twenty behavior change techniques (BCTs) based on the BCT Taxonomy V1 (Michie et al., 2013). Goal setting and planning (i.e., BCT 1.1 goal setting) (Hochli et al., 2018), self-efficacy (i.e., BCT 15.3 focus on past success) (Sniehotta et al., 2005), intrinsic motivation (i.e., BCT 2.4 self-monitoring of behavior) (Teixeira et al., 2012) and social support (i.e., BCT 3.3 social support [emotional]) (Stevens et al., 2019) were the most commonly cited factors contributing to PA maintenance (Fokkema et al., 2019). The most influential theories used by studies to understand PA determinants were Social Cognitive Theory (Bandura, 1991), Self-efficacy Theory (Bandura et al., 1999), Self-Determination Theory (Deci & Ryan, 1985) and the Transtheoretical Model (Prochaska & Velicer, 1997). These theories have been extensively researched and supported, providing a solid theoretical foundation for informing the design of our intervention and guiding strategies to address barriers and facilitators to sustained running participation. In addition, injury prevention education and strength training were behaviors specific to running that were identified as important and relevant to runners, despite not necessarily aligning with BCTs or theories. Important overarching themes emerging from these processes assisted the development of core constructs to behavior. Overall, important themes emerging from these processes assisted the development of core constructs to behavior.

Although not all identified studies were explicitly targeting behavior change, most of the studies discussed these behavior change techniques as potential antecedents to the health behavior. This review identified promising BCT and theories that can influence PA behavior, and highlighted the need for further investigation into the application of these factors into a novel intervention that addresses long-term running behavior in new runners specifically.

3.1.2. Findings from the current and discontinued runner interviews

Qualitative interviews highlighted common barriers to running participation, in conjunction with key themes, including goal setting, placing a priority on running and social support as key enablers (Blacket et al., 2023). These findings were used to guide intervention components targeted to runners specifically, and are consistent with findings from a recent qualitative study (McCormick, Pedmanson, Jane, & Watson, 2024).

3.1.3. Findings from expert consultation

Through expert consultation, previously unidentified constructs deemed important for behavior maintenance including, self-compassion (i.e., having the compassion for oneself as we do for a friend, which can facilitate health behavior) (Neff, 2014), habit formation (i.e., through repetition, behaviors gradually become routinized) (Gardner & Rebar, 2019), group dynamics (i.e., group identification is associated with greater running participation) (Stevens et al., 2019) and overcoming cognitive barriers (i.e., reframing can reduce decisional struggle to exercise) (Locke et al., 2019).

3.1.4. Findings of needs assessment

Based on the comprehensive needs assessment conducted through a narrative literature review, interviews with current and discontinued runners, and expert consultations, common personal and environmental determinants were identified. Selected behavior change techniques with the corresponding mechanism of action from the BCT Taxonomy (v1) (e.g., BCT Taxonomy 1.1 Goal setting [behavior]) (Michie et al., 2013) are shown in Table 1 (see Supplement 4 for expanded descriptions of inclusion rationale).

3.2. Step 2: Identification of outcomes and change objectives

In Step 2, the behaviors identified in Step 1 were translated into actionable change objectives and core goals (Table 1). This involved aligning the identified behaviors with target theoretical constructs such as autonomy, competency, self-efficacy, self-awareness, intrinsic motivation, and identity. For these objectives, a diverse set of BCTs (Michie, 2013) was carefully selected for each module. These BCTs were chosen based on their relevance to the targeted theoretical constructs and the overall goals of the intervention. The inclusion rationale for each BCT was defined, linking it to established psychological theories and empirical evidence. For example, instructional elements (BCT 4.1) were incorporated to enhance self-efficacy and competency in running, while self-incentive (BCT 10.7) and identification of self as a role model (BCT 13.1) were utilized to foster intrinsic motivation.

The general descriptions of implementations within each module were crafted to create a structured and scaffolded learning experience. For instance, the '*Your Guide to Just Run*' module introduced participants to PA guidelines and strength training recommendations to help build foundational knowledge and facilitate a sense of competency with being physically active. Throughout the process, the intervention was designed to be cohesive, with each module building upon the previous one, creating a logical and progressive content flow. Optional activities within each module were crafted to reinforce video content. This systematic approach ensured that the *Just Run* intervention is grounded in psychological theory and designed to be effective, engaging, and tailored to the needs of novice and returning runners.

3.3. Step 3: Program design

The interdisciplinary research team established the importance for each module to sequentially build on the previous module, starting with the most pertinent information (e.g., value identification) through to self-monitoring and more reflective modules (e.g., review running progress). A guide was developed to outline the ten modules, listing: (1) theoretical construct(s) targeted; (2) specific behavioral goal(s); (3) techniques targeted (BCT Taxonomy); (4) rationale: link between the theoretical constructs, goals, and techniques; and (5) the mode of delivery of each technique (e.g., video, resources and activities) (Table 1).

3.4. Step 4: Program production

3.4.1. Findings of program production

The final intervention included 10 modules delivered over 12 weeks, with a new module made available each week. The graphic designer identified opportunities to enhance accessibility features across the materials and the website, which included implementing a user-friendly navigation structure, a TabTopics interface, to facilitate easy browsing for individuals with varying levels of digital literacy. Videos summarizing the preceding 6 weeks of content were delivered in week 6 and 12 to provide an opportunity for participants to revisit missed modules.

Table 1
Description and rationale of Just Run modules with reference to Behavior Change Techniques (BCT) Taxonomy (v1) (Michie et al., 2013).

Module	Core Goals	Target Theoretical Constructs	BCT Taxonomy no.	Inclusion Rationale	General Description of Implementations
1. Your guide to Just Run	To promote autonomy and competency in running activity by imparting exercise knowledge, highlighting health benefits.	- Autonomy - Competency - Self-efficacy	4.1. Instruction on how to perform the behavior; 4.2. Information about antecedents	Enhancing understanding of running behavior, with guidance, can boost self-efficacy towards PA (Pereira et al., 2021).	First, participants introduced to PA & strength training guidelines. Next, participants encouraged to explore what makes PA enjoyable. Finally, a graded approach for injury prevention introduced.
2. FITT [a] training principles	To increase self-efficacy by informing individuals on training factors to structure running activity.	- Autonomy - Competency - Self-efficacy	4.1. Instruction on how to perform the behavior	Building awareness of running behaviors to promote competency to safely run (Adriaensens et al., 2014; Bandura et al., 1999; Verhagen et al., 2021).	First, participants introduced to training principles. Finally, tracking sheets including RPE can build awareness on how to structure and monitor running.
3. My values	To align running with personal values, & foster reflection on personal motives, distinguishing between autonomous & controlled motives.	- Self-awareness - Autonomy - Identity - Intrinsic motivation	10.7 Self-incentive; 13.1 Identification of self as role model; 13.5 Identity associated with changed behavior	Self-incentive targets self-determined motivation through prompting individuals to consider how running can help them to achieve satisfaction and fulfilment of value-based goals (Hochli et al., 2018). Exercise identity can facilitate more autonomous forms of regulation (Kwasnicka et al., 2016).	First, participants encouraged to reflect on values, self-identity, and aspirations. Next, avatars exemplify how running can promote alignment with values. Finally, participants may write a letter to their future self, fostering running behavior in harmony with values.
4. My running goals Part 1: Goal network Part 2: Action planning	To facilitate confidence to set and achieve goals. Promote awareness of individualized choices for sustainable running.	- Self-regulation - Self-efficacy - Competency - Intrinsic motivation	1.1 Goal setting (behavior); 1.4 Action planning; 2.3 Self-monitoring of behavior; 2.4 Self-monitoring of outcome(s) of behavior	Goal setting fosters self-regulation towards maintain running (Heatherton, 2011). Self-monitoring can assist in overcoming barriers & prevent relapse (Kwasnicka et al., 2016).	First, participants revisit values from previous module. Next, participants encouraged to create personal goal network, including core values & 'ideal self,' intermediate goals & subordinate strategies to successfully achieve goals. Finally, participants encouraged to use running action plan to manage setbacks.
5. Guide to self-compassion	To promote self-compassion choices with running. To challenge negative mindsets while encouraging decisions aligned with individual's best interest.	- Competency - Wellbeing - Self-regulation - Intrinsic motivation - Self-efficacy	11.2 Reduce negative emotions; 15.2 Mental rehearsal of successful performance; 15.3 Focus on past success; 15.4 Self-talk	Self-compassionate choices can foster a sense of wellbeing (Semenchuk et al., 2018). Reflecting on success can contribute to ongoing adherence (Brand & Ekkekakis, 2018).	First, participants learn about exercise self-compassion. Next, strategies to re-frame negative mindsets explored. Finally, prompt reflection on applying self-compassion in challenging situations discussed. A podcast link to 'The Academy of Imperfection' featuring Ben Crowe provided.
6. Building self-awareness as a runner	To raise awareness of supportive running patterns through reflecting on their behavior & strategies for achieving their goals.	- Autonomy - Intrinsic motivation - Competence - Self-efficacy	1.5 Review behavior goal(s); 2.4 Self-monitoring of outcome(s) of behavior;	Through reviewing progress, people can continue with their current behavior (providing a sense of competency), or modify their goal or behavior to facilitate success (Swann et al., 2021). Individuals prompted to reflect on intrinsic goals to foster autonomy (Vansteenkiste et al., 2004). Monitoring outcomes can enhance greater self-efficacy towards maintaining PA (Michie et al., 2009; Pekmezi et al., 2009).	First, runners learn the role of self-awareness in running behavior. Next, participants prompted to review Strava data, exploring challenging & enjoyable runs. Finally, participants prompted to reflect on what makes certain runs more enjoyable.
7. Support for success Part 1: Healthy habits Part 2: Social support	To develop supportive habits, promote physical & social antecedents to running behavior, & explore available support avenues through supportive relationships.	- Intrinsic motivation - Sustainability - Relatedness - Self-regulation	Part 1: 1.2 Problem solving; 7.1 Prompts/cues; 8.1 Behavioral practice/rehearsal; 8.3 Habit formation; 12.1 Restructuring the physical environment; Part 2: 3.1 Social support (unspecified), 3.2 Social support (practical), 3.3 Social support (emotional); 12.2 Restructuring the social environment	Problem solving to overcome current barriers can facilitate an increase in PA (Olander et al., 2013), assisting individuals to sustain the behavior. Encouraging daily routines that include PA can facilitate successful behavioral regulation (Rebar et al., 2014). Social support through finding suitable running groups or partners may assist individuals to maintain it (Rhodes & Sui, 2021).	First, the establishment of healthy habits & mechanisms for positive reinforcement in running is briefly outlined. Next, examples used to highlight the role of social supports in fostering running success, accommodating both individual & group preferences. Finally, participants are guided through establishing habits. Additional resources (e.g., links for creating running routes, running groups & video by James Clear on effective habit formation) provided.

(continued on next page)

Table 1 (*continued*)

Module	Core Goals	Target Theoretical Constructs	BCT Taxonomy no.	Inclusion Rationale	General Description of Implementations
8. Overcoming my running barriers	To recognize challenges & barriers to running, & boost self-regulation by promoting diverse tools & resources.	- Competence - Self-efficacy - Autonomy - Self-regulation - Intrinsic motivation	1.2 Problem solving; 7.1 Prompts/cues	Problem solving to overcome current barriers can facilitate an increase in PA (Olander et al., 2013), assisting individuals to sustain the behavior. Prompts/cues may help individuals associate the desired behavior with a trigger in their environment to facilitate adoption and maintenance (Olander et al., 2013).	First, the 'Capability, Opportunity & Motivation towards Behavior' model (Michie et al., 2011) introduced to identify barriers to running. Next, common barriers are addressed in individual videos, featuring runner testimonials. Finally, participants are provided a journaling activity for to overcome barriers, along with factsheets summarizing strategies to tackle obstacles.
9. Review running progress	To review strategies' success & re-evaluate running goals. Encourage reflection on goals, and adjusting strategies as needed.	- Self-efficacy - Self-regulation	1.5 Review behavior goal(s); 1.6 Discrepancy between current behavior & goal	By prompting reflection on progress, participants can modify strategies, fostering a sense of self-efficacy (Bandura et al., 1999). Reflecting on discrepancy between ones' goal and current behaviors may promote self-regulation & effort towards the goal behavior (Carver & Scheier, 1982).	First, participants prompted to reflect on progress & success. Next, past modules & activities summarized, encouraging revisiting useful education, reviewing goal achievement, and strategies for running maintenance. Finally, a podcast link on running progression included.
10. I am a runner	Encourage participants to align selves with new behavior, building a runner's identity to support ongoing motivation.	- Identity - Competency - Intrinsic motivation	13.1 Identification of self as role model; 13.5 Identity associated with changed behavior	By fostering self-redefinition in line with new health behavior (e.g., running identity) (Strachan et al., 2013), individuals are likely to sustain running behavior. Exercise identity has been associated with intrinsic motivation (Strachan et al., 2015), capturing more autonomous forms of regulation (Kwasnicka et al., 2016).	First, short testimonials from runners sharing personal meaning of running presented. Next, examples of 'being a runner' highlighted. Finally, a short interview with a local ParkRunner & link to the Australian documentary film 'I'm Not A Runner' provided.

[a] *PA*, physical activity; *FITT*, frequency, intensity, time (duration), type; *RPE*, Rating of Perceived Exertion

Each module included an average of 1.5 videos, ranging from 1 to 5 per week. The average length of a video was 4:05 min, ranging from 2:26 to 6:39 min. There was an average of one activity per module (examples shown in Fig. 2 and 3), with additional resources such as podcasts, running groups and documentary films. It was expected that each module would take approximately 4–19 min per week over 12 weeks.

3.4.2. *Findings of pre-testing*

Pre-testing participant feedback indicated a positive overall response to statements regarding the site and content (Supplement 5). High quality visuals, logical structure and topics, and the effectiveness of personal narratives and stories were commonly stated as enjoyable components of the education. Suggested areas of improvement with the decided outcome (e.g., adding clearer instructions for all activities) can be found in Supplement 6, with results used to revise future implementations of *Just Run*. The main threats to engagement and usability were identified and several improvements were made regarding user experience, design, content development and technical performance. For example, to facilitate access to the activities and resources, documents could be downloaded in bulk at the beginning of enrolment. In addition, activities were integrated onto the online E-Moodle format wherever possible to improve the experience of those without convenient access to a printer or PDF editor. Access to the site may be requested by emailing the corresponding author.

4. Discussion

Just Run is one of the first theory-based online approaches to improve ongoing running participation from a psychological and motivational perspective. The aim was to design an online intervention using the IM process to support ongoing running in new runners. *Just Run* was developed based on known approaches to exercise maintenance and adapted for the target population (new runners) following the IM framework. Although running is an accessible form of PA, discontinuation threatens the capacity for the known health benefits from regular participation to manifest, feeding into the rising tide of physical inactivity and chronic disease. Approaching running participation from a motivational and psychological lens through an online program was thus deemed necessary to enhance the potential and future reach of *Just Run*.

Final constructs to support the intervention aim stemmed from literature searching, interviews, and consultation with relevant experts and key stakeholder groups. The IM approach ensured the complexities of behavior change could be systematically implemented, reported and replicated in the running context. The systematic approach used in the development of the present study was guided by previous intervention designs incorporating the IM process for weight loss maintenance (Marques et al., 2021) and PA and sedentary behavior change (Direito et al., 2018). A key aspect of the *Just Run* design is the carefully scaffolded modules progressively building upon each other, offering a structured and guided learning journey to sustainable running.

The findings for promoting intrinsic motivation (Ryan & Deci, 2000), goal setting (Swann et al., 2021), self-monitoring and coping planning (Schroé et al., 2020), self-efficacy (Bandura et al., 1999) and autonomy towards the behavior (Gillison et al., 2019) were key constructs shown to have an impact on long-term health behavior engagement. The needs assessment and identification of outcomes and change objectives in the present study revealed similar determinants and processes of change found in other intervention designs within health and running interventions (e.g., goal setting and self-monitoring behavior) (Johnson et al., 2020; Marques et al., 2021; Pereira et al., 2021; Tsai et al., 2021). One construct, self-compassion, was a concept deemed critical in encouraging healthy behavior maintenance towards intrinsic motivation. Evidence and advice from the experts also supported the role of



Fig. 2. 'My values' module activity prompting reflection on identity, values and aspirations.

self-compassion in the self-regulation of PA, but not necessarily associated with the amount of activity completed (Wong et al., 2021). Although self-compassion strategies alone may not influence running participation, feedback from stakeholders for *Just Run* indicated the self-compassion module was imperative to include. It is possible that within a broader psychological intervention, education to promote self-compassion may facilitate running adherence and maintenance in this population, suggesting it to be an important addition to this motivational intervention.

Previous online interventions targeting running behavior have focused on injury-prevention strategies (Adriaensens et al., 2014; Hespanhol et al., 2018; Pereira et al., 2021; Vallio et al., 2021). Only one of these studies outlined their intervention design using the IM approach (Vallio et al., 2021). Considering the complexities of running behavior, demonstrated in the logic models of the present study, it is questionable whether such interventions would have long term influence on running behavior. Although demonstrating a level of effectiveness in preventing injury in this population, these studies only address a small portion of the possible array of contributors to running, and are unlikely to appropriately target the psychological and motivational tools to facilitate ongoing running participation. Given the significant injury risk and prevalence in novice runners (Videbæk et al., 2015), interventions should not only aim to address how to prevent injury, but provide strategies on how to psychologically cope during such adversity, and continue to successfully integrate running throughout their lives. Furthermore, adherence to running programs in clinical trials have been



Fig. 3. 'My running goals' module activity, labelled 'Running action plan' to help overcome future barriers.

poor, illustrating that the nature and design of the intervention should be carefully considered (Nielsen et al., 2020). *Just Run* effectively integrates all these factors, based on a comprehensive understanding of influences of health behavior change, and unifies the physical and psychosocial aspects of running into a single intervention.

Addressing a critical gap, our intervention targets running maintenance through an online motivational lens. Prior online behavior change attempts vary in success (Favieri et al., 2022; Marcus et al., 2007), but promising adherence in online running injury prevention studies (Adriaensens et al., 2014; Hespanhol et al., 2018) highlight the feasibility of this design within the running community. Developing an online running intervention from a psychological and motivational lens that is both informative, not time-intensive and appealing were critical considerations for the design to promote adherence. Including educational videos with short interviews with runners, supporting activities and external resources were essential to the quality of the final product. The estimated time commitment of *Just Run* is 4–19 min per week over 12 weeks, in what should be low burden to participants. This is consistent with other online interventions targeting this population (Adriaensens et al., 2014; Marques et al., 2021; Pereira et al., 2021).

Involvement of key stakeholders to inform, develop and refine the *Just Run* design was a strength of this intervention. Extensive international expert consultation and refinement to inform the final constructs and strategies assisted in ensuring the intervention was based on current recommendations. Usability testing demonstrated the promising translation of theories into the implementation of the online intervention. Limitations include the need for more extensive review, usability testing and implementation trials to inform future, large-scale rollout to test the feasibility of *Just Run* in a more applied setting. A comprehensive and systematic search was undertaken to inform our IM process, but this was not a formal systematic review and undertaking such a review might identify additional, relevant factors to consider for promoting running sustainability. Not exclusively focusing on running specific behavior-change studies in our literature review could be viewed as a limitation. While the decision to review literature more broadly was made to ensure all relevant literature was used to inform the intervention, it may have also resulted in less directly applicable literature being used in its design. This potential limitation will be considered when interpreting the future feasibility of this intervention. Further, including novice runners in the needs assessment and pre-testing could have provided additional insights. There is also a potential lack of generalizability of the intervention due to the runners within the stakeholder group residing in Australia, although many determinants of running behavior that informed the intervention are consistent with previous findings from other countries such as the Netherlands (Fokkema et al., 2019; Menheere et al., 2020) and Spain (Manzano-Sánchez et al., 2020).

In conclusion, this paper provides a comprehensive outline of the design and development of a novel online intervention to promote ongoing running participation in new runners. To the authors knowledge, no intervention has targeted this health problem following the IM process. The robust methodological approach allowed the integration of theory and stakeholder insights to ensure the *Just Run* intervention was appropriate and engaging whilst targeting key psychological and motivational outcomes. While up-to-date frameworks were used to guide intervention decisions, additional feasibility studies to observe changes in user engagement and experience, and randomized controlled trials to assess efficacy in maintaining PA participation will be valuable in understanding the success of this design.

CRediT authorship contribution statement

Chloe T. Blacket: Conceptualization, Data curation, Methodology, Resources, Visualization, Writing – original draft, Writing – review & editing. **Joel T. Fuller:** Methodology, Supervision, Writing – review & editing. **Hunter Bennett:** Methodology, Supervision, Writing – review & editing. **Alyson J. Crozier:** Methodology, Supervision, Writing – review & editing. **Jenelle K. Dziano:** Writing – review & editing. **John B. Arnold:** Methodology, Supervision, Writing – review & editing.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Data availability

Data will be made available upon reasonable request to the corresponding author.

Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.psychsport.2023.102581.

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Appendix 4.2 Statement of Authorship for Published article titled: *Just Run: Development of a theory-based motivational online intervention for promoting ongoing running participation.*

University of South Australia

Statement of Authorship

Title of Paper	Just Run: Development of a theory-based motivational online intervention for promoting ongoing running participation
Publication Status	☒ Published ☐ Accepted for Publication ☐ Submitted for Publication ☐ Unpublished and Unsubmitted work written in manuscript style
Publication Details Relevant reference details	Blacket, C.T., Fuller, J.T., Bennett, H., Crozier, A.J., Dziano, J. K. and Arnold, J.B. Just Run: Development of a theory-based motivational online intervention for promoting ongoing running participation. Psychology of Sport and Exercise, 2024. 71: p. 102581.
PRINCIPAL AUTHOR	
Name of Principal Author (Candidate)	Chloe Taneil Blacket
Contribution to the Paper Brief description of your work in this publication	CTB designed the study with support from co-authors. CTB prepared the original and final manuscript.
Overall Percentage (%)	75
Certification	This paper reports on original research I conducted during the period of my Higher Degree by Research candidature and is not subject to any obligations or contractual agreements with a third party that would constrain its inclusion in this thesis. I am the primary author of this paper.
Signature *Signatures will be redacted by the Library at the time of publication*	[redacted] Date 22/5/2024
CO-AUTHOR CONTRIBUTIONS	
By signing the Statement of Authorship, each author certifies that: I. the candidate's stated contribution to the publication is accurate (as detailed above); II. permission is granted for the candidate in include the publication in the thesis; and III. the sum of all co-author contribution is equal to 100% less the candidate's stated contribution.	
Name of Co-Author 1	Dr John Arnold

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% Contribution to the Paper	5	
Signature *Signatures will be redacted by the Library at the time of publication*	[redacted]	Date 23/05/2024
Name of Co-Author 2	Dr Joel Fuller	
% Contribution to the Paper	5	
Signature *Signatures will be redacted by the Library at the time of publication*	[redacted]	Date 23/05/2024
Name of Co-Author 3	Dr Hunter Bennett	
% Contribution to the Paper	5	
Signature *Signatures will be redacted by the Library at the time of publication*	[redacted]	Date 22/05/2024
Name of Co-Author 4	Dr Alyson Crozier	
% Contribution to the Paper	5	
Signature *Signatures will be redacted by the Library at the time of publication*	[redacted]	Date 23/05/2024
Name of Co-Author 5	MsJenelle Dziano	
% Contribution to the Paper	5	
Signature *Signatures will be redacted by the Library at the time of publication*	[redacted]	Date 23/05/2024

Appendix 4.3 Search terms to identify existing literature related to behavioural influences on running behaviour and Physical Activity maintenance

Embase

exp runner/

psychology/ or motivation/

1 and 2

CINAHL

(MH "Running, Distance") AND (MH "Psychology, Sports")

Web of Science

(run OR runner OR runners OR runs OR running OR ran) AND motivat* OR psych* OR reason* OR engag*

Sport Discus

run* AND motivat* OR psych* OR reason* OR engag*

Medline

("run*) AND (("motivat*") OR ("psych*") OR ("reason*") OR ("engage*")

Appendix 4.4 Pre-testing participant consent form and pre-testing feedback questionnaire.

This project has been approved by the University of South Australia's Human Research Ethics Committee. If you have any ethical concerns about the project, or questions about your rights as a participant, please contact the Executive Officer of this Committee, Tel: +61 8 8302 6330; Email: humanethics@unisa.edu.au

SECTION 1: CONTACT AND PROJECT DETAILS

Researcher's Full Name	Chloe Taneil Blacket
Contact Details	chloe.blacket@mymail.unisa.edu.au
Supervisor's Name	Dr John Arnold
Contact Details	John.Arnold@unisa.edu.au
Project Number	203978
Project Title	JUST RUN: An online motivational and psychological approach to sustainable running

SECTION 2: PARTICIPANT CERTIFICATION

In signing this form, I confirm that:

- The nature and the purpose of the research project has been explained to me. I understand and agree to take part.
- I understand the nature of my involvement in the project.
- I understand that I may not directly benefit from taking part in the project.
- I understand that I can withdraw from the project at any stage and that this will not affect my status now or in the future.
- I confirm that I am over 18 years of age.
- I understand that while information gained during the project may be published, I will not be identified and my personal results will remain confidential, unless required by law.
- I give permission to the use of information or data pertaining to me for the purpose of this research and possible future research for which further ethical approval will be obtained.
- I agree to the research team keeping my contact information for the purpose of being contacted by the research team for participation in future studies, if relevant.

Participant's Signature	*Printed Name*	*Date*

SECTION 3: RESEARCHER CERTIFICATION

I have explained the study to the participant and consider that he/she understand what is involved.

Researcher Signature	*Printed Name*	*Date*
[redacted]	Chloe Blacket	28/04/22

JUST RUN

UniSA Allied Health & Human Performance

Aims

Primary research aim

- Assess the feasibility of a 12 week online educational intervention on psychological factors known to relate to the continuation of exercise versus basic training advice.

Secondary research aims are to

- Determine the effect of a 12 week online educational intervention on psychological factors known to relate to the continuation of exercise versus basic training advice in novice runners.
- Describe running training characteristics and running discontinuation rates between education and control groups to inform future education interventions on novice runners.

Instructions

Please answer the following questions to the best of your ability regarding the JUST RUN UniSA Moodle website. Please highlight your responses where appropriate. The aim of this feedback is to aid the refinement of our intervention. There are no right or wrong answers, so please answer each question to the best of your ability. If you do not wish to respond to a question, you do not have to. We estimate this survey will take approximately 15-25 minutes.

Please note: Only answer based on the modules you were asked to review.

1. How did you access the course and materials?

Mobile	Laptop/desktop	Both

1a. If you accessed the course via mobile, which device/model did you use? Please enter below.

2. Did you experience any difficulties accessing the course or the materials?

Yes	No

2a. If you answered yes, please explain the difficulties you encountered below.

3. The overall structure of the course was logical.

Strongly disagree	Disagree	Neutral	Agree	Strongly agree

3a. Please expand on your response below.

4. The structure of the modules were presented and linked in a logical way.
Consider the order of the modules (if reviewed more than one), the structure of individual modules, the link between videos and activities, etc.

Strongly disagree	Disagree	Neutral	Agree	Strongly agree

4a. Please expand on your response below.

5. The videos were informational.

Strongly disagree	Disagree	Neutral	Agree	Strongly agree

5a. Please expand on your response below.

6. The videos were of a high quality.

Strongly disagree	Disagree	Neutral	Agree	Strongly agree

6a. Please expand on your response below.

7. The avatars and the short interview clips in the videos were useful and appropriate.
(*Avatars = the 'characters' usually with speech bubbles in the videos)*

Strongly disagree	Disagree	Neutral	Agree	Strongly agree

7a. Please expand below.

8. The activities were useful and appropriate for each module.

Strongly disagree	Disagree	Neutral	Agree	Strongly agree

8a. Please expand below.

9. The activities were well presented with clear instruction on how to complete them.

Strongly disagree	Disagree	Neutral	Agree	Strongly agree

9a. Please expand below.

10. The resources (e.g. links to podcasts/websites/groups) were useful and appropriate for each module.

Strongly disagree	Disagree	Neutral	Agree	Strongly agree

10a. Please expand below.

11. The information presented in the modules was accurate (e.g. current evidence, best practice based on your expertise etc).

Strongly disagree	Disagree	Neutral	Agree	Strongly agree

11a. Please expand below.

12. The information presented in the modules were appropriate and relevant for people new to running.

Strongly disagree	Disagree	Neutral	Agree	Strongly agree

12a. Please expand below.

13. I am confident that people new to running could apply this content to help them continue to run.

Strongly disagree	Disagree	Neutral	Agree	Strongly agree

13a. Please expand below.

14. If you found any of the modules to include surprising or unexpected information, please detail below.

15. What are the main things you liked about this course? Please describe below.

16. How could the course be improved? Please describe below.

Thank you for your time in reviewing the Just Run course and modules. Your feedback is greatly appreciated. Note that we may also reach out to discuss your experience via Zoom (15-20 minutes) at a time that suits you.

Appendix 4.5 Expanded description and rationale of Just Run modules with reference to Behaviour Change Techniques (BCT) Taxonomy (v1).

Module	Target Theoretical Constructs	BCT Taxonomy no.	Expanded Inclusion Rationale
1. Your guide to Just Run	Autonomy; competence; self-efficacy	4.1. Instruction on how to perform the behaviour	By building knowledge of the behaviour, it may help people begin to see how running fits in their life (59). 'Instruction on how to perform the behaviour' has been associated with higher physical activity and self-efficacy effect sizes in interventions targeting physical activity (244). Shaping knowledge through providing instruction on the behaviour can pave the way for individuals to make autonomous, informed decisions on integrating running patterns that suit them.
		4.2. Information about antecedents	Reinforcing *why* running is good for general health and prompting consideration on how running can help individuals build it into their life (8, 9). Knowledge about guidelines to being active, and how individuals may begin to move from intention to action can empower self-efficacy for individuals to understand how to successfully integrate running in their life (150).
2. FITT * training principles	Autonomy; competence; self-efficacy	4.1. Instruction on how to perform the behaviour	Building awareness of running behaviours to help promote competence to safely adopt and continue running (169, 173, 174). Understanding basic training principles of running can help individuals feel competent and confident in their ability to effectively structure their running to suit them, enhancing autonomous motivation (245).
3. My values	Self-awareness; autonomy; identity; intrinsic motivation	10.7 Self-incentive	Self-incentive targets self-determined motivation through prompting individuals to consider how running can help them to achieve satisfaction and fulfilment of value-based goals (164).
		13.1 Identification of self as role model	When someone identifies themselves as a role model, people can become more aware of their actions and the impact or influence they may have on others, such as children, friends and colleagues (163).
		13.5 Identity associated with changed behaviour	Finding a meaningful reason to run that relates to ones' identity can help people maintain running in their life (30). Exercise identity has been associated with intrinsic motivation (184) and capturing more autonomous forms of regulation (77).
4. My running goals Part 1: Goal network	Self-regulation; self-efficacy; competence;	1.1 Goal setting (behaviour)	Goal setting can foster self-regulation towards maintaining running behaviour (175). Goal setting can facilitate beliefs that one is capable and competent to achieve the desired behaviour (164).

	intrinsic motivation		
Part 2: Action planning		1.4 Action planning	Action planning mediates the intention-behaviour gap in exercise (246, 247), fostering goal achievement.
		2.3 Self-monitoring of behaviour	Self-monitoring of behaviour assists individuals to develop strategies to overcome barriers and prevent relapse (77). Self-monitoring can positively improve self-efficacy towards physical activity (180). Prompting individuals to monitor their behaviour and progress can foster a sense of competence with physical activity (74), helping the individual towards intrinsic regulation.
		2.4 Self-monitoring of outcome(s) of behaviour	Self-monitoring outcomes of behaviour (e.g., total mileage) may assist in self-regulating running activity each week. Monitoring outcomes can enhance greater self-efficacy towards maintaining physical activity (178).
5. Guide to self-compassion	Competence; wellbeing; self-regulation; intrinsic motivation; self-efficacy	11.2 Reduce negative emotions	Identifying negative thought patterns enables recognition of strategies that can foster self-efficacy towards running behaviour. Defining self-compassionate choices contributes to finding meaning in running, a sense of wellbeing associated with the behaviour, and cultivating a more flexible, sustainable mindset (176, 248).
		15.2 Mental rehearsal of successful performance	Overtime, visualising successful integration of desired behaviour can contribute to their belief in themselves in taking the relevant steps towards goal achievement (249).
		15.3 Focus on past success	Reflecting on past success can aid individuals to feel capable of maintaining behaviour (65). Reflecting on success and affective states connected with previous behaviour can contribute to ongoing adherence (54).
		15.4 Self-talk	Emphasise ones' capability of success with running through verbal encouragement in the form of self-talk (as a source of influence on self-efficacy) (178, 250). Positive

			self-talk can reduce perceived effort in endurance activity, allowing individuals to feel competent in their physical abilities (251).
6. Building self-awareness as a runner	Autonomy; intrinsic motivation; competence; self-efficacy	1.5 Review behaviour goal(s)	Through reviewing progress, people can continue with their current behaviour (providing a sense of competence), or modify their goal or behaviour in order to facilitate success (143). Individuals prompted to reflect on intrinsic goals to foster autonomy (177).
		2.4 Self-monitoring of outcome(s) of behaviour	Self-monitoring of outcome of their behaviour promoted to assist in self-regulating running activity each week. Monitoring outcomes can enhance greater self-efficacy towards maintaining physical activity (178, 179).
7. Support for success Part 1: Healthy habits Part 2: Social support	Intrinsic motivation; self-efficacy; sustainability; self-regulation; relatedness	Part 1: 1.2 Problem solving	Problem solving to overcome current barriers can facilitate an increase in physical activity (180), assisting individuals to sustain the behaviour.
		7.1 Prompts/cues	Prompts/cues can increase self-efficacy for physical activity (180). With appropriate prompts and reminders, individuals' intrinsic motivation for running can improve (218).
		8.1 Behavioural practice/rehearsal	Encouraging daily routines that include physical activity can facilitate successful behavioural regulation (181)
		8.3 Habit formation	Encouraging individuals to develop habits through planning responses to cues in their environment can improve the automatic regulation of the activity, fostering continued activity engagement even when intentions to be active are low (181).
		12.1 Restructuring the physical environment.	By understanding the importance of a supportive environment, participants recognize the potential to decrease external motives & pressures for running (252), thereby lowering the risk of discontinuation (142).
		Part 2:	

		3.1 Social support (unspecified)	Social support can help satisfy ones' sense of relatedness (basic psychological need), helping individuals to become self-determined towards running (253). Social support can increase physical activity participation (198) and facilitate self-regulation towards the goal behaviour (168).
		3.2 Social support (practical)	Social support through practical means (e.g., arranging to run with others) may enable physical maintenance through 'encouragement, resources, and companionship' (254) to fulfil a sense of relatedness with running.
		3.3 Social support (emotional)	Emotional support can promote positive associations with physical activity and facilitate enjoyment, forming a critical role in intrinsic motivation (34).
		12.2 Restructuring the social environment	Social support through finding suitable running groups or partners may assist individuals to maintain the behaviour through aligning their actions to social norms or standards' (182).
8. Overcoming my running barriers	Competence; self-efficacy; autonomy; self-regulation; intrinsic motivation	1.2 Problem solving	By reflecting on challenges and barriers to running activity, participants can define strategies that enhance self-efficacy and confidence in overcoming & reduces relapses (11). Problem solving to overcome current barriers can facilitate an increase in physical activity (180), assisting individuals to sustain the behaviour.
		7.1 Prompts/cues	Prompts/cues can increase self-efficacy for physical activity (180). With appropriate prompts and reminders, individuals' intrinsic motivation for running can improve (218).
9. Review running progress	Self-efficacy; self-regulation	1.5 Review behaviour goal(s)	By prompting reflection on progress, people can assess their running intentions and behaviours, and facilitators and barriers, fostering a sense of self-efficacy in their ability to control their behaviour (169).

		1.6 Discrepancy between current behaviour & goal	Reflecting on the discrepancy between ones' goal and current behaviours, and whether they are aligned or not, may promote self-regulation and greater effort towards the goal behaviour (reducing the discrepancy) (183).
10. I am a runner	Identity; competence; intrinsic motivation	13.1 Identification of self as role model	By fostering self-redefinition in line with new health behaviour (e.g., running identity) (136), individuals are likely to sustain running behaviour.
		13.5 Identity associated with changed behaviour	Finding a meaningful reason to run that relates to ones' identity can help people maintain running in their life (30). Exercise identity has been associated with intrinsic motivation (184), capturing more autonomous forms of regulation (77).

Appendix 4.6 *Just Run* additional content and resources

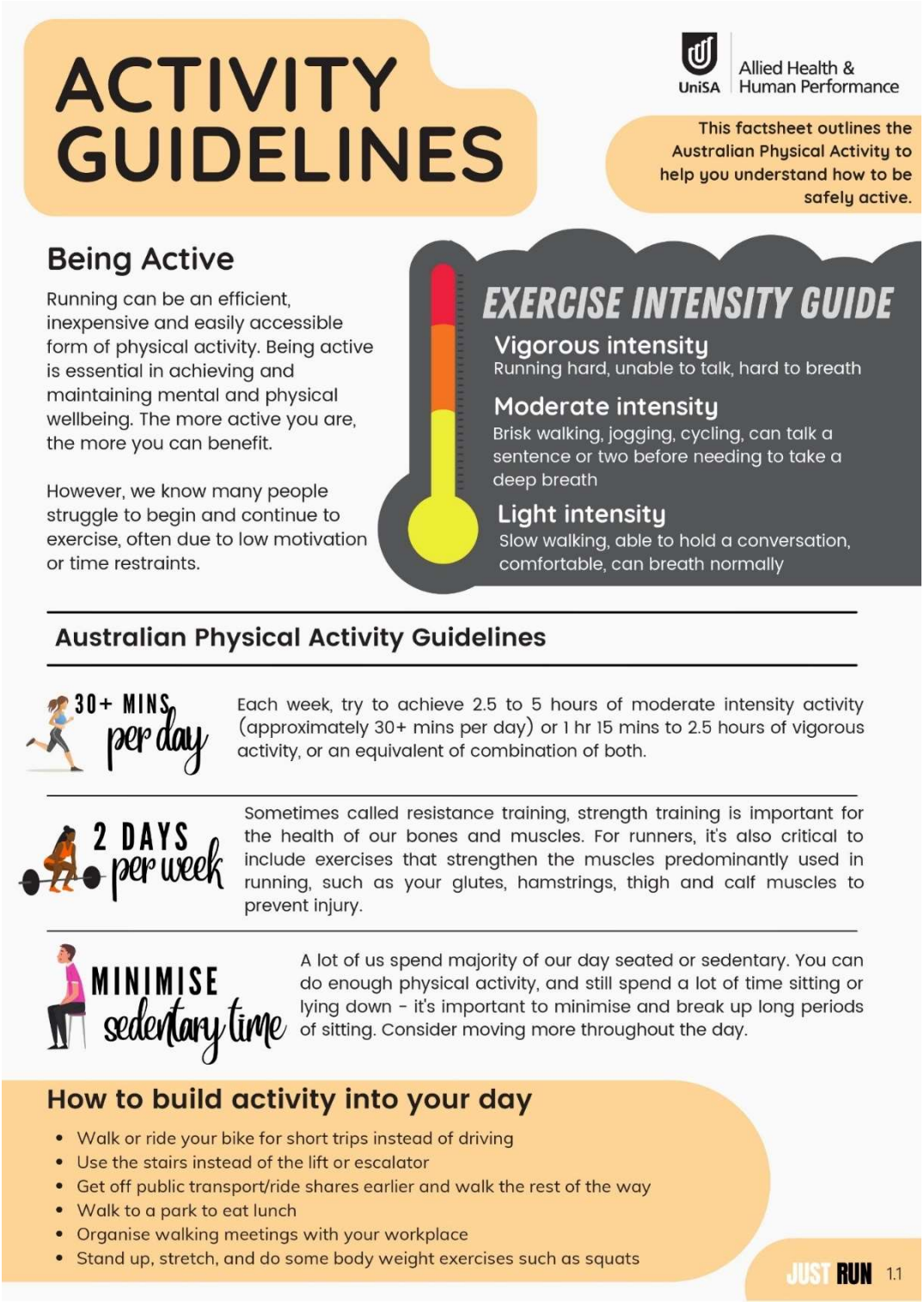


Figure 1. Physical Activity Guidelines



Figure 2. Running Technique Factsheet



Figure 3. Strength Training for Runners Factsheet 1



Figure 4. Strength Training for Runners Factsheet 2

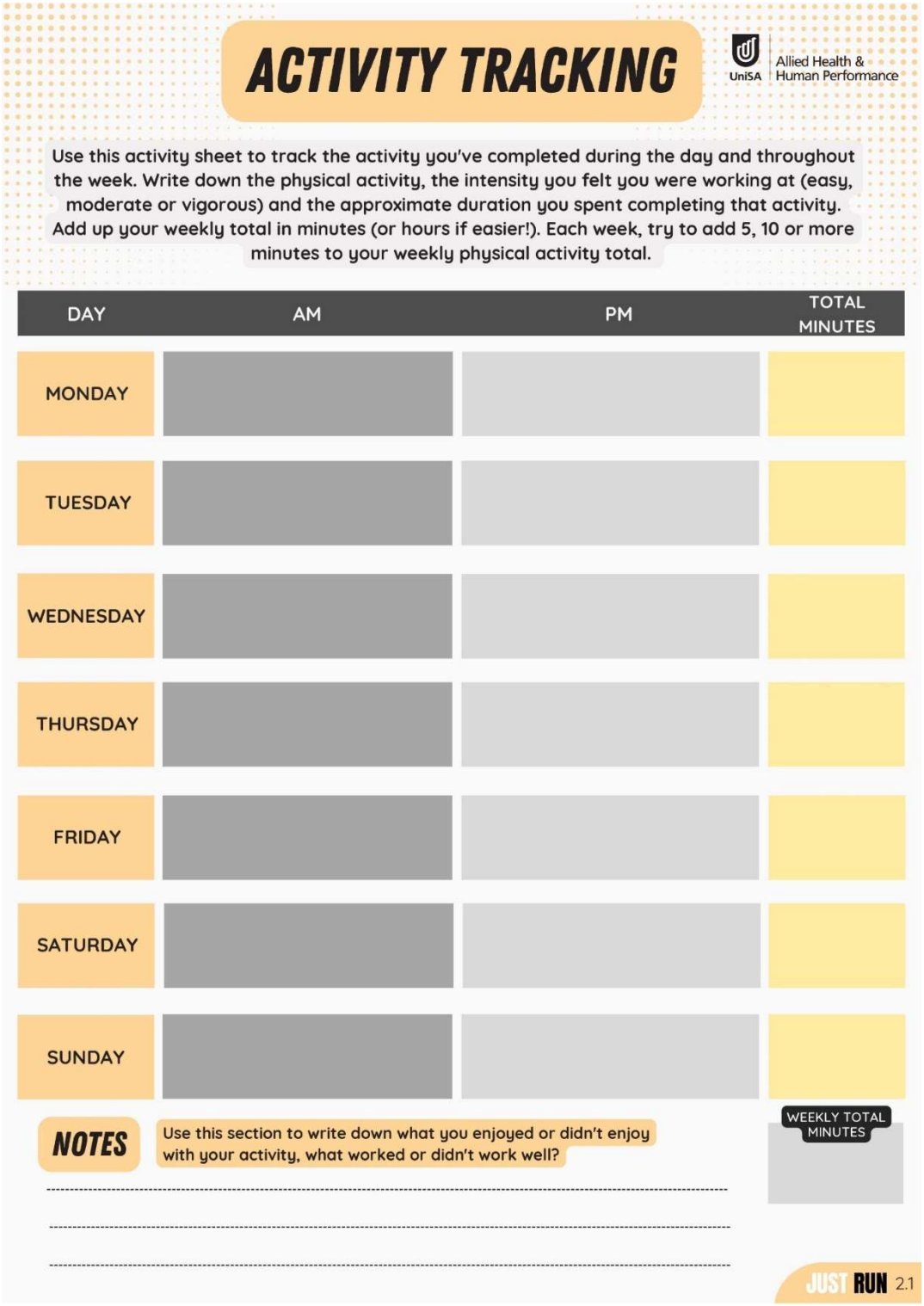
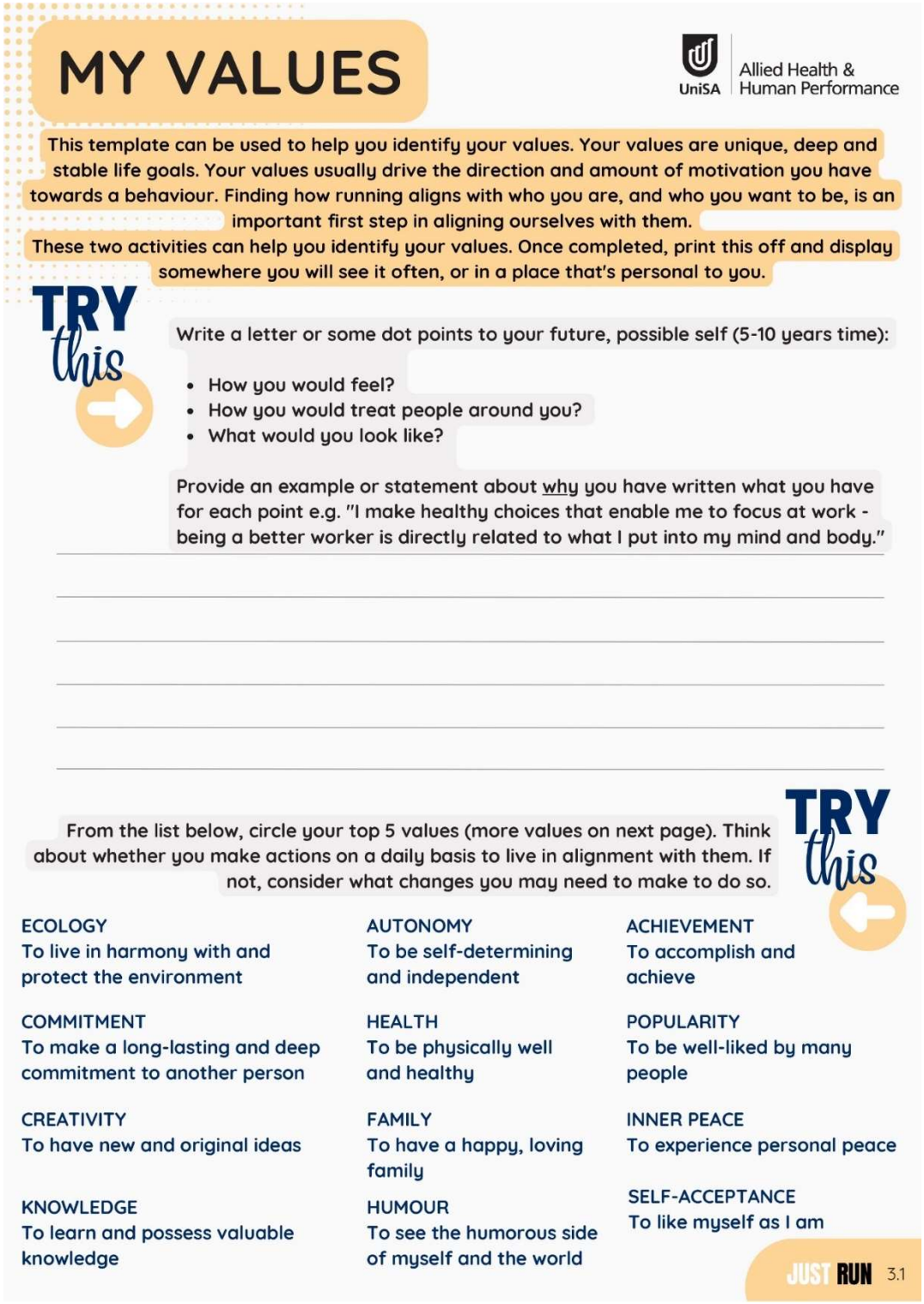


Figure 5. Activity Tracker



Figure 6. Rating of Perceived Exertion Factsheet



MY VALUES

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This template can be used to help you identify your values. Your values are unique, deep and stable life goals. Your values usually drive the direction and amount of motivation you have towards a behaviour. Finding how running aligns with who you are, and who you want to be, is an important first step in aligning ourselves with them.

These two activities can help you identify your values. Once completed, print this off and display somewhere you will see it often, or in a place that's personal to you.

TRY this

Write a letter or some dot points to your future, possible self (5-10 years time):

- How you would feel?
- How you would treat people around you?
- What would you look like?

Provide an example or statement about why you have written what you have for each point e.g. "I make healthy choices that enable me to focus at work - being a better worker is directly related to what I put into my mind and body."

TRY this

From the list below, circle your top 5 values (more values on next page). Think about whether you make actions on a daily basis to live in alignment with them. If not, consider what changes you may need to make to do so.

ECOLOGY
To live in harmony with and protect the environment

AUTONOMY
To be self-determining and independent

ACHIEVEMENT
To accomplish and achieve

COMMITMENT
To make a long-lasting and deep commitment to another person

HEALTH
To be physically well and healthy

POPULARITY
To be well-liked by many people

CREATIVITY
To have new and original ideas

FAMILY
To have a happy, loving family

INNER PEACE
To experience personal peace

KNOWLEDGE
To learn and possess valuable knowledge

HUMOUR
To see the humorous side of myself and the world

SELF-ACCEPTANCE
To like myself as I am

JUST RUN 3.1

Figure 7. My Values



Figure 8. My Values Examples

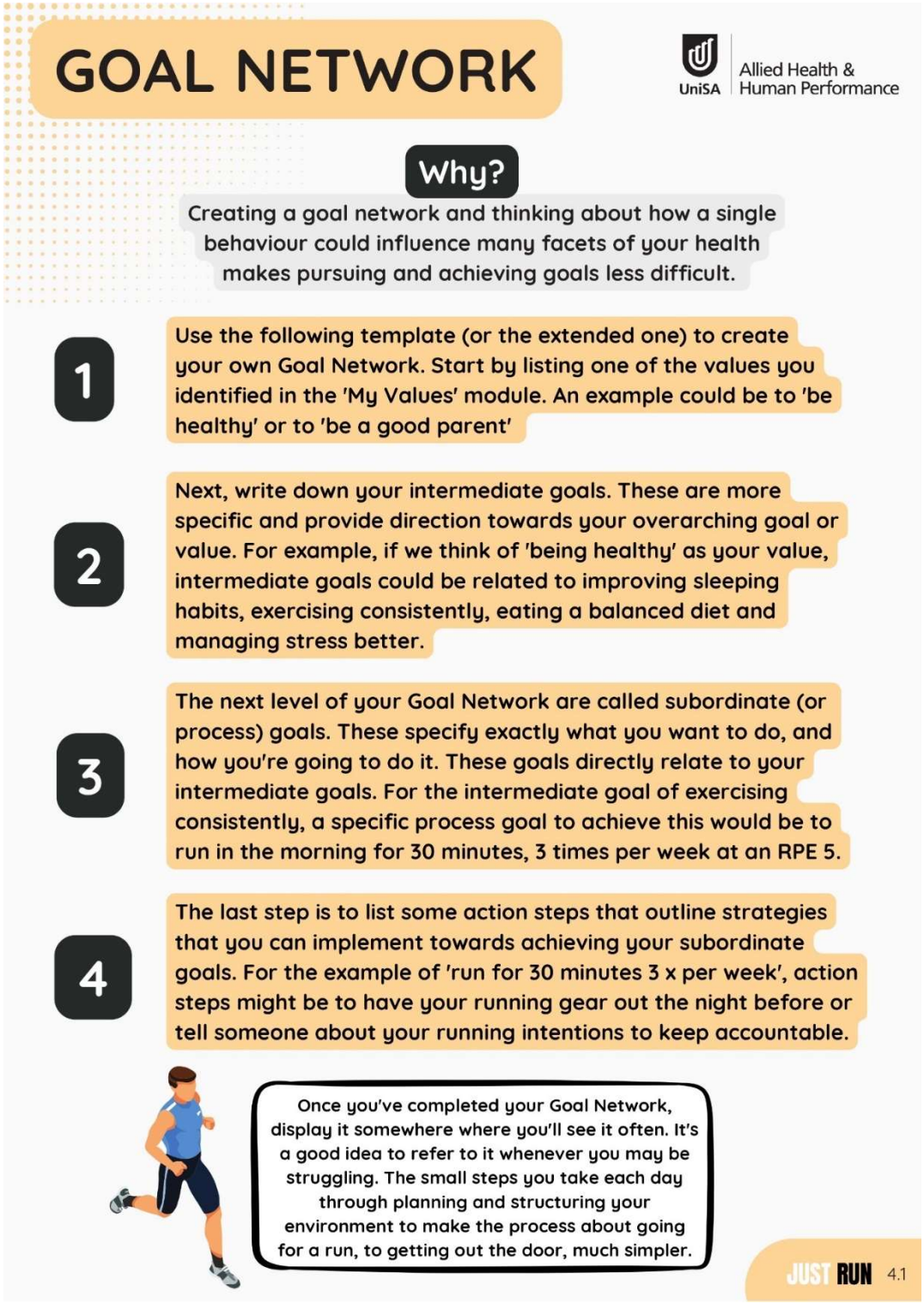


Figure 9. Goal Network Factsheet

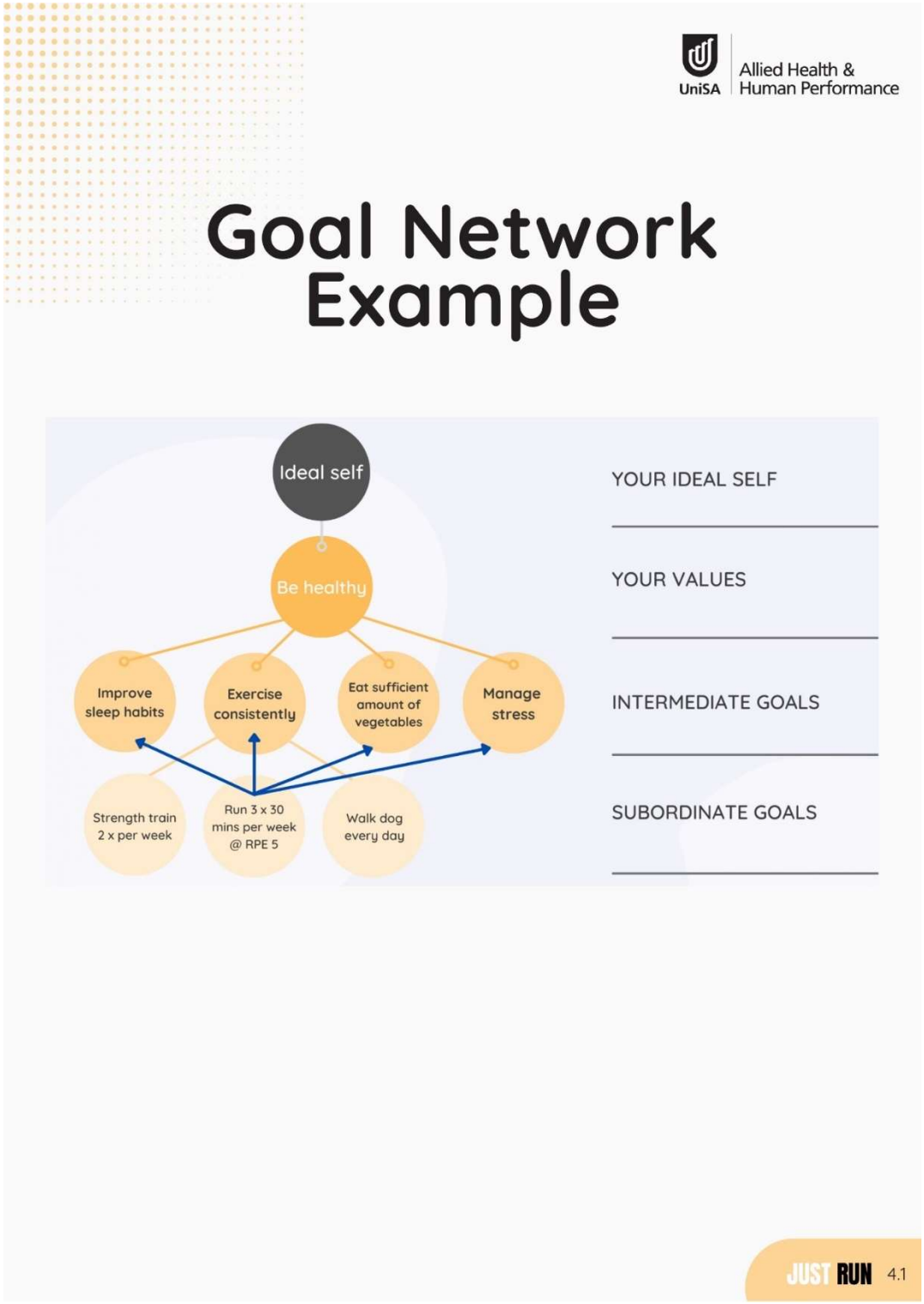


Figure 10. Goal Network Example



Figure 11. Goal Network

Figure 12. Goal Tracker

Goal Tracker

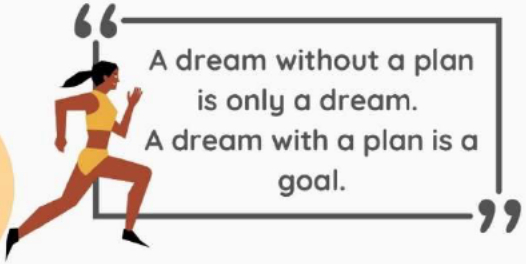
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This activity is to help you keep track of your goals and your readiness to work towards them

Running Goals	Already doing this	Ready to do now	Not ready yet	Start date	Review regularly and note your progress here
EXAMPLE Run 5 km in under 30 minutes		✓		Monday 1st August 2022	Can run at 6 min/km pace for 1km, gradually building by 500m.

How to use a Goal Tracker

- Having a plan to achieve your goals makes a difference
- Write your running goals in the left hand side column
- Identify where you are in reaching that goal
- Write down when you started or when you intend to start working towards your running goals. Make this date within the next 2 weeks
- Write down progress notes regularly to track how you're going





This is what I need to do to stay on top of my running:

My running goals is/are:

I began working towards this goal:

DD / MM / YYYY

I know that I have what it takes to continue running even if life is difficult or I don't feel like it.

I have to put these things in place in order <u>each day/week</u> to help me be successful:

- ✓ Example: I need to run at my goal 5 KM pace in one run per week / I must pre-plan my runs
- ✓
- ✓
- ✓
- ✓
- ✓

If I have been consistent with my running, I can expect to achieve my running goals.

I might need to make small changes to my running if I notice any of these:

- I feel unmotivated to run as often as I would like
- Running feels harder even though I haven't changed my running pace or my running pace has gotten slower
- I am bored with running
- My life circumstances have changed

This is what I can do straight away to get on top of my running goals:

1. Be kind to myself. It's okay to have a rest from running today.
2. Adjust my running goals to what I feel is achievable given my current circumstances.
3. Go for a short run instead of a long run.
4.
5.
6.

I know that running can sometimes feel hard, but I know that every run I do brings me closer to the person I want to be.

JUST RUN 4.4

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I need to make significant changes if any of these happen:

- I feel like I don't want to run at all anymore
- I find the thought of running is enough to put me off
- I haven't run in weeks/months now
- I am injured
- I am sick

NOW IS A GOOD TIME TO CHANGE YOUR RUNNING GOALS

- I will reach out to someone and talk to them about how I'm feeling.
- I can change the context I run in.
- I can organise a run with a friend, explore a new place, compete in a ParkRun or run at a different time of day.
- If I am injured, I will seek advice from my GP or allied health professional.
- If I am sick, I know it's okay to take a break from running until I am feeling well again. I can also seek advice from my GP or allied health professional.

I know that running will always be there. I am in control of my running activity. I listen to my body, and what I need, and take care of myself.

Figure 13. Action Plan

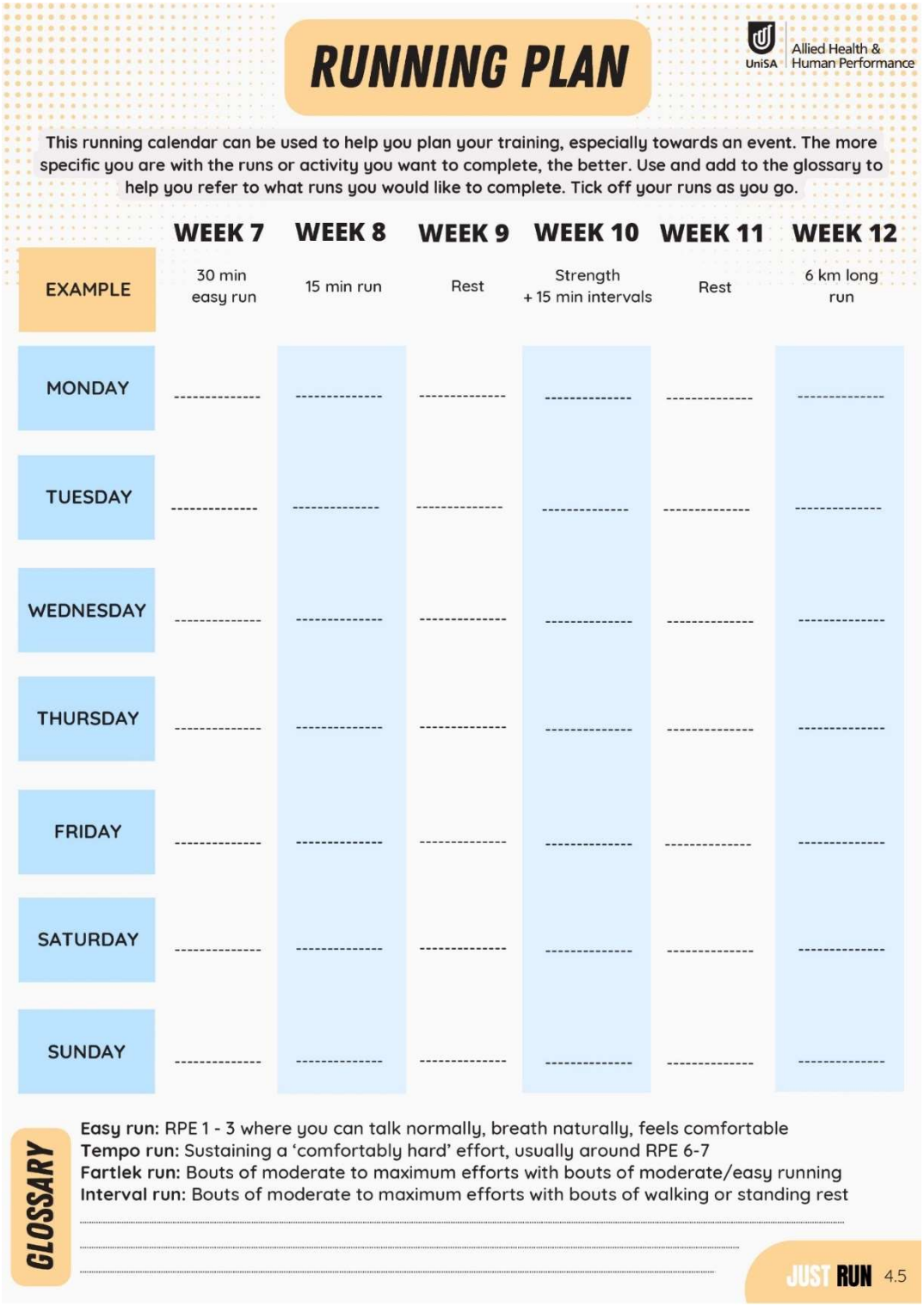


Figure 14. Running Plan



Figure 15. Self-compassion 1



Figure 16. Self-compassion 2



Figure 17. What I Love About Running

Figure 18. Running Reflection

Figure 19. Running Calendar



Figure 20. Habit Cheat Sheet



Figure 21. Make Running a Habit

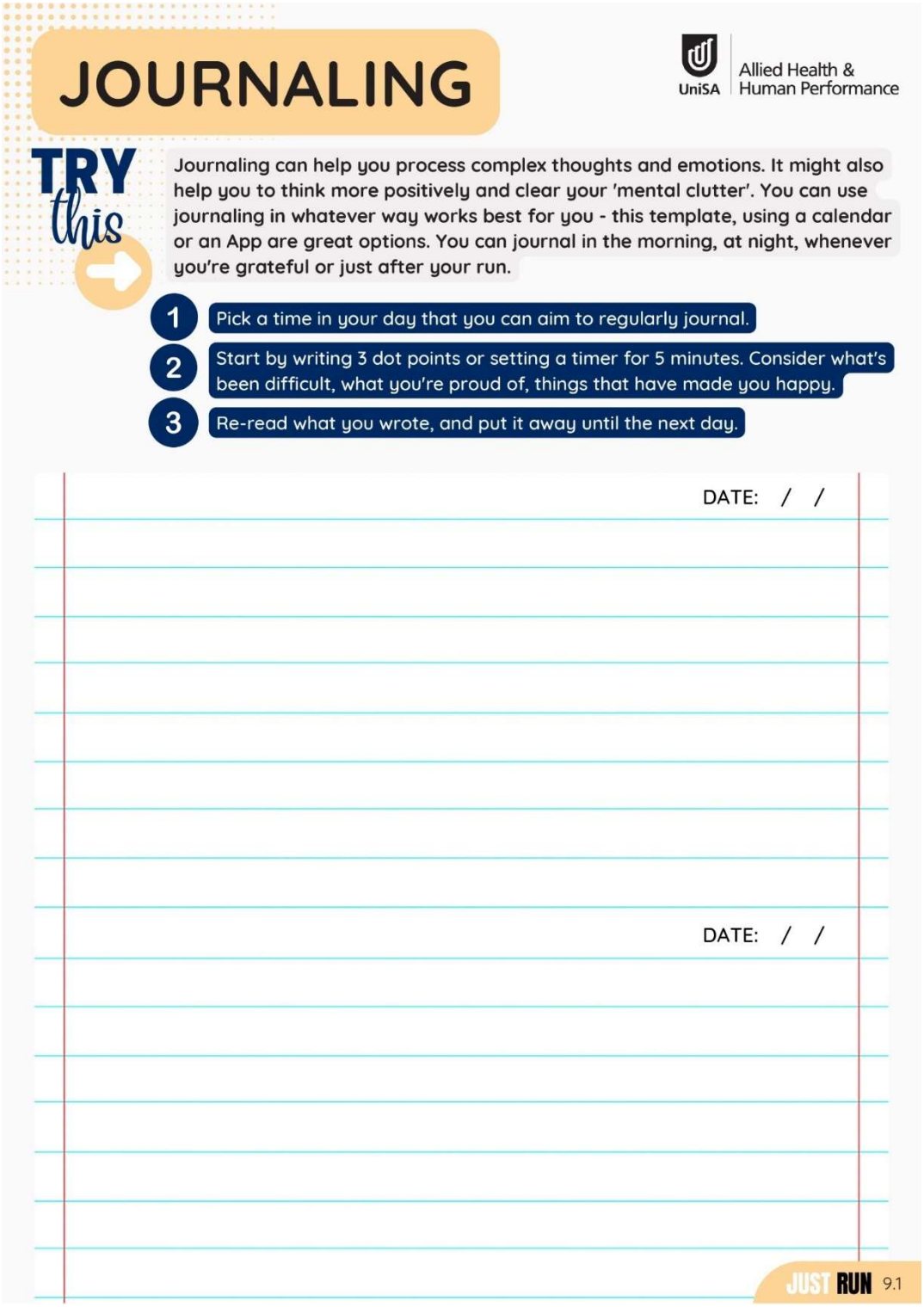


Figure 22. Journaling 1

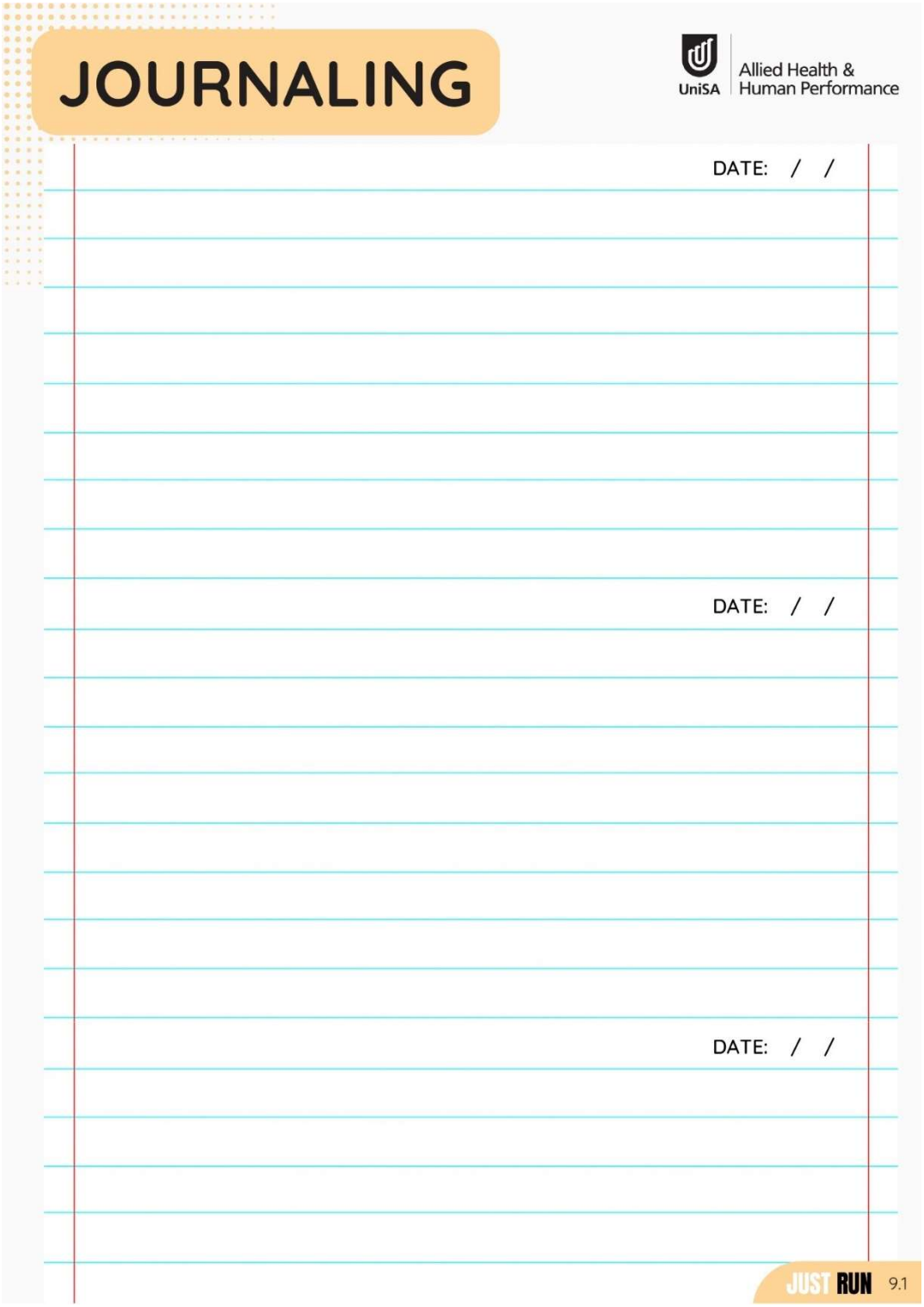


Figure 23. Journaling 2



Figure 24. Running in the Heat Factsheet



Figure 25. Running at Night Factsheet

Making time to run

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This factsheet will provide some information on how to run when you don't have time!



REMIND ME!

Set prompts and reminders on your phone or calendar for when you need to get ready to go for your run. This can allow you to "set and forget", knowing that when that reminder goes, you need to get ready!

FIND A GROUP

Running with a group is one of the best ways to not only keep accountable, but to socialise and meet people. There are many running groups that likely run regularly near your home or workplace. Often, these groups start at a regular time in a regular location. If you can't find a running group, why not get a group of people or friends together and create your own?

GET IT DONE EARLY

Some people aren't early birds, but getting a run in early before work can be beneficial. Plan to have a light snack or a coffee before you run to help you feel energised to get your run done.

FREE TIME? RUN LONGER

Run for longer on the days where you have less responsibility. For some, that may be the weekend, or at a time where you don't have to rush to get somewhere.

RUN COMMUTE

Run to or from work. You could use a running backpack to pack a change of clothes, or drop a change of clothes at work the day before you plan to run to work. Some runners park closer to work, and run only part the way, too!

RUN FROM HOME

Run straight from your house or workplace directly, reducing travel time between when you start and finish your run.

PLAN, PLAN, PLAN!

Yep, who would've thought that planning when you run ahead of time is likely to increase the chance of you actually running as you intend! Look ahead at your week, and schedule when, how long and where you want to run.

RUN WHILE THEY TRAIN

If you have a family, consider running while your children are at sports practice. You can arrange to meet with other parents and run/walk with them.

BE FLEXIBLE

Overhaul your schedule if you've been finding it difficult to stick to a routine. Reshuffle when you run or find time to fit in a small run during the day. You may have to shorten a run, and perhaps can extend another to make up for missed runs or runs cut short.

KEEP ACCOUNTABLE

Tell someone when and how long you plan to run for to help you keep accountable. You never know, they may want to join you one day!

JUST RUN 9.4

Figure 26. Making Time to Run Factsheet

Balance Running with a Family

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This factsheet will provide some information on how to balance your running activity with a family

SHARE YOUR SCHEDULE

Once you have your running schedule planned, let your family know of your running intentions by hanging it on your fridge. This is a helpful way to not only remind you, but remind your family of when you are planning to run.



TALK ABOUT IT

Let your partner or family know about when and where you plan to run . This can help you negotiate how to best fit running into your week that suits your responsibilites.

RUN EARLY

One of the most common strategies parents use to fit running into their life: run while your family sleeps! This might not work for everyone, but it could be something you consider. Start by waking up only a little earlier than usual (and getting to bed earlier!) and trying a short run in the morning. Getting your running clothes and shoes out the night before could help make this happen.

RUN WITH YOUR FAMILY

If it's difficult to fit running in, try getting out with your family. You could run in a less structured way, such as jogging laps around the oval while your family or children play with a ball or ride their bikes.

SIGN UP FOR AN EVENT

Whether it's a traditional, Saturday morning Parkrun or an annual Charity Run - signing the family up for a running event can make for a fun way to train and enjoy an active day out.

CHECK FOR CHILD-CARE

Enquire at local gyms as to whether child-care or child minding facilities are available. This may be something that suits you!

DRESS UP FOR THE RUN

Get your children help pick out your running outfit or perhaps ask them which songs you could listen to on your run. This can help make your child feel involved with your running journey.

MAKE IT EXCITING FOR YOUR FAMILY

While you run, have your partner or carer play a game or watch a certain show that is only played while you go for your run. This may help reduce tension if it's difficult to leave the house. It can also make 'run time' more exciting for them, too!

JUST RUN 9.5

Figure 27. Balancing Running with a Family Factsheet



Figure 28. Balancing Work with Running Factsheet

Running in all Seasons

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This factsheet will provide some information on how to continue on your running journey when weather may not be ideal.

CHECK THE FORECAST

Check the weather the night before you run. This can help you get the appropriate clothing and footwear ready. You may consider choosing an hour window in the day that looks more desirable (such as less rain, or less humidity).

RUN INDOORS

Most gyms sell casual passes, allowing anybody to access their equipment, including treadmills. You may pop into a local gym and give this a go! Otherwise, if you want a more permanent solution, you can often find second-hand treadmills on various sites such as Gumtree or Facebook Marketplace.



CAR PARK RUN

Some people have taken advantage of indoor spaces by running through indoor carpark facilities that aren't too busy. You could run up the ramps, or up the stairwell. We would recommend running with a friend and making sure you are comfortable doing this first.

PHONE A FRIEND!

If you know someone who runs or walks and owns a treadmill, ask them if you could pop around to use their treadmill to complete your run.

DRESS FOR THE WORST

It can be difficult to want to run when it's already raining. Remember that skin is waterproof! But, it's a good idea to layer up. Long sleeve tops and light-weight waterproof jackets, running gloves, beanies and small scarves are all useful to wear when you first head out the door. Make sure you have pockets to pop any gloves, for example, into once you've warmed up.

RE-ADJUST

Change your running schedule. There is no harm in adjusting your schedule to run on days where the weather is more desirable. Think of other things you could do to still work towards your goals. Perhaps you complete some strength exercises at home, or cook a nice, nutritious meal instead.

WEAR THE RIGHT SHOES

Slippery surfaces can make it a little more challenging than usual. Make sure your shoes have enough grip on them!

YOU MAY LIKE IT!

It may take some time, but rather than seeing the rain as a barrier, you may find that it's something you really enjoy, or at least something you can cope with! Try it and find out.

JUST RUN 9.7

Figure 29. Running in all Seasons Factsheet

"I'm too tired!" - Re-think the Run!

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This factsheet will provide some information on how to continue on your running journey when you are just too tired.

BEFORE YOU SKIP THE RUN...

Reflect on how energising running can be for you, or how it helps you sleep before skipping a run because of feeling tired.

REDUCE CHOICE

It can be easy to dismiss a run because of the effort it takes to get out the door. To reduce the number of choices you make, have all of your clothes, shoes and your earphones (if you run with music) charged and out ready to go! Some people even sleep in their running clothes, but you don't have to do this.

START WITH SLEEP

Consider what may be making you so tired. If you can't seem to get your morning run done because you are lacking sleep, think about how you can change your night time routine. How can you maximise your sleep? This might mean getting to bed earlier on the nights you plan to run in the morning.



STRAIGHT FROM WORK

Pack your running clothes in your car and drive to a destination you want to run around. This could be the beach, a running track, or a trail. You could get change at work and run as soon as you get to, say, the beach. Then you can still get home and crash, but have achieved a run first!

PRE-RUN IS KEY

You might try having a pre-run routine to help prime you for your run. For example, have a coffee or a light meal around 30 minutes before you run. This can help you feel energised and ready to run!

SNOOZE DON'T LOSE

If you do happen to sleep in and don't get out of bed in time for the early morning run you intended to do, don't beat yourself up! We all struggle sometimes. Before you start feeling guilty, look forward in your calendar or schedule and plan when you can squeeze a short run in. Throwing in the towel, and not running at all might not be the choice that's best for you and your goals!

LOOK FORWARD TO IT

Plan to watch your favourite show while you run if you have access to a treadmill, or listen to your favourite music! Remember, try to only listen to your favourite playlist when you run..

RUN WITH FRIENDS

Plan to meet up with a friend to help you keep more accountable. You could even plan to run to a coffee shop or brunch spot for breakfast and run back (if you haven't eaten too much!).

Figure 30. Running when Tired Factsheet

Appendix 4.7 Pre-testing participant feedback

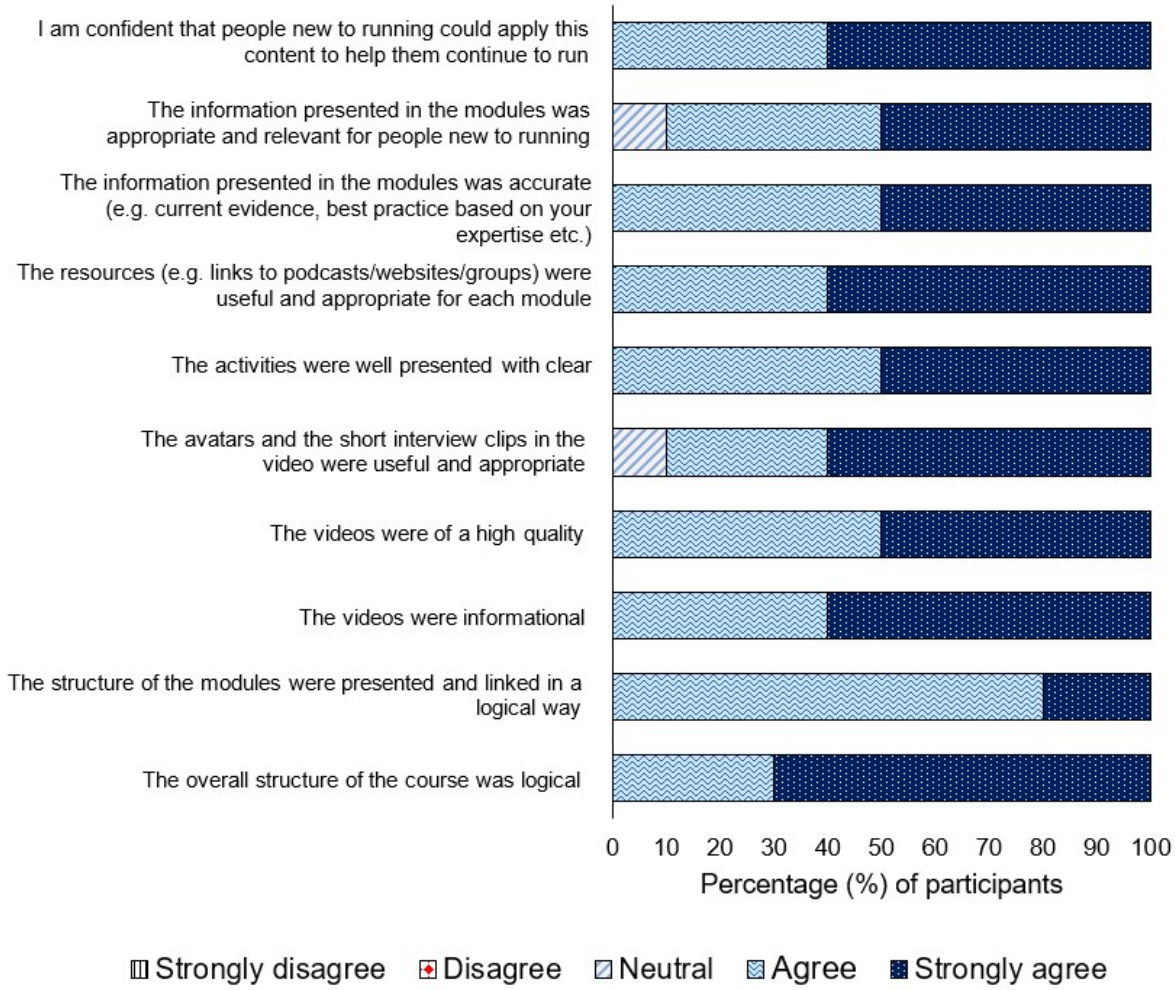


Figure 1. Summary of the level of agreement with usability statements from pre-testing participants for Just Run

Table 1. Detailed responses from question 15 of pre-testing participants feedback questionnaire with interdisciplinary team summary and outcome

15. Based on all of the questions above, and your review of the module(s), is there anything you think could be improved upon? Please detail below.	Summary	Outcome
1. The onus on people to print, fill out, and then post their activities is asking a 'lot' from people. There are just so many steps involved, starting from requiring a printer. If there was a way to either have the documents sent to participants beforehand or have them fill out a survey and then be sent a .pdf of their activities, I think it'd make it more likely that they will stay involved. With the integration on Strava, could one activity involve having them search to see whether they 'know' anyone on Strava, or have them 'follow' someone else – along with finding the group in the social support section? That's be super cool! I was a bit surprised that the values piece came so early within the modules. If people just setting out about running, I wonder whether they will really see the relevance of the values activity. Perhaps consider order and/or perhaps consider other ways to debrief about some of this stuff (e.g., perhaps, to begin the next module, have a summary of what they learned the last week and what it means for them). I found the moodle site a little clunky with respect to lots of clicking and navigating. I am guessing there's no way to, for example, embed the videos within the course website?	1.1 Too much for people to print, fill out and post activities 1.2 Include activity that involve searching + following friends/groups on Strava 1.3 Surprised 'My Values' was 3rd Module 1.4 Perhaps consider other ways to debrief at beginning of next module with summary of what they learned the last week and what it means for them 1.5 Moodle site clunky with clicking and navigating 1.6 Possible to embed videos within the course website?	1.1 Potential to make activities in various formats and embed online (doc/pdf) 1.2 Include in short video tutorial for Support for Success on how to follow others 1.3 Add a summary of last week's module and what it means for them in each video 1.4 Add a summary video in week 6 and 12 of learning up until that point 1.5 Ask IT if there is any way to make 'less clunky'? 1.6 Embed videos (rather than open in new tab)
2. Nope. Looks great! Good work		
3. I know the course isn't meant to be a running plan, but I think some mention of progression guidelines are warranted given many new runners stop due to injury – some advice to not increase volume/load too quickly may be advantageous. Although the order was generally very appropriate, I am not sure if starting with the physical activity guidelines is the most exciting or relevant way to begin. This is an important factor, but I think something more running or goal-setting specific could be a more impactful way to begin the program. I think some of the activities need a little bit more instruction or more clear	3.1 Some progression guidelines are warranted given many new runners stop due to injury – some advice to not increase volume/load too quickly may be advantageous 3.2 Physical activity guidelines not relevant or exciting as first module	3.1 Add slide in FITT regarding progression specifically 3.2 Unfortunately, first two modules are general advice (as per control group). Potential to call

15. Based on all of the questions above, and your review of the module(s), is there anything you think could be improved upon? Please detail below.	Summary	Outcome
statement of their purpose – I think this may be lost on some less familiar with the content and topics overall and think the WHY and HOW should be more explicitly stated and made clear. Examples include 'Identifying My Values' and 'Goal Network'. Some of the background videos were distracting from the content IMO. Conversely, I think the avatars were a really good way of engaging the viewer in the slide and content overall.	3.3 Running or more goal-setting specific could be more impactful to begin 3.4 Some activities need more instruction or more clear statement of their purpose – this may be lost on some less familiar with the content and topics (e.g. 'Identifying my Values' and 'Goal Network' 3.5 Avatars were engaging 3.6 Background videos sometimes distracting	first module something different e.g., 'Forming the Foundation: Being physically active' 3.3 Could add a resource with interview with a runner, basic running advice videos 3.4 Add instructions on all activities 3.5 Keep avatars 3.6 Keep background videos simple
4. The order of modules was great, but perhaps some of the videos (Beyond Belief, I'm not a runner etc.) provided would act as a motivator if offered earlier on in the program. There were just a handful of spelling errors throughout the video modules, predominantly in the cartoon character's speech bubbles. I was slightly confused as to the terminology used for secondary and/or subordinate goals. I think the audio referenced subordinate goals, whereas different PDFs used both secondary and subordinate... and then the action steps to achieve these.	4.1 Self-compassion may be more useful earlier in intervention 4.2 Spelling errors mostly in speech bubbles 4.3 Terminology in My Goal Network – inconsistency between videos and activities 4.4 Action steps in the My Goal Network activity unclear	4.1 Review module order to include Self-compassion earlier 4.2 Correct all spelling errors 4.3 Keep consistent terms in activities (only use Subordinate) 4.4 Specify instructions on action steps in 'My Goal Network Activity'
5. As a new runner who started her journey not being able to run around the block a couple of things I wanted to give feedback on. I noticed the use of RPE as a term early on, I have to say it took me a long time to even know what this meant in my running life! And text my coach! The example of 30mins for 5km as a goal is another little thing I wanted to mention. It's a fabulous goal! But it is also an example of a goal I wouldn't want someone to have in their mind straight away as I know it took me years and if I had started with that as a goal I think I may have felt some failure early on. I actually cried when I achieved it (crazy but	5.1 Use of RPE may be too complex 5.2 Keep examples realistic to target population (30 min 5 km may be too hard for most)	5.1 Add RPE factsheet 5.2 Ensure range of goal examples that embrace a range of physical activity levels and capabilities

15. Based on all of the questions above, and your review of the module(s), is there anything you think could be improved upon? Please detail below.	Summary	Outcome
true). For some people they could start doing this easily, for others not so easily. For me in the early days finishing 5km was a huge achievement not worrying about pace to start with. This is solely my opinion but I know many runners that still haven't achieved this but run regularly. Goals can definitely be changed along the way of course as you have mentioned.		
6. I am unsure if I am the best the answer this. As a long time, runner, I can hardly remember the order in which modules may be best placed to assist novice runner sustainability. Topics such as guide to self-compassion and overcoming barriers may even need to be perhaps placed prior to say 'monitoring running progress'? Overall, I can see how much work has gone into this and it's very solid. I don't have much critical feedback sorry, as I believe any novice runner would benefit from these tools in terms of sustainable running. Whether they read it and buy into it, is another thing? haha	6.1 Self-compassion and overcoming barriers may need to be placed prior to 'Monitoring Running Progress'	6.1 Review module order to include 'Self-compassion' and 'Overcoming Barriers' earlier before 'Monitoring Running Progress'
7. Here's my brain farts as I worked through the modules... Welcome Video · music right on point. · I watched it in my browser and little speech bubbles were a little bit small to read (would be fine in full screen). Frequently Asked Questions · Good content I can't think of anything else to add here Physical Activity Guidelines · Like how you framed the guidelines as recommendations · Clear message · All links opened with no issues Training Principles · Relevant and clear information · Useful resource Values · Good introduction to values · Extensive list of values on activity sheet very useful!!!! My Running goals · Awesome section – Autonomy, creating their own plan with the information provided to date. I really feel the spirit of your intervention right here! · All links opened	7.1 Speech bubbles too small 7.2 FAQ useful 7.3 PA and FITT useful information 7.4 Values introduction clear 7.5 Block colour in Goal Network activity too much if printing 7.6 Glitch in last 30s of Social Support video 7.7 Overcoming Barriers 'Contents' panel not appearing 7.8 Self-compassion very important but unsure what to write in 'letter to future self' 7.9 Prompt to circle back to activities useful 7.11 Low burden with all but one <10 minutes 7.12 Good use of examples and testimony	7.1 Increase font/decrease text in speech bubbles 7.2 Keep FAQ 7.3 PA and FITT useful 7.4 Values useful 7.5 Edit colours to be more printer-friendly 7.6 Fix glitch in Social Support video 7.7 Re-record Overcoming Barriers video or create small short videos 7.8 Review module order to include Self-compassion earlier and provide more instruction to 'letter to future self'

15. Based on all of the questions above, and your review of the module(s), is there anything you think could be improved upon? Please detail below.	Summary	Outcome
· My only feedback on this brilliant section is how much block colour there is on things that people may want to print. Can the same block be achieved with less fill? Monitoring my running · Such valuable content! Support for success · Lots of practical tips here · Is there a little glitch in last 30 seconds of social support video (repeats same sentence 3x) Overcoming barriers · All plays as one video ATM (but guessing that it by design for reviewing phase?) · I had to put Max on 100% volume to hear Self-compassion · If I could choose one section that I shared with new runners – THIS is it! · Well-articulated concept · I don't 100% understand what to put in the letter to my future self though Review Running Progress · Really great to get people to circle back to activities · Kipchoge for the win! I'm a Runner · LOVE choice of Alicia's story! That must be relatable for so many!! General feedback thinking about feasibility and acceptability for the participants Low burden. Most videos 5-10 minutes with the exception of one plus 1-2 brief activities. I think this is a very acceptable amount of time. Very clear message. I think each section clearly describes what your message and uses a good range of testimony or examples to illustrate. I don't think anything you are asking is going to cause any conflict in values in fact – the polar opposite as you are clearly providing guidance for running to co-exist in harmony with other values/responsibilities. Perceived effectiveness – I think this is a little innate being associated with the uni. I also think you have achieved this with your use of examples of others (even Kip has to believe!) This is what others do, this is what the pros do.	7.13 Values and running well integrated 7.14 Examples useful 7.15 TabTopics format useful for navigation, will be good to have them appear each week 7.16 'Self-compassion' and 'Overcoming barriers' presented earlier or more diminishing schedule and loading the front end more heavily with content and review-type activities in final 3 weeks	7.9 Summarise previous week's content at beginning of videos 7.11 Potential to split 'Overcoming Barries' video into small ones 7.12 Keep examples and interviews 7.13 Keep values module as is 7.14 Examples useful 7.15 TabTopics useful for navigation, will be good to have them appear each week 7.16 Review module order and structure to front-load content and leave final 3 weeks as review content

15. Based on all of the questions above, and your review of the module(s), is there anything you think could be improved upon? Please detail below.	Summary	Outcome
Ability to navigate – from my perspective it is easy but I have had recent exposure to multiple moodle sites. I think your plan of one tab popping up after one is complete will be helpful for anyone not familiar with this layout. Overcoming barriers and self-compassion are such key elements. If individuals are receiving 1 module/week they wont be accessing this until week 8 & 9 which means they will only have 1/3 -1/4 of intervention with this knowledge. I 100% agree with the order of information presented… is it worth a dimishing schedule and loading the front end more heavily with content and have more review type activities in final 3 weeks? Just thoughts….		
8. <u>Module 4 - My running Goals</u> "Eat sufficient vegetables", needs to be a balanced diet for running, fish, meat or vegetables with protein if vegetarian What is "RPE5"? If you do not run, you could do exercises at home rather than a walk if time and family doesn't permit <u>Activities</u> Global network- path is excellent, makes people accountable and can look back at goals Tracker is handy- but also on Strava, Garmin , Training Peaks Action plan- is good Running plan- is good, but could also use a Free Training Peaks account, plot a plan, upload info, download sessions to a watch etc. Training Peaks is an ideal app to use and its free (check it out) <u>Resources</u> Event calendar, does it cover trail races? Trail running has become very popular now days <u>Module 5 – Monitoring my Running</u> When first starting running its hard, very hard. Back off the pace, run ex-amount, walk ex-amount and build slowly, then slowly drop off the walking time Run with a friend is great motivation Parkruns are ideal to start with and great motivation to join other runners and meet people What I love about running – is good, But what about "what I dislike about running – how can I change the dislike, Running tracker – could all be done on Training Peaks for free <u>Module 7 – Support for Success</u>	8.1 "Eat sufficient vegetables" example in 'My Running Goals' needs to encompass a balanced diet 8.2 RPE5 unclear 8.3 Disclose other training apps 8.4 Include trail races in event calendar 8.5 Provide more prescription-based advice for starting to run 8.6 "What I dislike about running" and how to change the dislike as converse to "What I like about running" 8.7 Include links to running groups of all abilities	8.1 Specify a balanced diet is crucial in My Running Goals activities 8.2 Add RPE factsheet in first two modules 8.3 Include Factsheet with other training apps 8.4 Include trail races in event calendar resources 8.5 Provide more prescription-based advice for starting 8.6 Include a "What I dislike about Running" activity and how to work on these 8.7 Include links to running groups of all abilities

15. Based on all of the questions above, and your review of the module(s), is there anything you think could be improved upon? Please detail below.	Summary	Outcome
Meet someone for run- great motivation "get your running gear ready the night before"- excellent "plan a path "- excellent Run trails not just road for motivation "Running groups" excellent, should state all abilities <u>Activities</u> "Make running a habit sheet"- good <u>Resources</u> Brilliant- extensive list State based runs is also very good <u>Module 8 – Over coming my Running Barriers</u> <u>Family</u> Split days with your partner on the weekends- great works well, talk to your family, negotiate times <u>Work</u> "running a small amount is better than nothing"- good, also good mental not just physically <u>Weather</u> "hot " adjust your pace to suit the temp, "cold/wet" – skin is waterproof, just like having a shower- RUN. Buy a good waterproof jacket <u>Injury</u> Great information, stop/rest/recover/ cross train- excellent <u>Resource</u> "heat "- good information, "running at night" – wear a headlamp <u>Module 11 – I am a Runner</u> "Being a runner is NOT about how fast or how far"- BRILLIANT, so true and should be highlighted in a specific slide <u>Resources</u> "Parkrun"- excellent	8.8 'Overcoming my Running Barriers' should include more detail about resources to assist	8.8 'Overcoming my Running Barriers' should include more detail about resources (e.g., adjusting pace in heat, skin is waterproof, buy a waterproof jacket, wear a headlamp)

Appendix 5.1 CONSORT checklist of information to include when reporting a pilot trial

Section/topic and item No	Standard checklist item	Extension for pilot trials	Page No where item is reported
Title and abstract			
1a	Identification as a randomised trial in the title	Identification as a pilot or feasibility randomised trial in the title	114
1b	Structured summary of trial design, methods, results, and conclusions (for specific guidance see CONSORT for abstracts)	Structured summary of pilot trial design, methods, results, and conclusions (for specific guidance see CONSORT abstract extension for pilot trials)	115
Introduction			
Background and objectives			
2a	Scientific background and explanation and rationale	Scientific background and explanation of rationale for future definitive trial, and reasons for randomised pilot trial	117-120
2b	Specific objectives or hypotheses	Specific objectives or research questions for pilot trial	119-120
Methods			
Trial design:			
3a	Description of trial design (such as parallel, factorial) including allocation ratio	Description of pilot trial design (such as parallel, factorial) including allocation ratio	120
3b	Important changes to methods after trial commencement (such as eligibility criteria), with reasons	Important changes to methods after pilot trial commencement (such as eligibility criteria), with reasons	N/A
Participants			
4a	Eligibility criteria for participants		131
4b	Settings and locations where the data were collected		127
4c		How participants were identified and consented	120
Interventions:			
5	The interventions for each group with sufficient details to allow replication, including how and when they were actually administered		128-129
Outcomes:			
6a	Completely degined prespecified primary and secondary outcome measures, including how and when they were assessed	Completely defined prespecified assessments or measurements to address each pilot trial objective specified in 2b, including how and when they were assessed	121-130
6b	Any changes to trial outcomes after the trial commenced, with reasons	Any changes to pilot trial assessments or measurements after the pilot trial commenced, with reasons	130
6c		If applicable, prespecified criteria used to judge whether, or how, to proceed with future definitive trial	N/A
Sample size:			

7a	How sample size was determined	Rationale for numbers in the pilot trial	129
7b	When applicable, explanation of any interim analyses and stopping guidelines		N/A
Randomisation:			
Sequence generation			
8a	Method used to generate the random allocation sequence		128
8b	Type of randomisation; details of any restriction (such as blocking and block size)	Type of randomisation(s); details of any restriction (such as blocking and block size)	128
Allocation concealment mechanism:			
9	Mechanism used to implement the random allocation sequence (such as sequentially numbered containers), describing any steps taken to conceal the sequence until interventions were assigned		128
Implementation:			
10	Who generated the random allocation sequence, enrolled participants, and assigned participants to interventions		128
Blinding:			
11a	If done, who was blinded after assignment to interventions (eg, participants, care providers, those assessing outcomes) and how much		120
11b	If relevant, description of the similarity of interventions		128
Analytical methods:			
12a	Statistical methods used to compare groups for primary and secondary outcomes	Methods used to address each pilot trial objective whether qualitative or quantitative	130
12b	Methods for additional analyses, such as subgroup analyses and adjusted analyses	Not applicable	N/A
Results			
Participant flow (a diagram is strongly recommended):			
13a	For each group, the numbers of participants who were randomly assigned, received intended treatment, and were analysed for the primary outcome	For each group, the numbers of participants who were approached and/or assessed for eligibility, randomly assigned, received intended treatment, and were assessed for each objective.	132
13b	For each group, losses and exclusion after randomisation, together with reasons		131
Recruitment:			
14a	Dates defining the periods of recruitment and follow-up		131

14b	Why the trial ended or was stopped	Why the pilot trial ended or was stopped	131
Baseline data:			
15	A table showing baseline demographic and clinical characteristics for each group		133
Numbers analysed:			
16	For each group, number of participants (denominator) included in each analysis and whether the analysis was by original assigned groups	For each objective, number of participants (denominator) included in each analysis. If relevant, these numbers should be randomised group	133-147
Outcomes and estimation:			
17a	For each primary and secondary outcome, results for each group, and the estimated effect size and its precision (such as 95% confidence interval)	For each objective, results including expressions of uncertainty (such as 95% confidence interval) for any estimates. If relevant, these results should be by randomised group.	133-147
17b	For binary outcomes, presentation of both absolute and relative effect sizes is recommended	Not applicable	N/A
Ancillary analyses:			
18	Results of any other analyses performed, including subgroup analyses and adjusted analyses, distinguishing prespecified from exploratory	Results of any other analyses performed that could be used to inform the future definitive trial	N/A
Harms:			
19	All important harms or unintended effects in each group (for specific guidance see CONSORT for harms)		139
19a		If relevant, other important unintended consequences	N/A
Discussions			
Limitations:			
20	Trial limitations, addressing sources of potential bias, imprecision, and, if relevant, multiplicity of analyses	Pilot trial limitations, addressing sources of potential bias and remaining uncertainty about feasibility	162-163
Generalisability:			
21	Generalisability (external validity, applicability) of the trial findings	Generalisability (applicability) of pilot trial methods and findings to future definitive trial and other studies	162-163
Interpretation:			
22	Interpretation consistent with results, balancing benefits and harms, and considering other relevant evidence	Interpretation consistent with pilot trial objectives and findings, balancing potential benefits and harms, and considering other relevant evidence	147-163
22a		Implications for progression from pilot to future definitive trial,	147-163

		including any proposed amendments	
Other information			
Registration:			
23	Registration number and name of trial registry	Registration number for pilot trial and name of trial registry	120
Protocol:			
24	Where the full trial protocol can be accessed, if available	Where the pilot protocol can be accessed, if available	120
Funding:			
25	Sources of funding and other support (such as supply of drugs), role of funders		N/A
26		Ethical approval or approval by research review committee, confirmed with reference number	120

Appendix 5.2 TiDIER Checklist

TIDieR Template for Intervention Description and Replication

The TIDieR (Template for Intervention Description and Replication) Checklist*

Item number	Item	Where located **	
		Primary paper (p or appendix no.)	Other † (details)
	BRIEF NAME		
1.	Provide the name or a phrase that describes the intervention.	114	
	WHY		
2.	Describe any rationale, theory, or goal of the elements essential to the intervention.	119-120	
	WHAT		
3.	Materials: Describe any physical or informational materials used in the intervention, including those provided to participants or used in intervention delivery or in training of intervention providers. Provide information on where the materials can be accessed (e.g. online appendix, URL).	128-129	Ch. 4
4.	Procedures: Describe each of the procedures, activities, and/or processes used in the intervention, including any enabling or support activities.	128-129	Ch. 4
5.	WHO PROVIDED		
	For each category of intervention provider (e.g. psychologist, nursing assistant), describe their expertise, background and any specific training given.	94	Ch. 4
	HOW		
6.	Describe the modes of delivery (e.g. face-to-face or by some other mechanism, such as internet or telephone) of the intervention and whether it was provided individually or in a group.	128	
	WHERE		

7.	Describe the type(s) of location(s) where the intervention occurred, including any necessary infrastructure or relevant features.	128
	WHEN and HOW MUCH	
8.	Describe the number of times the intervention was delivered and over what period of time including the number of sessions, their schedule, and their duration, intensity or dose.	121 & 128
	TAILORING	
9.	If the intervention was planned to be personalised, titrated or adapted, then describe what, why, when, and how.	N/A
	MODIFICATIONS	
10.‡	If the intervention was modified during the course of the study, describe the changes (what, why, when, and how).	N/A
	HOW WELL	
11.	Planned: If intervention adherence or fidelity was assessed, describe how and by whom, and if any strategies were used to maintain or improve fidelity, describe them.	121-122
12.‡	Actual: If intervention adherence or fidelity was assessed, describe the extent to which the intervention was delivered as planned.	122 & 136-137

** **Authors** - use N/A if an item is not applicable for the intervention being described. **Reviewers** – use '?' if information about the element is not reported/not sufficiently reported.

† If the information is not provided in the primary paper, give details of where this information is available. This may include locations such as a published protocol or other published papers (provide citation details) or a website (provide the URL).

‡ If completing the TIDieR checklist for a protocol, these items are not relevant to the protocol and cannot be described until the study is complete.

* We strongly recommend using this checklist in conjunction with the TIDieR guide (see *BMJ* 2014;348:g1687) which contains an explanation and elaboration for each item.
* The focus of TIDieR is on reporting details of the intervention elements (and where relevant, comparison elements) of a study. Other elements and methodological features of studies are covered by other reporting statements and checklists and have not been duplicated as part of the TIDieR checklist. When a **randomised trial** is being reported, the TIDieR checklist should be used in conjunction with the CONSORT statement (see www.consort-statement.org) as an extension of **Item 5 of the CONSORT 2010 Statement.** When a **clinical trial protocol** is being reported, the TIDieR checklist should be used in conjunction with the SPIRIT statement as an extension of **Item 11 of the SPIRIT 2013 Statement** (see www.spirit-statement.org). For alternate study designs, TIDieR can be used in conjunction with the appropriate checklist for that study design (see www.equator-network.org).

Appendix 5.3 Ethics Approval

From: no_reply@unisa.edu.au
Sent: Wednesday 19 January 2022 5:24 PM
To: Chloe Blacket, John Arnold, Joel Fuller, Hunter Bennett, Alyson Crozier, Human Ethics
Subject: Application Approved.

Dear Applicant,

Re: Ethics protocol "A feasibility study comparing online running education to basic training advice on motivation and psychological factors for long-term running participation" (Application ID: 203978)
Thank you for submitting your ethics protocol for consideration. Your protocol has been considered by the E2 Committee Review Group.
I am pleased to advise that your protocol has been granted ethics approval and meets the requirements of the National Statement on Ethical Conduct in Human Research.
Please note that the E2 Committee Review Group's decision will be reported to the next meeting of the Human Research Ethics Committee for endorsement.
Please regard this email as formal notification of approval.
Ethics approval is always made on the basis of a number of conditions detailed at https://i.unisa.edu.au/siteassets/staff/ris/docs/hrec-conditions-of-approval.pdf; it is important that you are familiar with, and abide by, these conditions. It is also essential that you conduct all research according to UniSA guidelines, which can be found at https://i.unisa.edu.au/staff/research/research-ethics/human-research-ethics/ethics-policies-guidelines/.
Please note, if your project is a clinical trial you are required to register it in a publicly accessible trials registry prior to enrollment of the first participant (e.g. Australian New Zealand Clinical Trials Registry http://www.anzctr.org.au/) as a condition of ethics approval.
Best wishes for your research.

Executive Officer
UniSA's Human Research Ethics Committee CRICOS provider number 00121B

This is an automated email and cannot be replied to. Please direct your query to humanethics@unisa.edu.au.

Appendix 5.4 Participant information sheet

PARTICIPANT INFORMATION SHEET
JUST RUN: An online motivational and psychological approach to sustainable running

Research Team

PhD Candidate (Primary Researcher)	Miss Chloe Blacket [1]
Email:	chloe.blacket@mymail.unisa.edu.au
Principal Supervisor:	Dr John Arnold [1]
Email:	John.Arnold@unisa.edu.au
Phone:	(08) 8302 1329
Co-Supervisor:	Dr Joel Fuller [2]
Email:	joel.fuller@mq.edu.au
Telephone:	+61 2 9850 4040
Co-Supervisor:	Dr Hunter Bennett [1]
Email:	Hunter.Bennett@unisa.edu.au
Telephone:	(08) 8302 2570
Co-Supervisor:	Dr Alyson Crozier [1]
Email:	Alyson.Crozier@unisa.edu.au

[1] Allied Health and Human Performance, Alliance for Research in Exercise, Nutrition and Activity, University of South Australia
[2] Faculty of Medicine, Health & Human Sciences, Macquarie University

This Participant Information Sheet aims to inform you of this research project and what your participation in the study will involve if you decide to take part in this project. We encourage you to read the information carefully, and to ask questions about anything you do not understand or want to know more about.

Description of the study

This project will investigate the effect of an online running intervention on motivational and psychological factors related to sustainable running. This project will form part of Chloe Blacket's PhD thesis.

Participant Involvement

If you agree to participate in the research study, you will be asked to:

- Participate in a 12-week online research study receiving either condensed or extended education relevant to running activity (education involves no face-to-face delivery)
- Enrol and access the study through an online website hosted by UniSA
- Record and/or upload all running activity onto Strava (more information can be found here https://www.strava.com/features), an online running tracking application
- Complete a series of online questionnaires at Week 0 (baseline), Week 6 (midway), Week 12 and 3-month follow up
- Report any injury, if they occur, via the online website
- May be asked to provide feedback on the study with a short survey or interview at the end of your study involvement with a member of the research team
- Receive email/text prompts or reminders to access the website and/or complete questionnaires

Participant Eligibility

To be considered eligible for inclusion, you must satisfy the following conditions:

- Aged 18 – 64 years old

- Previously ran as a form of regular physical activity or interested in starting to run or currently running but with less than 3 months of running experience
- Own a smartphone and/or a smartwatch capable of tracking basic running metrics
- Willing to use a running activity application (Strava) to upload running activity and allow the primary researcher to follow your profile to track running activity
- Are not currently injured or undergoing rehab for an injury which may make it difficult to run
- Have no known medical conditions which may heighten the risk of adverse event due to running or receive GP clearance to be involved
- Have regular internet access

Screening and Enrolment

Upon registering your interest in the study, the primary researcher will contact you via phone call to assess your eligibility according to the above criteria and answer any questions you may have about the study or your involvement. You will be asked a series of medical-based questions to assess your risk of an adverse event due to running. If you are screened to be at risk of an adverse event, you will be asked to seek formal clearance from an appropriate allied health professional or medical practitioner prior to participating in the study. If you are deemed eligible to participate, additional information regarding informed consent, study enrolment and accessing the online study website and how to download and sign up for Strava will be provided to you.

Participation

Involvement in this study lasts a total of 6 months: 3 months for the online educational phase and a final questionnaire 3 months afterward. The questionnaires relate to your general health, basic psychological needs, motivation, confidence and benefits/barriers to running and will take approximately 25 minutes to complete each time. Please see below flowchart for the study procedures (Figure 1). In addition to the below, you may also be asked to provide feedback regarding your study experience at the end of your participation.

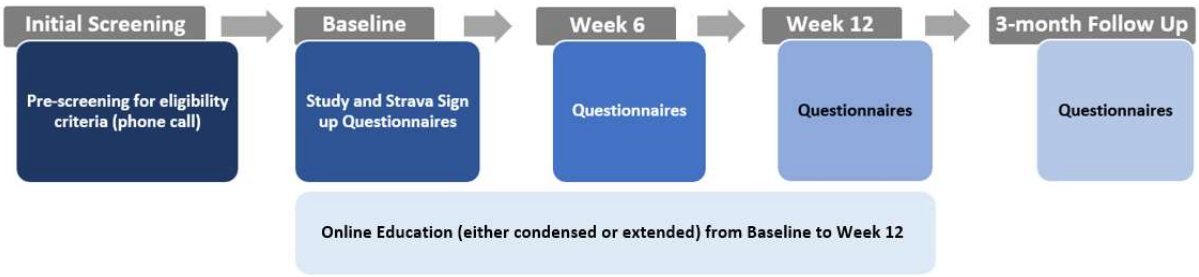


Figure 1 Flowchart of the study procedure.

Education

The online education will address topics known to influence exercise participation. The educational content has been developed in consultation with runners, running experts, coaches and exercise physiologists. Participants will either receive either condensed or extended education from Baseline to Week 12. The content will include short videos and activities that you will be encouraged to watch and complete.

Withdrawal Rights

You may, without any penalty, decline to take part in this research study. If you decide to take part and later change your mind, you may, without any penalty, withdraw at any time during data collection without providing an explanation if you do not wish. You are free to withdraw from the study at any time during data

collection without affecting your relationship with the researchers or the University of South Australia, now or in the future. If you do wish to withdraw, please contact:
Chloe Blacket on chloe.blacket@mymail.unisa.edu.au to notify the research team that you no longer wish to participate in this research.

Confidentiality and Privacy

The running education intervention and questionnaires all take place online and under a de-identified participant code. Only researchers listed on this form have access to the individual information provided by you. Privacy and confidentiality will be always assured. This study forms part of a PhD thesis, and thus data collected from this study may be used for further analysis within the larger thesis if necessary, for which separate ethics approval will be sought. You will not be named, and your individual information will not be identifiable in any research reports without your explicit consent. Results are intended to be disseminated via thesis publication, journal article, research papers and conference presentation. Participants can also elect to receive a copy of the final report of this study if desired by emailing the primary researcher.

As you will be using Strava, an online running tracking application, you can adjust the privacy settings to allow friends to view or 'follow' their running activity. You will be provided with instruction on how to restrict your privacy settings. As part of this study, the research team will request to view or 'follow' your Strava profile to track your running activity in which we will need access to the distance, duration and pace of each of your runs. At the end of the 12 weeks, you will be provided with instruction on how to download your Strava data from the past 12 weeks in Excel format, in which you will be required to upload onto the study site. You will require a laptop or desktop device to download this data. Please note that Strava, a third-party electronic application, will be storing your running data, and any personal information that you enter into the application, for the duration you use it. For more information regarding Strava's privacy policy, please follow this link: https://www.strava.com/legal/privacy. Any personal information exported and provided to the research team will be deleted as soon as possible to protect it from potential unauthorised access. However, after you have completed participating in this study (inclusive of your follow-up period), you have the choice to delete the app or continue using it for personal reasons. Any data entered into the app outside of the data collection period will not be accessed or collected by the research team. No data, including identifiable, non-identifiable and de-identified datasets, will be shared or used in future research projects without your explicit consent.

Data Storage

The information collected will be stored securely on the UniSA server and backed up in a folder on a password protected UniSA server location only accessible by this research team. Data will be stored for fifteen years, after which the data will be appropriately destroyed according to university protocols.

Possible Benefits

All participants will be placed in a prize draw to win a running prize pack worth $100, which will be drawn once the study period has elapsed for all participants. You will be notified by phone and email if you are successful. There is no guarantee of any direct benefits to participants for being involved in the educational intervention, although it is intended that you will find this useful to help you start and stay involved with running. You will also be providing a valuable contribution to the scientific knowledge of running psychology and motivation.

Possible Risks

Like all forms of physical activity, there is a risk of injury associated with running especially when starting. It is important that you understand a running-related injury may occur at any time during your participation in the study. If you do sustain a running-related injury during the study period, report your injury by filling out an injury report which is available on the study website. You will be encouraged to seek health and medical advice from an allied health professional or medical practitioner for appropriate guidance or treatment plan if necessary. If you are given advice to limit or cease running activity for a time, we encourage you to do so. You will remain enrolled in the study and are encouraged to continue accessing the site and completing the questionnaires until your time in the study has elapsed, as your injury may not impact your ability to continue online participation. Medical costs will not be covered by the university or research team.

COVID-19 Precautions

There are no face-to-face requirements for this study. This study will be delivered entirely online to eliminate researcher-participant contact and ensure the project is viable given the potential disruption due to COVID-19. We encourage you to follow the appropriate guidelines on current restrictions or requirements with regard to exercise in your local area.

Ethics Approval

This project has been approved by the University of South Australia's Human Research Ethics Committee (Protocol # 203978). If you or third parties have any ethical concerns about the project or the way it is conducted please contact the Executive Officer of UniSA HREC in the first instance via email on humanethics@unisa.edu.au or ph. 8302 3118.

If you have any questions regarding the study, please contact:

Chloe at chloe.blacket@mymail.unisa.edu.au.

Appendix 5.5 Exit feedback questionnaire

Table 1. Exit feedback

Question or Statement	Response Option	n (%)*
How did you access the education and materials?	Mobile	3 (20.0)
	Laptop/desktop	6 (40.0)
	Both	6 (40.0)
Did you experience any difficulties accessing the education or the materials?	Yes	3 (20.0)
	No	12 (80.0)
Top most useful module	My Running Goals	6 (42.9)
	Do not know	4 (28.6)
	Overcoming my Running Barriers	2 (14.3)
	Support for Success	1 (7.1)
	FITT Principles	1 (7.1)
Were there any modules you think should be removed from the education because you did not find them useful?	None	13 (100.0)
The length of the study (12 weeks) was appropriate	Agree	6 (46.2)
	Unsure	4 (30.8)
	Strongly agree	2 (15.4)
	Neutral	1 (7.7)
The site was easy to navigate and find what I needed	Unsure	4 (30.8)
	Agree	3 (23.1)
	Neutral	3 (23.1)
	Strongly agree	2 (15.4)
	Disagree	1 (7.7)
The education followed a logical sequence (i.e., “Your Guide to Just Run” through to “I am a Runner”)	Agree	4 (30.8)
	Unsure	4 (30.8)
	Strongly agree	3 (23.1)
	Neutral	2 (15.4)
The videos were informative	Agree	6 (46.2)
	Unsure	5 (38.5)
	Strongly agree	2 (15.4)

The length of the videos were too short	Neutral	6 (46.2)
	Unsure	4 (30.8)
	Disagree	2 (15.4)
	Strongly disagree	1 (7.7)
The length of the videos were too long	Neutral	6 (46.2)
	Unsure	4 (30.8)
	Disagree	2 (15.4)
	Agree	1 (7.7)
The videos were of a high quality	Agree	7 (53.8)
	Unsure	4 (30.8)
	Strongly agree	2 (15.4)
There was a clear link between the video content and the activities and resources	Strongly agree	4 (30.8)
	Agree	4 (30.8)
	Unsure	4 (30.8)
	Neutral	1 (7.7)
The activities were useful and appropriate for each module	Unsure	6 (46.2)
	Agree	5 (38.5)
	Strongly agree	2 (15.4)
The activities were well presented with clear instruction on how to complete them	Unsure	6 (46.2)
	Agree	5 (38.5)
	Strongly agree	1 (7.7)
	Neutral	1 (7.7)
The resources (e.g. links to podcasts/websites/groups) were useful and relevant for each module	Strongly agree	4 (30.8)
	Agree	4 (30.8)
	Unsure	4 (30.8)
I learnt things about running that will help me sustain my running activity in the future	Agree	5 (38.5)
	Unsure	4 (30.8)
	Strongly agree	3 (23.1)
	Neutral	1 (7.7)
The education made me more confident to run	Agree	5 (38.5)
	Unsure	4 (30.8)

	Strongly agree	2 (15.4)
	Neutral	2 (15.4)
The education helped me set and achieve my running goals	Strongly agree	4 (30.8)
	Agree	4 (30.8)
	Unsure	4 (30.8)
	Neutral	1 (7.7)
The education improved my ability to overcome running barriers	Agree	4 (30.8)
	Unsure	4 (30.8)
	Strongly agree	3 (23.1)
	Neutral	1 (7.7)
	Disagree	1 (7.7)
The education helped me develop a flexible running schedule	Agree	5 (38.5)
	Unsure	4 (30.8)
	Neutral	2 (15.4)
	Strongly agree	1 (7.7)
	Disagree	1 (7.7)
The education taught me how to be self-compassionate as a runner	Unsure	5 (38.5)
	Agree	3 (23.1)
	Neutral	3 (23.1)
	Strongly agree	2 (15.4)
The education helped me develop strategies and habits to make it easier to run	Neutral	4 (30.8)
	Unsure	4 (30.8)
	Agree	3 (23.1)
	Strongly agree	2 (15.4)
Please indicate the overall appropriateness of the education given your level of running experience	Just right	6 (46.2)
	Unsure	6 (46.2)
	Mostly too advanced	1 (7.7)
How often did you access the education on the Just Run site	Monthly	5 (38.5)
	Daily	4 (30.8)
	Fortnightly	4 (30.8)

*n = 14 responses for first three questions, n = 13 for remaining questions

Appendix 5.6 Injuries reported during intervention

Table 1. Participants who sustained an injury during the intervention (n [%])

Injury type	Control[a]	Intervention[b]
Foot-related injury	1.0 (3.57)~	1.0 (3.57) [#]
Ankle-related	1.0 (3.57)[+]	-
Knee	1.0 (3.57)[+]	-
Hip-related	1.0 (3.57)~	-

[a] n = 28, [b] n = 28 ~ running not primary cause of injury [#] running primary cause of injury.

[+] non-running related injury.

Quote from a participant in *Just Run*

Used with permission (24 Jan 2023).

Hi Chloe,

I wanted to thank you for the opportunity to be involved in this study. Introducing running competence into my regular routine has really given me a boost to my health and the confidence to feel good about my own health.

Shortly after the 12 weeks finished I participated in a Geelong 10km fun run, never did I think I would have the ability or confidence to participate in such an event! It sure was a challenge but oh-what a fun one!

I've also recently joined Parkrun in my new hometown, which has been a great social opportunity. I am just so grateful to now have the belief of running being accessible to me in all forms, when I'm feeling energised or low energy - I know the value in allowing myself the time and space to run to suit my needs.

It's not an exaggeration to say this has been a positively life-shifting change introduced :)

Thank you again so very much. I hope that the study brings together some really interesting work for your PhD!!