

Moving Denmark

Physical Activity Beliefs and Motivation Within and Across Life

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Birgitte Westerskov Dalgas

Moving Denmark

Physical Activity Beliefs and Motivation
Within and Across Life

PHD Thesis

Kolofon

Moving Denmark: Physical Activity Beliefs and Motivation Within and Across Life

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MOVING DENMARK

Physical Activity Beliefs and Motivation
Within and Across Life

Preface

This dissertation is a culmination of a study conducted between 2020 and 2024 at the Centre for Research in Sports, Health and Civil Society (CISC), affiliated with the Department of Sports and Biomechanics, University of Southern Denmark. It is part of the Moving Denmark project, funded by the Nordea Foundation.

Writing this dissertation has (mostly) been a fulfilling experience. It allowed me to deeply explore a subject of great interest to me: The underlying causes of human behaviour. It has enriched my academic knowledge and further ignited my interest in the topic.

I extend my sincere gratitude to my main supervisor, Thomas Bredahl. Your guidance, steadfast support, and invaluable feedback have been fundamental to the development of this dissertation. Your ability to challenge and inspire has significantly guided me in my research approach and thinking. I would also like to thank you for letting me find my own way, providing advice along the journey.

I am grateful to my co-supervisor, Karsten Elmoose-Østerlund, for his valuable contributions and insights, which have greatly enriched and inspired me in my study. Thank you for seeing and consistently reminding me of the value and potential of my work.

My collaboration with Nikos Ntoumanis deserves special mention. Your commitment to our joint article, keen insights, and critical feedback have profoundly influenced the quality and depth of our work. You have challenged me academically, and your feedback has significantly enhanced the final output of my dissertation.

I am also grateful to Martin Hagger and the team at SHARPP Lab, University of California, Merced. Their support during my research stay was instrumental in advancing my work. Special thanks to Kyra Hamilton for her collaboration on the first article and for enriching discussions on qualitative methods and psychological theory.

I owe a debt of gratitude to my colleagues at CISC and Active Living. Their support, insights, discussions and feedback have been invaluable throughout my programme.

I am deeply appreciative of the time and expertise dedicated by each member of the Assessment Committee in reviewing my dissertation. The opportunity to present my work to such an accomplished panel is a privilege. I extend my sincere thanks for your invaluable contribution to this process.

My sincere appreciation goes to each interview participant for their openness and trust. You have generously shared the stories of your lives with me, discussing not only the positive experiences but also the challenges and pains. This level of trust and honesty has been invaluable to my research and has greatly enhanced the depth and authenticity of my work. Thank you for entrusting me with your stories.

Finally, my appreciation goes to my husband, Mathias. Your support, patience, and encouragement have been a constant source of strength, especially during challenging times in this project. Thank you for living through the entire process with me and for putting everything into perspective. Your love and support mean everything to me.

Birgitte Westerskov Dalgas
Odense, January 2023

List of Papers

Paper 1 (Under review at Journal of Health Psychology)

Dalgas, B. W., Hamilton, K., Elmoose-Østerlund, K., & Bredahl, T. V. G. (2023) The Influence of Life Transitions on Physical Activity Beliefs and Behaviour. Manuscript submitted for publication.

Paper 2 (Accepted)

Dalgas, B. W., Elmoose-Østerlund, K., & Bredahl, T. V. G. (2024) Exploring Basic Psychological Needs Within and Across Domains of Physical Activity. *Journal of Qualitative Studies on Health and Well-being*. <https://doi.org/10.1080/17482631.2024.2308994>

Paper 3 (Under review at Motivation Sciences)

Dalgas, B. W., Ntoumanis, N., Elmoose-Østerlund, K., & Bredahl, T. V. G. (2023) Exploring the Process of Restoring Psychological Needs After Incidences of Frustration and Need Unfulfillment. Manuscript submitted for publication.

English Summary

This thesis is conducted in response to the growing concerns about sedentary lifestyles and their impact on public health, where understanding the motivational aspects of physical activity has become imperative. I aimed to explore how physical activity beliefs and motivation are influenced within and across life.

The study drew on Theory of Planned Behaviour and Self-determination Theory. Theory of Planned Behaviour focuses on how beliefs, attitudes, and social norms influence behavioural intentions and, consequently, behaviour. Self-determination theory emphasises the role of basic psychological needs—autonomy, competence, and relatedness—in shaping the quality and sustainability of the motivation behind the behaviour.

The aim of the study was explored through the use of long individual semi-structured interviews with 42 Danish adults selected through purposeful maximum variation sampling (Criteria: Physical activity frequency level, age, gender and geographical location), ensuring a diverse range of experiences with physical activity. The interview data were analysed using codebook thematic analysis, specifically, the framework method, which allowed for the early identification of a framework of themes while maintaining the flexibility for the inductive generation of new themes.

The study was reported in three papers. Paper 1 examined the influence of life transitions on physical activity beliefs and behaviour through the lens of the Theory of Planned Behaviour. Paper 2 explored the variations in psychological need satisfaction, frustration, and unfulfillment within physical activity domains using Self-determination Theory. Paper 3 investigated the restoration of psychological needs after incidences of frustration and unfulfillment in physical activity contexts, focusing on the strategies that individuals employ to restore their psychological needs.

Looking into the results, the first paper identifies six key transitions that notably influence individuals' physical activity beliefs and behaviour. While transitions like beginning school, starting a career, and forming relationships often lead to reduced physical activity intention due to increased sedentary environments and responsibilities, transitions such as leaving home and retiring can enhance physical activity intentions.

The results of the second paper suggest that psychological need satisfaction and frustration in physical activity vary across domains, which influences motivation. The utilitarian view on activities within the transport and household domains often leads to need unfulfillment, while perceived personal relevance and collaborative tasks can enhance need satisfaction. In the occupation domain, alignment with personal interests and social support are crucial for need satisfaction. The results on need satisfaction within the recreational domain underscore a complex interplay between perceived obligation for future health, personal values, and social factors in shaping motivation. These findings highlight the diverse need-supportive nature of physical activity domains and the potential for need satisfaction within each.

The third paper demonstrated that the strategies restoring psychological need after incidences of need frustration and need unfulfillment diverge; individuals 'fight back' against experiences of need unfulfillment by making adjustments or engaging in new activities, whereas they 'flight' from experiences of need frustration by avoiding or disengaging from adverse situations. Our findings further indicate that the context of need frustration—voluntary or obligatory—significantly influences restoration strategy longevity, emphasising the lasting influence of need frustration in physical education.

Synthesising the findings of the three papers, the study demonstrates the significant impact of our life experiences on physical activity beliefs, motivation, and behaviour. It highlights that not only do current life situations, such as transitions and the need-support within different life domains, influence our beliefs in relation to and motivation for physical activity, but early experiences and future expectations also play important roles. Negative experiences in early life, especially within compulsory settings like physical education, can lead to long-term avoidance of physical activities. Conversely, positive anticipations regarding future health can motivate physical activity. However, the quality and sustainability of this motivation are contingent upon the satisfaction of psychological needs within the selected physical activities.

The study enriches the Theory of Planned Behaviour by reconceptualising background factors as active influencers of attitudes, norms, and perceived behavioural control rather than mere controls and suggesting life transitions as a background factor. It also refines Self-determination Theory by distinguishing between need frustration and unfulfillment in the process of restoring psychological need, highlighting the role of human agency in addressing these challenges.

The findings further provide practical insights for enhancing physical activity through adaptable interventions and strategies, emphasising the significance of life transitions, early life experiences, and a domain-sensitive approach. It highlights the need for context-sensitive, need-supportive measures that consider the unique challenges of different life domains, advocating for interventions that focus on satisfying basic psychological needs to promote sustained physical activity engagement.

Dansk Resumé

Dette studie er motiveret af den stigende bekymring for fysisk inaktivitet blandt voksne, en tendens med betydelige negative konsekvenser for folkesundheden. Formålet med undersøgelsen er at få en dybere indsigt i, hvordan individers overbevisninger i relation til og motivation for fysisk bevægelse påvirkes på tværs af og i løbet af livet.

Til at undersøge dette anvendes to adfærdspsykologiske teorier, Theory of Planned Behaviour og Self-determination Theory. Theory of Planned Behaviour beskriver, hvordan individets holdninger, subjektive normer og opfattet adfærdskontrol former deres intentioner om at udføre en given handling, mens Self-determination Theory understreger vigtigheden af individets omgivelser i forhold til at få opfyldt de basale psykologiske behov for autonomi, kompetence og samhørighed. Opfyldelsen af de basale psykologiske behov er ifølge Self-determination Theory afgørende for kvaliteten og holdbarheden af motivationen for at udøve aktiviteten.

Gennem brugen af lange semistrukturerede interviews med 42 deltagere fra forskellige demografiske baggrunde, giver studiet indsigt i interviewdeltagernes personlige oplevelser og overbevisninger relateret til fysisk aktivitet. Interviewene blev analyseret ved hjælp af framework-metoden, som er en form for tematisk analyse. I framework metoden gøres der brug af en kodebog i analysearbejdet, men samtidig er der mulighed for at tilpasse den og tilføje nye temaer undervejs i analyseprocessen.

Studiet er afrapporteret i tre artikler. I artikel 1 anvendes Theory of Planned Behaviour til at undersøge, hvordan livstransitioner påvirker individers overbevisninger i relation til fysisk bevægelse. I artikel 2 anvendes Self-determination Theory til at undersøge hvordan understøttelsen af de psykologiske behov varierer mellem forskellige domæner for fysisk aktivitet (transport, beskæftigelse, husholdning og fritid). Self-determination Theory anvendes også i artikel 3, som fokuserer på, hvordan individer restituerer deres psykologiske behov efter de er blevet undermineret eller ikke er blevet opfyldt.

Fundene fra artikel 1 peger på, at livstransitioner ændrer individers sociale roller og deres dertilhørende forpligtigelser. Især livstransitioner som skolestart, at starte i arbejde og det at blive forældre har en tendens til begrænse individets intention om at være

fysisk aktive på grund af de øgede forpligtelser de medfører. I disse livstransitioner viser vores fund dog, at støttende omgivelser og individuelle tilpasningsstrategier kan bidrage til at opretholde intentionen om at være fysisk aktiv på trods af ændrede sociale roller forpligtelser. På den anden side kan transitioner som at flytte hjemmefra eller gå på pension medføre en øget intention om at være fysisk aktiv, fordi disse transitioner ofte tilbyder større autonomi.

Fundene fra artikel 2 viser, at understøttelsen af de psykologiske behov varierer mellem de forskellige domæner for fysisk aktivitet. I transportdomænet oplevede interviewdeltagerne generelt udøvelsen som en nødvendighed for at komme fra a til b, og de oplevede ikke at deres psykologiske behov blev opfyldt i domænet. Det samme billede gik igen i husholdningsdomænet. I fritidsdomænet og beskæftigelsesdomænet oplevede interviewdeltagerne i højere grad at deres psykologiske behov blev understøttet, men der var samtidig også en del som oplevede at få undermineret deres psykologiske behov i disse domæner.

Desuden viser fundene fra artikel 3 at restitutionsprocessen forløber forskelligt alt afhængt af om processen sker på baggrund af underminering eller mangel på behovsopfyldelse. Når individer oplever mangel på behovsopfyldelse har de en tendens til at kæmpe imod. Det gør de f.eks. ved at ændre måden, de deltager i aktiviteten på, ved at skifte kontekst eller ved at vælge en helt anden aktivitet. Når individer føler, at deres psykologiske behov bliver direkte undermineret, har de derimod en tendens til at trække sig helt fra den pågældende aktivitet og undgår generelt at engagere sig i lignende aktiviteter fremover. Desuden fandt vi, at langvarigheden af reaktionerne på at få undermineret sine psykologiske behov varierer betydeligt afhængigt af, om det er sket i en frivillig eller obligatorisk sammenhæng. Når de psykologiske behov undermineres i en obligatorisk sammenhæng (fx i idrætsfaget i skolen), har det ofte langvarige negative konsekvenser for den enkeltes holdninger til fysisk aktivitet.

Studiet bidrager samlet set med indsigt i at individers overbevisninger i relation til og motivation for fysisk aktivitet overordnet set påvirkes af tre faktorer på tværs af og i løbet af livet: Individets tidligere erfaringer, nuværende omstændigheder og forestillinger om fremtiden. Tidligere erfaringer, både positive og negative, skaber grundlaget for en persons overbevisninger om og motivation for fysisk aktivitet. Disse tidligere erfaringer kan have en langvarig indvirkning på, hvordan en person opfatter og er motiveret for fysisk aktivitet. Nuværende omstændigheder, herunder livstransitioner og hvorvidt man bliver behovsunderstøttet i domæner, spiller også en afgørende rolle for hvordan en persons overbevisninger om og motivation for fysisk aktivitet udvikler sig.

Forestillingen om fremtiden er også en vigtig faktor. Forventninger om sundhedsmæssige fordele i fremtiden kan motivere individer til at ændre deres overbevisninger i relation til fysisk aktivitet og deltage mere aktivt, men varigheden og kvaliteten af denne motivation afhænger af opfyldelsen af psykologiske behov inden for de aktiviteter, de engagerer sig i.

Dette studie bidrager til Theory of Planned Behaviour ved at argumentere for at baggrundsfaktorer bør ses og anvendes om faktorer som aktivt påvirker holdninger, forestillede normer og adfærdskontrol, i stedet for blot at blive anvendt som kontrolvariabler. Ydermere foreslår vi at inddrage livstransitioner som en baggrundsvARIABLE. Studiet bidrager til Self-determination Theory ved at beskrive processen for restitution af de psykologiske behov, og herunder at restitutionsprocessen forløber forskelligt alt afhængt af om processen sker på baggrund af underminering eller mangel på behovsopfyldelse.

Studiet frembringer væsentlige praktiske indsigter ved at påpege nødvendigheden af kontekstspecifikke, behovsstøttende interventioner og strategier. Disse bør tage højde for de unikke udfordringer, som opstår i forbindelse med forskellige livstransitioner og livsdomæner.

01 Introduction

Physical activity is a natural part of life. We eat, we feel, we think, we move. Some people engage in competitive sports, strike a yoga pose, or walk the dog, while others weed the garden or pedal through the streets to their day's work.

Broadly defined by the World Health Organisation (2010), physical activity encompasses any bodily movement produced by skeletal muscles that results in energy expenditure. Thus, physical activity is manifold and includes sport and exercise as well as everyday activities requiring physical exertion, not as an end but as a means (Sallis et al., 2006). The diversity in physical activity patterns can be systematically understood through the framework of 'domains of physical activity,' which segregates physical activities into four domains of life: Transportation, occupation, household, and recreation (Bauman et al., 2012; Bull et al., 2020; Sallis et al., 2006). These domains reflect when, where, and how physical activity is practised. In the transportation domain, physical activity includes all active travel methods, like walking to shops or biking to work. The occupation domain covers tasks within one's job or education, which could range from manual labour in construction to physical education. Household activities include chores done at home, such as gardening and cleaning. The recreation domain is about leisure activities like running, being active in nature or playing team sports.

Each domain contributes to the overall physical activity level (Dalgas et al., 2024; Sallis et al., 2006). A substantial portion of moderate-to-vigorous physical activity individuals get is derived from work, active transportation and household tasks (Brondeel et al., 2016; Koblinsky et al., 2021; Strain et al., 2020; Stroope et al., 2022). Conversely, while still important, recreation activities tend to contribute the least to the overall physical activity levels (Garcia et al., 2022; Strain et al., 2020). Thus, exploring behavioural patterns in their broadness is relevant to generating a comprehensive understanding of behavioural patterns (Sallis et al., 2006).

Physical activity is recognised for its profound implications on both individual well-being and societal health. It is a key determinant in maintaining and enhancing quality of life (Gill et al., 2013) and instrumental in the broader context of health promotion and disease prevention (Fletcher et al., 2018; Warburton & Bredin, 2017). Empirical

evidence robustly supports the assertion that regular physical activity is linked with a reduction in the prevalence of chronic diseases, which in turn correlates with enhanced longevity (Rhodes et al., 2017; Warburton & Bredin, 2017). The scope of these further extends into the psychological and social spheres. Eime et al. (2013) have shown that physical activity also has positive effects on mental health, notably in reducing symptoms of depression and anxiety. Beyond individual health, physical activity promotes social cohesion, encouraging community engagement and fostering social connections (Eime et al., 2013). While the benefits of physical activity are well-established, its effects vary across the different domains of physical activity. Both active transportation and recreational activities significantly benefit health (Guo et al., 2022; Lind et al., 2021; Pandey et al., 2023; Watts et al., 2022; Woodward & Wild, 2020). Household activities benefit brain health and stress reduction (Koblinsky et al., 2021; Santos et al., 2016) but can cause discomfort (Swain et al., 2020). Occupational activities enhance cognitive and mental health and reduce chronic disease risks, yet pose injury risks in physical jobs and ergonomic challenges (Swain et al., 2020).

Despite the inherent role of physical activity in human life, a significant proportion of the global population falls short of the levels recommended by the World Health Organisation (WHO) to reap the extensive benefits of physical activity. The WHO guidelines advise adults to engage in at least 150–300 minutes of moderate-intensity aerobic physical activity, or 75–150 minutes of vigorous-intensity activity, or an equivalent combination of moderate- and vigorous-intensity activity per week. Additionally, muscle-strengthening activities are recommended at least twice weekly (Bull, 2020). However, globally, 28% of adults aged 18 and above do not adhere to these guidelines (Guthold et al., 2018). In Denmark, this figure is 58% (Rosendahl et al., 2022).

The likelihood of physical inactivity increases with age (Rosendahl et al., 2022), which underscores that the challenge of maintaining adequate physical activity is not only evident across the population but also during individuals' lives. Research indicates that the decline in physical activity often observed with increasing age is not solely due to ageing itself. Instead, significant life transitions, such as beginning formal education, entering parenthood, or retiring, are closely linked with changes in how physically active an individual is (Engberg et al., 2012; Gropper et al., 2020). The impact of these transitions on physical activity can vary, with some studies reporting positive effects while others note negative impacts (Gropper et al., 2020). The transition from kindergarten to primary school is an example of a transition that typically leads to a decline in physical activity. This change can be attributed to the more structured environment of primary school, which may limit opportunities for physical activity compared to the less structured setting of kindergarten (Jáuregui et al., 2011; Sigmund et al., 2009; Taylor et al.,

2013). However, some studies, such as Oja & Jurimae (2001), have observed an increase in physical activity during this transition. Moving out of the parental home and gaining residential independence has been linked to decreases in physical activity (Miller et al., 2019; Van Houten et al., 2019) or no significant changes (Simons et al., 2015). Entry into the labour market often leads to a reduction in physical activity, attributed to the sedentary nature of many jobs and time constraints that limit opportunities for physical activity (Larouche et al., 2012; Paluch et al., 2018). Entering into a new relationship can also lead to altered physical activity patterns. Studies have shown both increases (Paluch et al., 2018) and decreases (Josefsson et al., 2018; Salin et al., 2019; Van Houten et al., 2019) in physical activity during this period, indicating that the effect of relationship changes on physical activity is not uniform and might depend on individual circumstances and lifestyle adjustments. Parenthood is another critical transition that has been extensively studied. Research generally finds that transitioning to parenthood results in decreased physical activity (Gropper et al., 2020; Palomäki et al., 2023). Versele et al. (2022) identified shifting priorities, fatigue, time constraints, and altered motivation as key factors influencing reduced physical activity levels among new parents. However, some parents may experience an increase in activity, possibly due to greater health awareness or activities involving childcare (Divine et al., 2021; Gao et al., 2019; Hamilton & White, 2010). In contrast to the decrease in physical activity generally observed in life transitions, retirement is typically associated with an increase in physical activity, often due to more free time and a focus on leisure and health. However, it is important to note that this increase in physical activity often diminishes over time (Barnett et al., 2014; Evenson et al., 2002; Feng et al., 2016). A recent study by Pulakka et al. (2020) found that physical activity changes during retirement are influenced by previous work-related and commuting physical activity, suggesting that those with active jobs or commutes may maintain higher levels of activity post-retirement. Socci et al. (2021) highlight that the experience of retirement and its impact on physical activity is subjective, varying greatly based on individual circumstances. This finding echoes earlier research, which indicated that health status, socioeconomic conditions, and personal preferences significantly influence physical activity levels in retirement (Berger et al., 2005; Chung et al., 2009; Ding et al., 2016). Additionally, a recent study by Klostermann et al. (2023) found that participation in recreational activities varies significantly during life. The study observed a decline in vigorous physical activities with age but a steady or increased interest in less strenuous activities, suggesting a shift in the type of activities preferred at different life stages (Klostermann et al., 2023). The majority of studies in this field tend to adopt a generalised understanding of physical activity (e.g. Ding et al., 2016; Gropper et al., 2020; Miller et al., 2019) or primarily focus on changes in physical activity within one domain or two domains, e.g. the recreation domain (e.g.

Klostermann et al., 2023; Reisberg et al., 2020), household domain (Divine et al., 2021), and occupation domain (Pulakka et al., 2020).

While the existing literature has significantly contributed to our understanding of the trends in physical activity across various life transitions, there are notable limitations in the current research that call for further exploration. Firstly, while general trends are well documented, the contextual and psychological dynamics behind these trends in physical activity within life transitions are not yet fully understood (Gropper et al., 2020, 2023). To fully understand why individuals engage in physical activity differently, generating knowledge on the underlying reasons is crucial. This kind of knowledge might aid health professionals, policymakers, and physical activity program developers in creating targeted and effective strategies to boost physical activity levels. Consequently, more people can experience the benefits of physical activity mentioned above. Moreover, existing studies often use a total measure of physical activity or focus on specific domains such as recreation, household tasks, or work and occupation. As previously mentioned, some studies have suggested that life transitions impact physical activity across various domains (e.g. entering the workforce often results in a decrease in physical activity, largely due to more sedentary as well as time constraints in the recreation domain). However, there is a need for more detailed insights into how life transitions influence physical activity across all domains, including occupation, household, recreation, and transportation. Notably, in contrast with the life transition literature, there has been considerable research into the psychological aspects of physical activity within the domains of recreation and occupation (e.g., Gerber et al., 2018; Kang et al., 2020; Lochbaum & Jean-Noel, 2016). However, studies focusing on the transportation and household domains are more scarce (Burgueño et al., 2020; Dalgas et al., 2024). In essence, while current research offers valuable insights, a limited number of studies comprehensively address various life transitions and domains. Additionally, these studies often fall short of exploring the underlying psychological and contextual dynamics that influence how physical activity changes within and across life.

Secondly, Gropper (2020) establishes that existing studies on physical activity in life transitions are primarily descriptive, and emphasises the need for research based on theoretical knowledge to identify factors influencing physical activity during transitions and further highlights the importance of psychologically appropriate and contextually suitable strategies for promoting and maintaining physical activity consistently throughout a person's life.

Thirdly, the existing literature is predominantly characterised by the use of quantitative research methods. To generate a more rich understanding, there is a need to integrate

qualitative methodologies, like in-depth interviews, into the research landscape. Such qualitative approaches can provide richer, more detailed insights, generating knowledge on aspects and nuances of physical activity behaviour that quantitative methods might overlook.

Generating insight into the nuances of how behaviour is maintained or changed requires a focus on individual psychological mechanisms. This focus is pivotal because these mechanisms provide a deeper understanding of the internal processes that motivate or deter individuals from engaging in physical activity (Hagger et al., 2020). Research has shown that specific methods and techniques for behaviour change based on psychological theories are effective in improving and maintaining physical activity behaviour (Hagger et al., 2020). However, these tend to be insensitive to the contexts of life transitions and domains. Theory of Planned Behaviour and Self-Determination Theory are two influential frameworks for understanding the psychological mechanism underlying physical activity behaviour. Together, Theory of Planned Behaviour and Self-Determination Theory offer comprehensive perspectives on the factors that influence physical activity behaviour, from decision-making processes to the innate psychological needs that continuously drive human behaviour. Importantly, both theories are sensitive to the contexts of life transitions and domains, making them well-suited to address how changes in life circumstances affect physical activity beliefs and motivation. The Theory of Planned Behaviour suggests that a person's intentions to behave in a certain way are influenced by their beliefs (attitudes, social norms, and perceived control over the behaviour) (Ajzen, 1991). This theory is helpful in understanding why individuals choose or do not choose to engage in physical activity and acknowledges the role of the context in this. Self-determination Theory, on the other hand, posits that human behaviour is primarily motivated by the fulfilment of three fundamental psychological needs: autonomy, competence, and relatedness. The theory places a strong emphasis on the nature of motivation. It differentiates between autonomous motivation, which originates internally within the individual, and controlled motivation, which is influenced by external factors such as rewards or pressures. Self-determination theory posits that when individuals experience satisfaction of these three basic psychological needs – feeling autonomous in their choices, competent in their abilities, and connected in their relations – they are more inclined to engage in activities voluntarily and maintain their involvement over an extended period (Ryan & Deci, 2017). Conversely, experiences of need unfulfillment and frustration can diminish motivation and engagement. Recent Self-determination literature has nuanced this by suggesting that experiences of need frustration might act as a driver towards fulfilling experiences (Dalgas et al., 2023b). However, these studies are either laboratory studies or quantitative-biased and haven't clearly distinguished between need frustration and unfulfillment (Dalgas et al., 2023b).

Exploring this psychological mechanism can generate context-sensitive insights on how individuals respond to and recover from motivational threats due to need frustration or unfulfillment, both within and across life domains and transitions. Thus, such knowledge can help in identifying ways to sustain or enhance physical activity engagement across various life domains and transitions.

Applying Theory of Planned Behaviour and Self-Determination Theory to this study could deepen our understanding of physical activity behaviour. This approach emphasises individual psychological processes and simultaneously considers the wider social contexts in individuals' lives. Theory of Planned Behaviour enables an exploration of how personal attitudes, subjective norms, and perceived control over behaviour evolve in individuals' lives. This theory aids in generating knowledge on why individuals might choose to engage or not in physical activity at different life stages, reflecting the changing dynamics of these factors across various life domains such as occupation, household, transport and recreation (Dalgas et al., 2023a). Self-determination Theory complements this perspective by focusing on the evolving nature of human motivation and the fulfilment of psychological needs - autonomy, competence, and relatedness. It provides insight into how internal motivation for physical activity can be nurtured and sustained amidst different or changing external circumstances within and across life. Thus, Self-Determination Theory aids in understanding how fulfilling or not fulfilling these psychological needs in various life areas and during life transitions can clarify why individuals continue, modify, or stop their physical activity behaviour (Dalgas et al., 2023b). This study's findings could offer an in-depth insight into the formation of physical activity beliefs and motivation throughout an individual's life and across various life domains. This knowledge is crucial for policy-making and enhancing public health. It helps understand the changes in physical activity over time and in different life aspects. Tailored interventions can be designed to suit the specific temporal and contextual aspects of an individual's life. Such a tailored approach, acknowledging personal experiences, is likely to yield interventions that are both more meaningful to individuals and more effective in the long term (Garcia et al., 2022).

01.01 The Current Study

To aid researchers and practitioners in enhancing the number of individuals who can benefit from physical activity, this study aims to generate a rich understanding of how individuals' physical activity beliefs and motivation are influenced within and across life. "Within life" pertains to experiences both within each life transition and within each domain of physical activity, while "across life" encompasses the experiences across all life transitions as well as across all life domains. Guided by this aim, the study is

structured into three distinct yet interconnected objectives, each exploring a different facet of this question:

1. To understand how life transitions influence physical activity beliefs and behaviour.
2. To understand variations in need satisfaction, frustration, and unfulfillment within and across domains of physical activity.
3. To understand the process of restoring psychological needs after incidences of need frustration and need unfulfillment.

To achieve these objectives, the study is organised into three papers, each aligned with a specific objective:

Paper 1, Physical Activity Beliefs and Behaviour Within Life Transitions relates to objective 1 by exploring how life transitions influence physical activity beliefs and behaviour using Theory of Planned Behaviour.

Paper 2, Exploring Basic Psychological Needs Within and Across Domains of Physical Activity, relates to objective 2 by, rooted in Self-determination Theory, exploring variations in need satisfaction, frustration, and unfulfillment within and across domains of physical activity.

Paper 3, Exploring the Process of Restoring Psychological Needs After Incidences of Frustration and Need Unfulfillment, relates to objective 3 by exploring the process of restoring psychological needs after incidences of need frustration and need unfulfillment, drawing on Self-determination Theory.

The three papers within the study are distinct in their focus. Yet, they collectively contribute to a comprehensive understanding of how physical activity beliefs and motivation are influenced within and across an individual's life.

01.02 A part of Moving Denmark

The study presented in this thesis was part of the research project *Moving Denmark*. With multiple methods, the study's research group examined the adult population of Denmark's movement habits and the importance of motivation and opportunities for these. The aim was to inform initiatives, projects, and campaigns in health, physical activity, and sports and to provide professionals and researchers in the field with new knowledge.

Moving Denmark was inspired by an ecological approach to physical activity, where we understood the initiation and maintenance of physical activity participation as a complex phenomenon influenced by psychological, social, and environmental factors (Bauman et al., 2012; Calogiuri & Chroni, 2014; Downward et al., 2014; Giles-Corti & Donovan, 2002; Sallis et al., 2006; Ulseth, 2007, 2008).

Moving Denmark used a mixed-methods design (Creswell & Clark, 2018), which allowed us to draw on the strengths of different research design types during data analysis and collection phases. The purpose of this was to achieve a nuanced understanding of the Danes' sports, exercise, and physical activity habits. The research program was implemented across three distinct phases, each building upon the foundations laid by the preceding phase to ensure a comprehensive understanding of physical activity beliefs and motivation within the life course.

Phase 1: Pre-studies

The initial phase of the research program comprised two foundational pre-studies. The pre-studies, conducted in autumn 2019, comprised three literature studies (Elmose-Østerlund et al., 2020; Pedersen et al., 2021, 2022) and a focus group study (Dalgas et al., 2020). The literature studies aimed to collect Danish and international literature on physical activity habits, motivation, and opportunities. Concurrently, the focus group interview study, featuring four focus group interviews, explored various motives and barriers to physical activity.

The systematic reviews suggested that a lack of motivation for physical activity broadly can be explained by three factors. First, due to a cost-benefit analysis, people deselect to spend time and resources on regular physical activity. Many people experience that they are busy (due to family obligations, housekeeping, and work commitments) and may not value physical activity enough to make it a priority in their lives. Second, people may feel that they need to be more competent at physical activities, i.e., not feeling physically fit or skilled enough to be physically active. Third, people may not have sufficient social support to be more physically active. Moreover, people may lack social groups or communities to be physically active with (Elmose-Østerlund et al., 2020; Pedersen et al., 2021, 2022).

The focus group study broadly supported the findings of the systematic review. However, the study further indicated that the initial motives for a physical activity behaviour change often differed from those that led to sustained participation in a physical activity. The motives that lead to sustained participation in physical activity seemed to

be of higher stability over time than the initial motives for a physical activity behaviour change (Dalgas et al., 2020). This highlighted the need to look more closely into how we can facilitate a more stable and high-quality motivation that leads to sustained participation in physical activity.

This pre-study laid the groundwork for the subsequent survey and the follow-up studies. Regarding the interview study reported in this thesis it guided the selection of theories to be applied in the research, specifically the Theory of Planned Behaviour and Self-Determination Theory.

Phase Two: Survey study

The second phase centred around the execution of the main survey. Approximately 400,000 representatively selected adults were invited to participate in the survey in their digital mail (E-Boks). The questions centred on their movement habits, social and cultural background, socioeconomic status, motives and barriers to physical movement and experience of their opportunities to be physically active in their local area. We received responses from 163,133 people. The respondent's answers were linked to GIS data and information from external data sources (e.g., databases), and non-response bias analysis was carried out.

Phase Three: Follow-up studies

The final stage of the "Moving Denmark" research programme consisted of three additional studies, each serving to deepen and refine the understanding established in the previous phases: An objective measure study, a map-based survey, and an interview study.

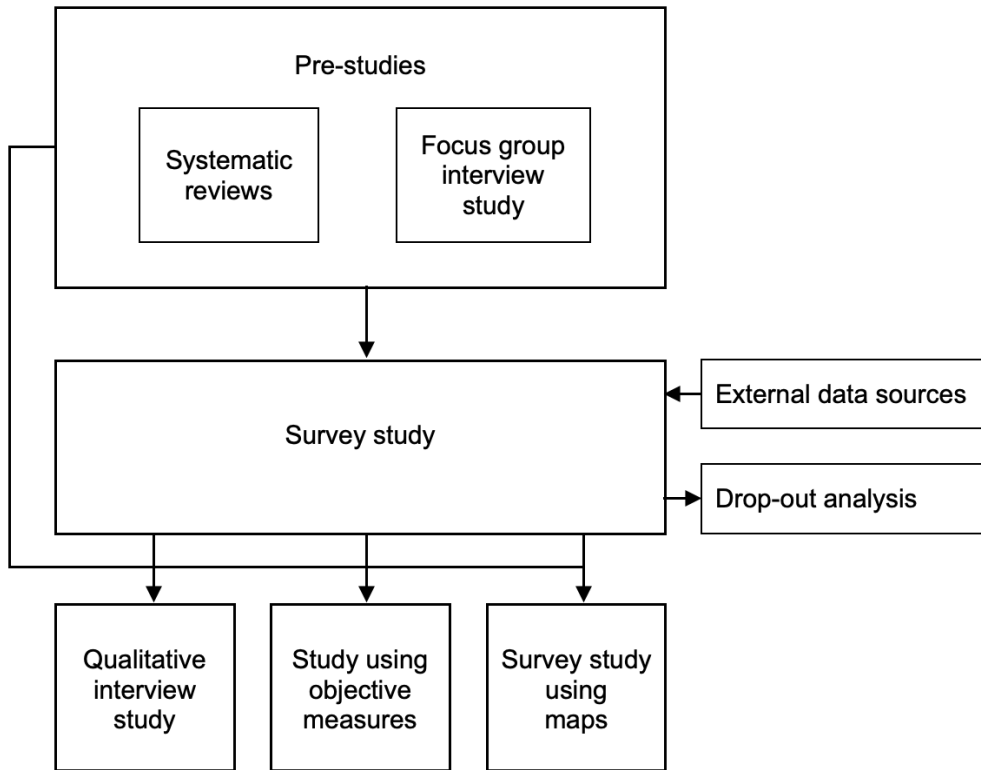
The objective measure study assessed physical activity levels among 1500 participants who had completed the initial survey. An accelerometer, attached to the thigh, was used to record shifts in the body's centre of gravity during movement. The goal was to acquire a "representative" objective indicator of physical activity across Denmark to correlate with the survey findings.

The *map-based survey* was a complementary survey utilising a digital map-based tool (Maptionnaire). It was carried out with a subset of those who had responded to the primary questionnaire. Participants could pinpoint their residential area on a map, their usual walking routes, fitness training locations, etc., and provide evaluations regarding the quality of these locations. This additional survey yielded fresh perspectives on how the proximity to and the quality of physical activity venues influence individuals'

choices regarding where to engage in physical movement. The interview study did not draw on this study's methods, respondents, or results.

The *interview study* is the study I report in this thesis. While other studies in Moving Denmark examine the topic in the "broadness" to generate knowledge on general patterns in the population's movement habits and the importance of motives and opportunities to these, the purpose of this PhD project is to examine Danish adults' physical activity beliefs and motivation to generate rich knowledge on how they physical activity within and across life transitions and life domains. Thus, I undertook an interview study, selecting forty-two participants from those who had previously responded to our questionnaire. I purposefully chose a diverse group to reflect a wide range of perspectives based on the variety of answers they provided in the questionnaire. This will be detailed in the Methods Section. The methodological approach to the interview study is described in detail in the methodology section. See Figure 1.2 for a visual overview of the studies in Moving Denmark.

Figure 1.2: Overview of the studies in Moving Denmark covering the central elements of the research program.



The "Moving Denmark" research programme was structured in three phases. The first phase comprised two pre-studies, a systematic review, and a focus group study. This informed the main survey in phase two. The final stage involved three additional studies: interviews, objective activity measurement, and a Maptionnaire survey, all building on the previous findings from the pre-studies and survey.

02 Epistemology

Life can be understood as a biological phenomenon as well as a psychological phenomenon. The first refers to being alive — to breathe, metabolise, and reproduce. The latter refers to living a life — to do, feel, and think. The ancient Greeks used distinct names for the two kinds of life. The kind of life we refer to when we talk about "being alive" they called zoe. The kind of life we refer to when talking about "living a life" they called bios (Brinkmann, 2020).

Physical activity also involves both processes of zoe and bios. Zoe, since we initiate numerous organic life processes that help us stay alive when we move our bodies (Warburton et al., 2010). Bios in the sense that we have to act to move our bodies.

We have to move to live. We have to live to move.

Even though I am mainly interested in bios, I assume that living as a human being involves both zoe and bios: We eat, we feel, we think, we move.

The study reported in this thesis is driven by an interest in analysing psychological drivers of physical activity behaviour, focusing on the bios aspect of it. Thus, I am interested in exploring how living a life influences physical activity. Focusing on bios as opposed to zoe guides the epistemological framework of my study towards a humanistic, social, and cultural understanding of life that emphasises the complexities of human existence within social contexts and addresses its inherent subjectivity.

The epistemological framework of this study is anchored in three foundational tenets that collectively guide my exploration of physical activity beliefs and motivation. These tenets, inspired by phenomenology and contextualism, provide a lens through which the complexities and nuances of human experiences can be understood. Yet, the study's epistemological underpinnings, while inspired by phenomenology and contextualism, are not a wholesale adoption of these philosophies. Rather, it is a careful and considered borrow of specific elements from each, chosen for their relevance and potential to enrich the understanding of physical activity within and across bios. The three tenets are:

1. Bios can best be assessed through human interaction
2. To understand behaviour, we must understand the context of it
3. The context of bios must be understood as multidimensional

These tenets collectively form the epistemological framework that guides my study. I will detail each of them below.

Bios Can Best Be Assessed Through Human Interaction

The epistemology that human life (bios) best can be assessed through human interaction positions the researcher's person as the primary instrument in understanding and interpreting human experiences. Inspired by some of the principles of phenomenology, this epistemology emphasises the importance of subjective, lived experiences and the role of the researcher in empathetically engaging with and interpreting these experiences within their social contexts.

Phenomenology is generally concerned with the lived experience of individuals. It posits that the most authentic and valid understanding of human phenomena can be accessed through the exploration of how the world appears to individuals (Zahavi, 2003). This perspective recognises the subjective nature of experience, suggesting that reality should be constituted through individual experiences and interpretations (Brinkmann, 2022; Davidsen, 2013; Zahavi, 2003). Husserl's concept of the 'lifeworld' (Lebenswelt) is particularly relevant here. The lifeworld refers to the world as experienced in the immediacy of our lived experiences (Zahavi, 2003). The concept of lifeworld implies a focus on the subjective experience of physical activity, which is central to this study. My central interest is to understand physical activity behaviour from the practitioners' perspectives, emphasising the meanings they ascribe to their actions and the social contexts that shape these experiences. Hence, my approach to understanding the participants' lifeworld is borrowed from Alfred Schutz's phenomenological sociology rather than Husserl's transcendental phenomenology. Schutz expanded on Husserl's concept of the "lifeworld" to the realm of sociology. He argued that individuals' experiences are fundamentally social and that understanding how people perceive and interact within their lifeworld is crucial for comprehending social phenomena (Zahavi, 2003).

By focusing on the lifeworld, I seek to generate knowledge on individual perceptions and experiences. This implies that the data material generated should be rooted in the personal, subjective experiences of the study subjects, offering a rich and nuanced understanding of their experiences related to their physical activity behaviour. In the exploration of the lifeworld, phenomenology advocates for a first-person perspective for comprehending human experiences (Zahavi, 2003). The first-person perspective focuses

on the individual's subjective experiences and how they experience and interpret their world (Høffding & Martiny, 2016). Here, it's important to recognise the individual's unique perspective and understand that their perception of reality is shaped by personal experiences and context (Høffding & Martiny, 2016; Zahavi, 2003). In practice, this means that during interviews, I, as the interviewer, strived to create an empathetic and open environment to encourage the interviewee to share their experiences openly, while I actively listened and asked questions without judgment. Thus, my role as interviewer was not to observe the interview. It was to participate in the interview through engagement, seeking to understand the lifeworld as the interviewee experiences it (see Brinkmann, 2022).

Thus, the epistemology that human life best can be assessed through human interaction is inspired by the phenomenological acknowledgement of the subjectivity of human experiences, emphasising the belief that a profound understanding of human life is attainable through the empathetic and interpretive engagement between the researcher and the interviewee's lived experience (Høffding & Martiny, 2016; Zahavi, 2003).

To Understand Behaviour, We Must Understand the Context of It

The epistemology that is comprehending behaviour necessitates understanding its context places a central focus on the interplay between individual agency and the surrounding environment. Although the work of Alfred Schutz, particularly his emphasis on the contextuality of human behaviour and interactions, informs this aspect of the study, the epistemological tenet is more directly inspired by Glen H. Elder's contextualistic life course perspective (Elder, 1995).

Elder emphasises the dynamic interaction between individual agency and social-historical context. From an ontological perspective, he views behaviour as a process shaped by life trajectories and transitions, interdependent relationships, and agency within structures (Elder, 1975, 1995). Thus, in line with Schutz, he understands behaviour as a dynamic, contextually embedded form of agency shaped by experiences in personal relationships as well as within the wider social and historical context. Aligned with this ontology, the focus of this study extends beyond the immediate context of physical activity behaviour, aiming also to situate individual experiences in personal relationships as well as within the wider social and historical context.

In my approach to exploring physical activity beliefs, motivation and behaviour, I incorporate three ontological elements derived from Elder that influence the epistemology this study is underpinned by: 1) Behaviour is a product of life history, 2) lives are interdependent, and 3) individuals exercise agency within structure.

Starting with the first ontological element, Elder posits that behaviour is a product of life history and thus emphasises the importance of an individual's past experiences in shaping their current actions and attitudes (Elder, 1995). Thus, I view behaviour as closely linked to an individual's life history, acknowledging that present behaviour are not isolated phenomena but are outcomes of a cumulative process shaped by past experiences. In order to understand behaviour, I, therefore, must be sensitive to the historical trajectory of individuals' lives, tracing how past stages and experiences impact their current behaviour. Elder further centres on the impact of life transitions on individual life trajectories, emphasising their role as either drivers for change or of continuity in behaviour. By exploring these critical moments and their relation to individuals' paths and decisions, we can generate insights into the dynamics of behavioural change or persistence (Bernardi et al., 2019). As demonstrated in the introduction above (see section 01 Introduction), existing research has found that life transitions, such as starting school, entering parenthood, or retiring, have an influence on physical activity levels, with the nature and direction of this impact varying depending on the specific transition and individual circumstances. Understanding how life transitions influence physical activity can provide insights into why individuals may become less active at certain stages of their lives, offering the possibility of exploring physical activity behaviour as a dynamic process that evolves over time.

Additionally, Elder posits the concept of interdependence in human lives, suggesting that our behaviour and choices are significantly influenced by our relationships and interactions with others (Elder, 1995). Following Elder's concept of linked lives, my approach recognises the significant influence of social relationships on individual behaviour. I understand that behaviour is embedded in a network of social interactions, reflecting the influence of family, friends, and broader social communities. This interconnectedness is a vital aspect of my research, as it highlights the importance of considering both proximal and distal social contexts and relationships in analysing and understanding behaviour.

Furthermore, Elder's perspective acknowledges that individuals exercise agency within the constraints and opportunities afforded by societal structures (Elder, 1995). This understanding informs my approach to studying human behaviour, emphasising the need to consider the historical, relational, and societal contexts in which behaviour occurs. Drawing from Elder's perspective, I maintain a balanced view of individual agency and societal structure in shaping behaviour. This approach acknowledges that while individuals are active agents making choices, their behaviour are also conditioned by the societal context, including norms, institutional boundaries, and cultural frameworks. In

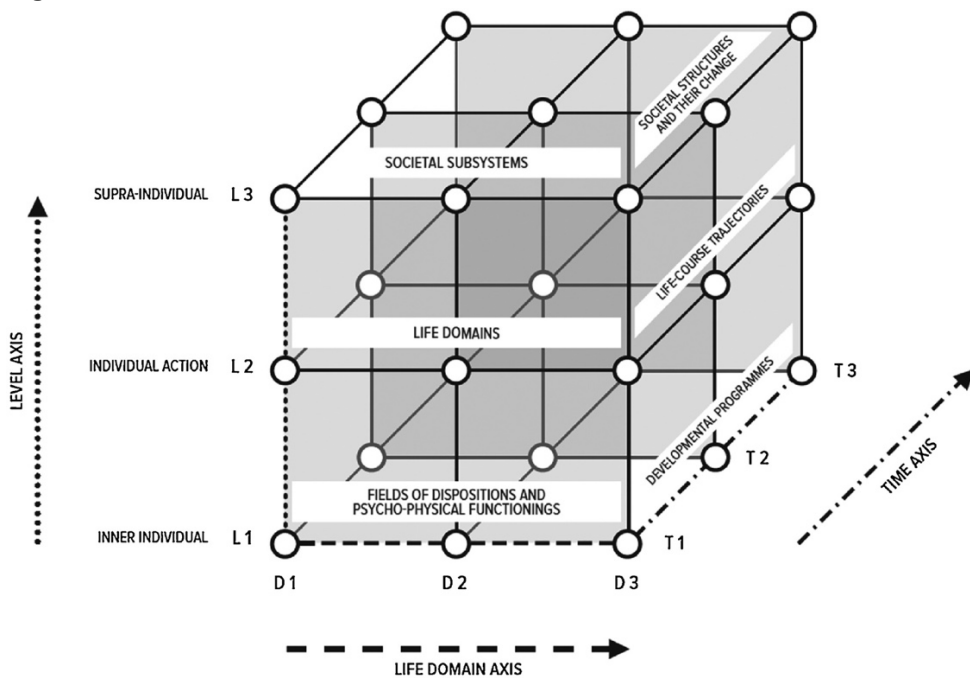
my study, this translates into an exploration of how individuals navigate the societal structures that frame their lives, offering a view of behaviour that accounts for both personal actions and external influences. This duality acknowledges that while individuals have the capacity to make choices (agency), their decisions and behaviour are also shaped by societal structures and constraints. In applying this to the study, it becomes possible to explore how individuals actively shape their life courses as well as how they are influenced by external factors beyond their control.

The context of bios must be understood as multidimensional

The epistemology that the context of bios must be understood as multidimensional posits that individual behaviour cannot be fully understood in isolation but must be seen in relation to the multidimensional context of human experiences. This understanding of the multidimensional context of bios thus encapsulates both Schutz's (see Zahavi, 2003) and Elder's (see Elder, 1975, 1995) key principles and situates individual behaviour within a broad, interwoven framework of personal history, social places, social relations, and societal structures, advocating for a holistic approach to understanding human behaviour.

Recently, Bernardi et al. (2019) have constructed a multidimensional model titled the "Life Course Cube" that incorporates the contextuality of the life course perspective with the multilevel approach of socioecology. Thus, Life Course Cube illustrate the epistemological tenet of this thesis, that to understand behaviour, we must understand the context of it. The Life Course Cube is a multidimensional model structured along three axes that are interdependent: the Time axis, the Life Domain axis, and the Level axis (See Figure 02.01).

Figure 02.01: The Life Course Cube



Adapted from Bernardi et al. (2019), the Life Course Cube is a framework depicting the dynamic, multi-dimensional nature of an individual's life. It comprises three axes: time, life domains, and levels. The time axis represents life stages from birth to old age, denoting chronological development. The life domain axis covers various life aspects like work, household, and recreation, underscoring diverse life experiences. Lastly, the level axis spans from personal to societal and environmental influences, demonstrating the various factors shaping an individual's life trajectory.

The *Time axis* is essentially the timeline of a person's life, encompassing all the significant transitions and phases the person goes through from birth to death. Included in this are 'turning points,' significant events that disrupt an individual's life trajectory and may lead to changes in, e.g. physical activity behaviour. In the present thesis, the time axis is operationalised through the lens of the most salient life transitions in the participants' narratives (Dalgas et al., 2023a). According to Bernardi et al., this timeline is not a series of isolated events but a connected sequence where earlier experiences have an impact on what happens later in life (2019, 2020). This idea is known as 'path dependency' (Bernardi et al., 2019, 2020; Elder, 1995). The Time axis thereby provides a structured, longitudinal perspective for understanding the evolution of physical activity beliefs and behaviour within life transitions.

The *Life Domain axis* captures the various domains that constitute an individual's life (Bernardi et al., 2019, 2020). In this thesis, life domains are defined by the domains of physical activity: transport, occupation, household, and recreation (Bauman et al., 2012; Chu et al., 2015; Dalgas et al., 2023b; MacNiven et al., 2012; Sallis et al., 2006). The 'transport' domain encompasses methods of active travel, such as jogging to a bus stop or rollerblading to a nearby park. The 'occupation' domain highlights activities linked to one's professional or academic life, ranging from the physical exertion required in landscaping to teaching a dance class. The 'household' domain includes activities related to home upkeep, such as washing the car or sweeping floors. Lastly, the 'recreation' domain pertains to voluntary leisure activities, including swimming laps in a pool or playing a game of basketball (Dalgas et al., 2023b). The Life Course cube and the Life Domain axis facilitate a deeper understanding of how physical activity is experienced differently across various domains of life. Bernardi et al. (2019, 2020) stress the key role of the Life Domain axis in exploring the connections between different life areas. This approach illuminates the interconnection between different life domains, revealing how physical activity in one area can affect or be affected by actions in another. It aids in identifying the motivation for physical activity across these domains and underscores the substantial influence of activities in one part of life on those in other parts (Bernardi et al., 2019).

The *Level Axis* categorises influencers into 'inner individual,' 'individual action,' and 'supra-individual' levels. The inner-individual level focuses on psychological and physiological attributes. The individual action layer examines the role of immediate social contexts in shaping life courses. The supra-individual level considers the influence of macro-social factors (Bernardi et al., 2019). In this thesis, the level axis is operationalised through the lens of psychological theories of behaviour. Psychological theories of behaviour aim to understand the psychological mechanisms that influence how people behave (Biddle & Murte, 2008). This approach offers insight into the interplay between psychological processes and external factors in shaping behaviour. It examines how internal psychological mechanisms interact with immediate social contexts, addressed at the 'individual action' level, and broader macro-social factors, situated at the 'supra-individual' level, to collectively influence behaviour. The specific psychological theories of behaviour applied in this study will be detailed in the following sections.

By acknowledging the importance of the network of *interdependencies* between life transitions, life domains, and multiple levels of influence, the inspiration of the life course cube as an epistemological framework can aid in generating knowledge on the dynamics behind why some people are sufficiently physically active while others are

not. Understanding these can help identify paths to encourage consistent and beneficial physical activity habits throughout life.

03 Theory

In this section, I will detail the theoretical underpinnings that guide the exploration of physical activity beliefs, motivation, and behaviour during life. I have applied two theoretical frameworks: Theory of Planned Behaviour and Self-Determination Theory. Both theories provide a lens through which the individual psychological drivers can be explored, as well as the socio-contextual influences that shape these (Ajzen, 1991; Ryan & Deci, 2017).

Theory of Planned Behaviour, a social-cognitive theory, has frequently been used to explain what determines behavioural intentions and different types of health behaviour, including physical activity (Hagger & Chatzisarantis, 2009). Theory of Planned Behaviour emphasises that intentions and behaviour are mediated by a three-part belief system that includes evaluations of behavioural outcomes, societal expectations, and perceived control factors. Meta-analyses have validated the theory's efficacy in explaining physical activity behaviour (Downs & Hausenblas, 2005; McEachan et al., 2011). In the context of the present study, its relevance has been demonstrated by a recent meta-analysis conducted by Hagger and Hamilton (2023), which analysed longitudinal applications of Theory of Planned Behaviour. Their findings show that Theory of Planned Behaviour is a stable theoretical framework that is highly effective in predicting behaviour over extended periods (Hagger & Hamilton, 2023). This is pertinent to life course studies, as it highlights the theory's capacity to account for changes in people's beliefs and attitudes across the life course. Thus, it is an applicable framework for understanding and predicting behaviour in diverse and changing life contexts.

While the Theory of Planned Behaviour offers valuable insights into behavioural determinants, it falls short in certain areas, notably in differentiating between various types of motivation and their underlying qualities. This limitation means that Theory of Planned Behaviour does not adequately explain the reasons behind the pursuit of specific beliefs and their influence on behaviour (Hagger & Chatzisarantis, 2009). Therefore, complementing with an additional theoretical framework could enhance our understanding of the experience-based drivers for the continuation of physical activities. In this regard, the Self-Determination Theory is a relevant complementary perspective to Theory of Planned Behaviour. While Theory of Planned Behaviour falls short in

differentiating between various types of motivation and their underlying qualities, Self-Determination Theory delves into the quality of motivation, categorising it on a spectrum from autonomous to controlled. According to Ryan and Deci (2017), motivation that are autonomously driven tend to be linked with better psychological health and a stronger commitment to health-related behaviour. In contrast, motivation that are overly controlled often lead to adverse psychological effects and a tendency to shun certain activities. This distinction in motivation types provided by Self-Determination Theory can be instrumental in understanding behaviour in health-related contexts. Numerous studies confirm Self-Determination Theory's usefulness in investigating physical activity (Teixeira et al., 2012; Wang & Hagger, 2023). While some scholars have suggested integrating these theories to offer a unified model of motivation and behaviour (Hagger & Chatzisarantis, 2009), I have used them as complementary distinct frameworks focusing on different underlying psychological aspects of physical activity behaviour. The theory of Planned Behaviour primarily concentrates on the factors that initiate behaviour. It does so by examining how attitudes, subjective norms, and perceived behavioural control collectively influence behavioural intentions. In contrast, Self-determination theory is more concerned with what sustains behaviour over time, particularly the psychological mechanisms that contribute to the persistence and quality of motivation in relation to an activity (Deci & Ryan, 2000; Ryan & Deci, 2002). Thus, Theory of Planned Behaviour provides a detailed understanding of the social cognitive determinants that lead to behaviour changes, answering the 'what' and 'how' of taking that first step. Self-determination theory, on the other hand, addresses the 'why' behind the ongoing engagement in a behaviour, elucidating the psychological needs that must be met for an activity to be sustained over time. In applying both theories, the objective is to achieve a rich and comprehensive understanding of the entire behavioural process.

03.01 Theory of Planned Behaviour

The Theory of Planned Behaviour, formulated by Ajzen (1991) and building upon earlier work by Fishbein and Ajzen (1975), is a well-validated theory for understanding behavioural change (Hagger et al., 2002). Anchored in social cognitive theory, Theory of Planned Behaviour places particular emphasis on the concept of 'intention' as the most direct predictor of behaviour (Ajzen, 1991; Fishbein & Ajzen, 1975; Hagger et al., 2002). Ajzen conceptualises 'intentions' as the individual's level of commitment to engage in the behaviour in question (Ajzen, 1991). The stronger an individual's intention to undertake a specific behaviour is, the more likely they are to actually perform it (Ajzen, 1991). An example from the household domain of physical activity is that when an individual's intention to tend their garden for weeding is strong, they are likely to

actually do it. Conversely, if their intention to weed the garden is limited, the probability of completing the task is reduced.

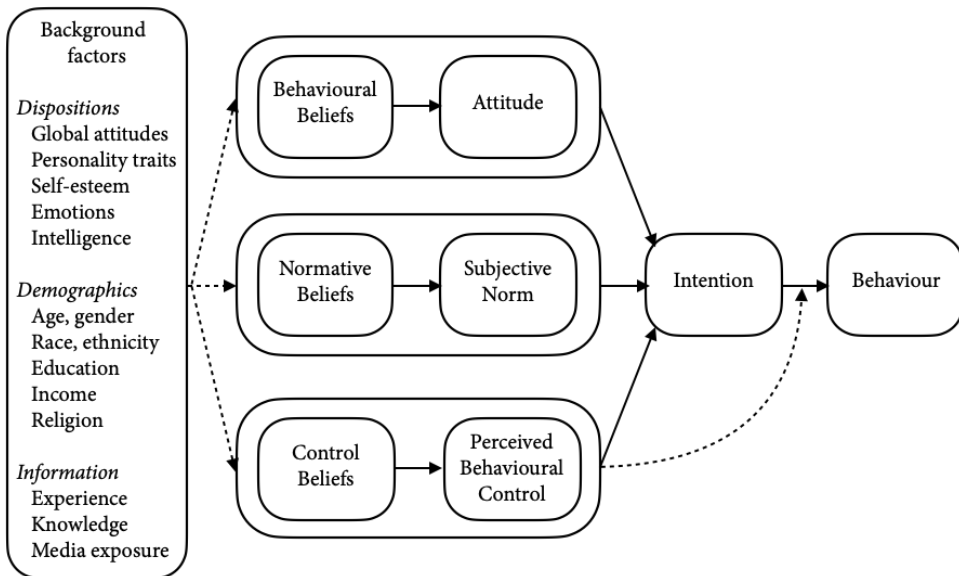
The strength of the intention is influenced by three belief-based constructs: Attitude towards the behaviour, subjective norms surrounding it, and perceived behavioural control over it. Attitude is the individual's evaluative assessment concerning the behaviour, whether positive or negative. If the individual's attitudes concerning the behaviour are positive, the behaviour is associated with desirable consequences. If the individual's attitude concerning the behaviour is negative, the behaviour is associated with undesirable consequences (Ajzen, 1991; Fishbein & Ajzen, 1975). Subjective norms relate to the individual's subjective assessment of perceived social pressure to perform or not to perform the behaviour. Individuals can either perceive that important others approve of the behaviour and thereby perceive social pressure and support to perform the behaviour, or they can perceive that important others disapprove of the behaviour, thus perceiving a social pressure to not perform the behaviour (Ajzen, 1991; Fishbein & Ajzen, 1975). Perceived behavioural control encompasses the individual's subjective assessment of the ease or difficulty associated with performing the behaviour. Factors that enhance perceived behavioural control, such as having access to a gym or possessing knowledge about exercise techniques, can encourage the behaviour. Conversely, factors that diminish perceived behavioural control, like a lack of time or physical limitations, might inhibit the behaviour (Ajzen, 1991). When individuals possess positive attitudes, sense supportive social norms through their subjective assessments, and believe they have control over their actions, they are more likely to form strong intentions to perform the behaviour. As a result, the probability of actual behaviour enactment increases (Ajzen, 1991; Dalgas, 2023a; Fishbein & Ajzen, 1975; Hamilton & White, 2010). For example, an individual's intention to regularly tend their garden may be strengthened by a positive attitude towards gardening, supportive subjective norms from a spouse, and perceived control over their time, collectively increasing the likelihood of consistent maintenance. On the other hand, if their intention to weed the garden is weakened due to a negative attitude towards gardening, lack of supportive norms, and perceived time constraints, the likelihood of performing the task is significantly reduced.

Salient beliefs underpin each of the three core constructs—attitudes, subjective norms, and perceived behavioural control. Behavioural beliefs, normative beliefs, and control beliefs are integral components of the Theory of Planned Behaviour, a framework developed by Icek Ajzen to understand human behaviour. Behavioural beliefs refer to an individual's perceptions of the outcomes of a behaviour and their evaluations of these outcomes, shaping their attitude towards the behaviour. For example, believing that exercise leads to better health forms a positive attitude towards physical activity.

Normative beliefs concern the perceived social pressures regarding a behaviour based on how significant others view it. These beliefs underlie subjective norms, influencing whether an individual feels social pressure to conform to these expectations. For instance, if a person perceives that their family and friends think they should quit smoking, this creates a social motivation to comply. Lastly, control beliefs relate to the perceived ease or difficulty of performing the behaviour, considering various facilitating or impeding factors. These beliefs contribute to an individual's perceived behavioural control, impacting their ability to perform the behaviour. For example, having enough time and resources increases perceived control over starting a new hobby. Collectively, these beliefs form a comprehensive understanding of how attitudes, social pressures, and perceived control influence human behaviour across different situations (Ajzen, 1991). Taking the example of weeding the garden, an individual's overall positive or negative feeling towards the task (attitude) is shaped by beliefs such as its benefits or tediousness (behavioural beliefs). Their perception of social pressure to weed (subjective norms) is influenced by what they think significant others expect of them (normative beliefs). Finally, their belief in their ability to weed the garden (perceived behavioural control) is determined by factors like available time and tools (control beliefs).

Ajzen (2020) has expanded the model to include background factors such as dispositions (e.g. intrinsic patterns of thought, emotion, and action), demographics (e.g., age, gender, race, socioeconomic status, and education), and information (e.g. knowledge on and experience with the behaviour). These factors indirectly shape intentions and behaviour by influencing attitudes, subjective norms, and perceived behavioural control. For instance, an individual's age or economic status (demographics) may influence their belief about how feasible it is to engage in regular physical activity, which in turn affects their intention and the actual undertaking of the activity.

Figure 03.01: Theory of Planned Behaviour



Adapted from Fishbein & Ajzen (2010). This figure illustrates the central constructs of the Theory of Planned Behaviour. Central to the model is 'Intention', influenced directly by 'Attitude', 'Subjective Norms', and 'Perceived Behavioural Control', each grounded in 'Behavioural Beliefs', 'Normative Beliefs', and 'Control Beliefs' respectively. Background factors indirectly shape these constructs, depicted by dashed arrows, while solid arrows represent direct influences on intention, guiding the likelihood of performing a behaviour.

Using the Theory of Planned Behaviour to explore physical activity beliefs in life provides a perspective on how personal beliefs and intentions are situated within the broader context of an individual's life. Theoretically, the lives of individuals might influence the background factors in the Theory of Planned Behaviour, consequently affecting attitudes, subjective norms, and perceived behavioural control. For example, beginning school or a job introduces individuals to new social circles, potentially altering their subjective norms (beliefs about what others think they should do) regarding certain behaviour, such as physical activity. In the context of weeding a garden, moving to a new house might expose an individual to neighbours who place a high value on gardening, thereby influencing their perceptions and potentially making them more inclined to engage in gardening activities like weeding. Thus, this perspective allows for a rich understanding of how psychological and contextual factors interact across different life transitions and shape and modify behaviour.

03.02 Self-Determination Theory

Self-determination theory takes an organismic approach, centring on the quality and types of motivation. Developed by Deci and Ryan (1985), this theory advances the idea that individuals are inherently active and growth-oriented, inclined towards pursuing challenges and integrating their experiences into a coherent sense of self (Ryan & Deci, 2017).

Self-Determination Theory encompasses six mini-theories, including Cognitive Evaluation Theory, which explores intrinsic motivation; Organismic Integration Theory, addressing extrinsic motivation and its internalisation; Causality Orientations Theory, examining motivational orientations; Basic Psychological Needs Theory, focusing on the needs for autonomy, competence, and relatedness; Goal Contents Theory, differentiating intrinsic and extrinsic goals; and Relationship Motivation Theory, concerning motivation within relationships (Ryan & Deci, 2017). This study primarily draws on Basic Psychological Needs Theory. The decision to focus on Basic Psychological Needs Theory within Self-determination theory is grounded in its assertion that the satisfaction of the basic psychological needs is important for fostering high-quality motivation and psychological well-being. Additionally, the Basic Psychological Needs Theory emphasises the role of context in either supporting or hindering the satisfaction of the psychological needs for autonomy, competence, and relatedness, which aligns with the study's epistemological underpinnings as well as its aim.

According to Self-determination theory, motivation means “to be moved to do something” (Ryan & Deci, 2000, p. 54), and it is distinguished as either autonomous or controlled. Autonomous motivation, regarded as higher quality, arises from an individual's genuine self, reflecting their personal values and interests or deriving from a sense of enjoyment. In contrast, controlled motivation, seen as lower quality, originates from internal or external pressures such as feelings of guilt or the presence of rewards or punishments (Ryan & Deci, 2017). In the context of weeding a garden, a person may engage in a task driven by autonomous motivation, where their actions stem from a deep-seated love for gardening and the intrinsic pleasure derived from nurturing plants and maintaining a beautiful outdoor space. This aligns with their personal values and provides a sense of fulfilment. Conversely, another individual might approach the same task with controlled motivation, prompted by external pressures such as societal expectations or disapproval from neighbours over an unkempt yard. Their motivation is rooted in a desire to avoid criticism and feelings of guilt rather than any inherent enjoyment of the activity. Within physical activity contexts, autonomous motivation is associated with various positive outcomes, including increased engagement in physical

activity, sustained effort (Ng et al., 2012; Teixeira et al., 2012), beneficial behaviour (Ng et al., 2012; Sheeran et al., 2020), enhanced vitality (Rouse et al., 2011), and overall well-being (Ng et al., 2011). Controlled motivation, conversely, tends to relate to negative well-being, unhelpful behaviour (Ng et al., 2012), reduced life satisfaction and self-esteem (Ng et al., 2011), and depressive symptoms (Ng et al., 2012; Rouse et al., 2011).

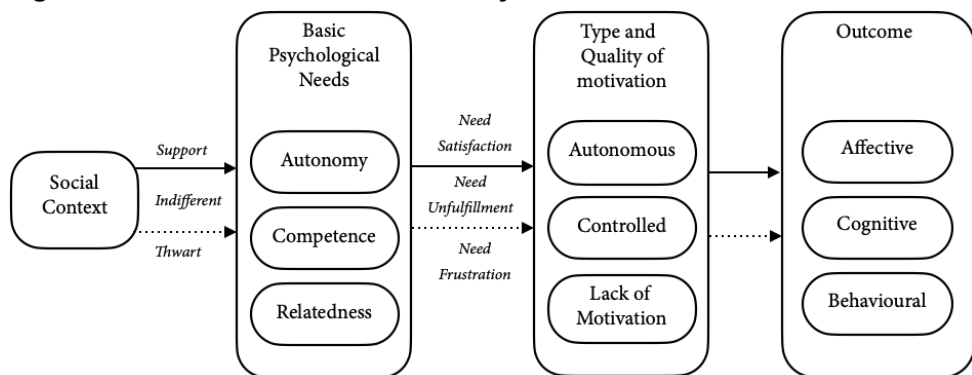
Self-determination theory suggests that the fulfilment of three innate basic psychological needs, autonomy, competence, and relatedness, determines whether motivation is autonomous or controlled (Ryan & Deci, 2017; Quested et al., 2021). Autonomy encompasses the desire to feel volitional and in control of one's actions. Competence involves feeling capable and effective in one's social interactions and having opportunities for skill development. Relatedness involves a sense of connection and acceptance by others (Ryan & Deci, 2017).

The social context either fosters or hinders these needs. Environments that support these needs encourage their fulfilment, while those that thwart them lead to frustration (Ryan & Deci, 2017; Bartholomew et al., 2018). Experiencing need frustration typically results in controlled motivation, leading to the negative outcomes mentioned earlier. In contrast, when needs are satisfied, motivation tends to be autonomous, resulting in positive outcomes (Ryan & Deci, 2017; Quested et al., 2021). Recent studies have introduced a third state between need frustration and satisfaction, termed need unfulfillment (or dormant need; Reeve et al., 2023). This state occurs when psychological needs are overlooked or neglected (Bhavsar et al., 2020; Huyghebaert-Zouaghi et al., 2021; Ntoumanis, 2023). Indifferent environments often give rise to perceptions of need unfulfillment (Ntoumanis, 2023; Reeve et al., 2023). It's suggested that while need unfulfillment can lead to maladaptive functioning, it is not as detrimental as experiences of need frustration, with examples including classroom disengagement rather than outright defiance (Reeve et al., 2023).

Taking the example of gardening, the principles of Self-Determination Theory can be applied to understand the motivation behind weeding a garden. If a person feels a sense of autonomy in gardening, experiencing it as a volitional and self-directed activity, this aligns with their need for autonomy. When they perceive themselves as skilled and effective in gardening, successfully managing the task of weeding, this fulfils their need for competence. Furthermore, if this gardening activity is acknowledged and appreciated by others, contributing to a feeling of connectedness and acceptance, it satisfies the need for relatedness. In such a scenario, where the social context of gardening supports these psychological needs, the motivation to weed the garden is likely to be autonomous. The individual engages in the task out of a genuine interest or pleasure, leading

to positive experiences and outcomes. Conversely, if the social environment thwarts these needs — for instance, if the individual feels pressured to weed the garden to avoid disapproval from neighbours (autonomy frustration), doubts their gardening skills (competence frustration), or feels isolated in their gardening efforts (relatedness frustration) — this can lead to psychological need frustration. Such a scenario typically results in controlled motivation, where the individual weeds the garden not out of enjoyment or personal value but due to external pressures or obligations. This controlled motivation often leads to less favourable outcomes, such as reduced enjoyment or a sense of obligation. Need unfulfillment manifests as an individual engaging in weeding without feeling particularly pressured or fulfilled by the task. It's a neutral state, less harmful than need frustration, but not as beneficial as need satisfaction.

Figure 03.02: Self-Determination Theory



This figure illustrates the SDT framework, showing how social context supports, thwarts or is indifferent towards basic psychological needs—autonomy, competence, and relatedness. Supportive contexts lead to need satisfaction, while indifferent contexts lead to need unfulfillment, and thwarting contexts lead to need frustration. These experiences, in turn, influence the quality and type of motivation: Autonomous motivation arises from need satisfaction, while need frustration can result in extrinsic motivation or motivation. The type of motivation then affects affective, cognitive, and behavioural outcomes.

The application of Self-determination theory to the context of individuals' lives provides a possibility of exploring how different life contexts influence the satisfaction, unfulfillment, or frustration of basic psychological needs. In the context of life domains, theoretically, each domain might offer unique challenges and opportunities for experiencing autonomy, competence, and relatedness, which in turn influences the type and quality of motivation that drives behaviour within these domains. Self-determination theory is attuned to various levels of influence, acknowledging the influence of internal

psychological needs, the role of immediate social contexts like family, work, or the sports club, as well as the impact of broader cultural and societal factors (Ryan & Deci, 2017). Self-determination Theory's sensitivity to these different levels of influence and contexts lies in its recognition that the fulfilment of basic psychological needs and the resultant motivational states are not only determined by internal psychological factors but are also profoundly influenced by the social and cultural contexts in which an individual operates.

04 Methods

The use of qualitative semi-structured interviews is aligned with the study's epistemological foundations in phenomenology and contextualism, and it effectively meets the study's aim and objectives by allowing for an in-depth and nuanced exploration of individual experiences and perspectives on physical activity. The study's ontological foundation recognises human life (bios) as encompassing complex, subjective experiences. Phenomenological perspectives advocate that understanding these subjective aspects necessitates engagement through empathetic and interpretive means (Brinkmann, 2022; Høffding & Martiny, 2016; Zahavi, 2003). Qualitative methods were chosen for this study because they are well-suited to explore the complexities of human subjective experiences, as detailed by Denzin & Lincoln (2011).

More specifically, Semi-structured interviews are used in this study to capture context-rich, detailed data on physical activity behaviour. This method aligns with the phenomenological approach, as it enables an exploration of individuals' lived experiences from their own perspectives, enhancing our understanding of the subjective factors influencing physical activity habits and motivation. The semi-structured format also offers the flexibility for participants to contribute their unique experiences and insights, enriching the research findings while ensuring a systematic exploration of the key research themes (Brinkmann, 2023; Kvale, 2007; Smith & Sparkes, 2016).

Qualitative semi-structured interviews are therefore chosen for their capacity to provide a comprehensive approach to understanding the multifaceted and subjective nature of physical activity, capturing the nuances of individual experiences, and offering a depth of understanding that quantitative methods may not provide.

04.01 Participants

Below, I will account for the sampling strategy and recruitment process of the study reported in this thesis. The interview participants were selected from the respondents of the *Moving Denmark* survey (N=163,136, RR= 40 %). At the survey's conclusion, respondents were given the option to indicate their interest in being approached for the interview study. 48,488 agreed to be potential interview participants. It was among these, the participants for this interview study were drawn.

I adopted a purposeful sampling strategy, as recommended by Polkinghorne (2005), to select participants from the source population. This approach aligns well with our aim to deeply understand complex experiences. The choice of purposeful over random sampling was driven by the need to gather data that are rich in information and directly pertinent to our research aim and objectives. To implement this, I used maximum variation sampling (Creswell & Poth, 2018; Gray, 2004; Maxwell, 2013; Patton, 2015; Schreier, 2018). This method allowed us to capture a wide array of viewpoints, ensuring a diverse sample that enabled us to explore patterns across varied experiences, thereby enriching the breadth of our study's findings.

As Creswell & Poth (2018) state, maximum variation sampling requires some criteria to differentiate the participants into. The criteria for differentiation among participants in the present study included physical activity frequency, age groups, gender, and municipality socioeconomic status profile. The criteria serve as a methodological tool rather than the primary object of analysis. The goal is not to compare these constructs across different activity levels but to sample a variety of persons to generate robust insights into the environmental factors that influence them across the spectrum of physical activity behaviour. The criteria will be detailed below.

Gender is a fundamental aspect of identity that can significantly influence an individual's experiences, perspectives, and behaviour. Research has shown that physical activity habits and motivation can differ markedly between genders due to various biological, psychological, and social factors (Craft et al., 2014; Pan et al., 2009). By including both male and female respondents, the study ensures a diverse range of perspectives, enriching the understanding of physical activity behaviour across different genders. The survey respondents' genders were sourced from a national database with categories for male and female.

Different age groups typically represent distinct life stages, each with unique experiences, challenges, and priorities. By categorising ages into 15-29, 30-64, and 65+ years, the study effectively encapsulates the major phases of adult life in a Danish context, ranging from youth and early adulthood to middle age and senior years. More specifically, these categories were designed to encapsulate distinct life phases in a Danish context. The age brackets were informed by the findings of the existing studies on physical activity changes within life transitions, which suggested that having a child and retiring cause the most significant physical activity behaviour changes (Gropper et al., 2020). The first age bracket, 15-29 years, covers a period leading up to the average age at which individuals in Denmark typically become first-time parents (Danmarks Statistik,

2023). The second age bracket, 30-64 years, encompasses the years following the typical age for becoming a first-time parent up to the average retirement age of 64.6 years (Beskæftigelsesministeriet, 2023). The third age bracket of 65+ years commences at the average retirement age and above. The survey respondents' ages were sourced from a national database.

Physical activity frequency levels were calculated from the survey respondents' responses to physical activity behaviour questions, which were recoded into five levels of activity frequency ranging from 'Never' to '5+ times per week'. Thus, the physical activity frequency level was defined by the frequency of engagement in activities per week. Physical activity frequency was measured across the four domains of physical activity — transport, occupation, household, and recreation. In each of the four physical activity domains, indices were developed by dividing respondents into five groups of equal size. These groups were assigned values from 1 to 5, where 1 indicated the bottom 20% in terms of activity level, and 5 indicated the top 20%. These indices were combined to form a comprehensive index reflecting the relative participation level in physical activity across all domains. The combined index was then categorised for selection purposes: the lowest 20% of respondents were classified as having 'low' participation, the middle 60% as 'medium' participation, and the top 20% as 'high' participation.

The profile for municipality socio-economic status was constructed based on a categorisation that integrates two factors: a) the size of the largest town in the municipality and its job availability, and b) a socio-economic index that aggregates various parameters indicative of the relative social expenditure needs within the municipality (Danmarks Statistik, 2018; Økonomi- og Indenrigsministeriet, 2019). Ten distinct types of municipalities were identified for this study: The Capital, capital municipalities with socio-economic advantages, capital municipalities with socio-economic disadvantages, major city municipalities, provincial municipalities with socio-economic advantages, provincial municipalities with socio-economic disadvantages, countryside municipalities with socio-economic advantages, countryside municipalities with socio-economic disadvantages, rural municipalities with socio-economic advantages, and rural municipalities with socio-economic disadvantages. Refer to Appendix A for clarification on which municipalities are included in each municipality type. This categorisation allowed for a diverse representation of physical activity behaviour and motivation across varying socio-economic and geographical contexts within Denmark. Data for these municipalities were sourced from a national database.

To operationalise this sampling strategy, we implemented filters using SPSS to form 36 different sampling groups. For instance, one filter targeted males within the age bracket

of 15-29 years who reported low levels of physical activity and lived in a provincial municipality with a socioeconomic advantage. A table of all sampling groups is displayed in Table 6.1 below. From each of the 36 sample groups, I aimed to include at least one participant.

Table 04.01: Sample groups

Male	15-29 years	Low PA frequency level	Rural municipalities with SE advantage
			Provincial municipalities with socio-economic advantage
		Average PA frequency level	Major city municipalities
	High PA frequency level	Capital	
		Countryside municipalities with socio-economic advantage	
		Capital municipalities with socio-economic advantage	
	30-64 years	Low PA frequency level	Capital municipalities with socio-economic advantage
			Provincial municipalities with socio-economic disadvantage
		Average PA frequency level	Capital
Countryside municipalities with socio-economic advantage			
High PA frequency level		Capital municipalities with socio-economic disadvantage	
		Rural municipalities with SE disadvantage	
65+ years	Low PA frequency level	Countryside municipalities with socio-economic advantage	
		Rural municipalities with SE disadvantage	
	Average PA frequency level	Capital municipalities with socio-economic advantage	
		Provincial municipalities with socio-economic advantage	
	High PA frequency level	Provincial municipalities with socio-economic disadvantage	
		Rural municipalities with SE advantage	
		Major city municipalities	

Fe- male	15-29 years	Low PA frequency level	Provincial municipalities with socio-economic disadvantage
		Average PA frequency level	Capital Rural municipalities with SE disadvantage
		High PA frequency level	Countryside municipalities with socio-economic disadvantage Capital municipalities with socio-economic disadvantage
	30-64 years	Low PA frequency level	Provincial municipalities with socio-economic disadvantage
			Provincial municipalities with socio-economic advantage
		Average PA frequency level	Capital municipalities with socio-economic advantage Provincial municipalities with socio-economic disadvantage
		High PA frequency level	Provincial municipalities with socio-economic advantage
			Rural municipalities with SE disadvantage
		65+ years	Low PA frequency level
Average PA frequency level	Rural municipalities with SE advantage Provincial municipalities with socio-economic advantage		
High PA frequency level	Major city municipalities		
	Capital		

PA: Physical Activity, SE: Socio-Economic. This table shows the 36 sample groups. Each sample group represent a unique combination of the criteria (Gender | Age Bracket | PA Frequency Level | Municipality Type).

Given the present study's focus on exploring beliefs and motivation about physical activity during various life stages and in different settings, the use of maximum variation sampling allowed us to choose participants with a wide range of views and experiences within these contexts.

Invitation

I invited the participants to participate through an e-mail invitation. The email invitation detailed their prior involvement in the *Moving Denmark* survey conducted by Syddansk Universitet in the fall of 2020. The invitation clarified that they were being approached for an in-depth interview to explore their physical activity habits and motivation further. The objective, as outlined in the email, was to investigate the interplay between their life experiences, their movement habits, and motivation for physical activity. The email also introduced me, Birgitte Westerskov Dalgas, a PhD student at the University of Southern Denmark, as the individual responsible for conducting and analysing the interviews. Participants were informed that each interview would likely last between 2 to 3 hours and were assured of their anonymity. Additionally, it was proposed that the interview be conducted during a specific time frame, for example, between October 14th and October 17th, to coincide with my visit to the municipality. For the full e-mail invitation, please refer to Appendix B.

In light of an initially low response rate on the invitation, I issued 5-10 invitations at the same time for each sampling group. Out of 436 invitations dispatched, I received 58 positive responses. I proceeded to conduct interviews with these respondents in an iterative manner, continuously evaluating the generation of new themes and insights as I went along. After completing interviews with 42 individuals, it became evident that I had reached data saturation, as no new or distinct insights were being generated (Kvale, 2007). Therefore, I chose to terminate the interview process at this juncture, even though additional participants had expressed interest.

Participant characteristics

The final sample consisted of 42 participants. In the following, the distribution of their characteristics is described in terms of gender, age, physical activity frequency level, and municipality type.

The gender distribution in the sample was nearly balanced, with a slight female majority (52%) compared to males (48%).

The age range of participants was wide, from 16 to 79 years, with a mean age of 49 years. The age distribution within the sample was relatively spread out, with a standard deviation of around 21.21, indicative of a relatively high age diversity among the participants. The age distribution was spread across three groups: Younger adults (15-29 years) formed about a third of the sample, while the middle-aged (30-64 years) and older adults (65 years and above) groups were slightly larger.

In terms of physical activity frequency, participants were distributed relatively evenly across low, average, and high-frequency levels, however, with a marginally larger proportion in the low-frequency group.

Geographically, participants from 18 different municipalities in Denmark showed some variation in distribution. While some municipalities, particularly those in the capital, capital municipalities and countryside municipalities, had a higher representation, other municipality types like major city municipalities, provincial municipalities and rural municipalities had fewer participants. See Table 04.02 for detailed participant characteristics.

Table 04.02: Participant Characteristics

Participant Characteristics		N (n=42)	Total Sample (100%)	
Gender	Female	22	52%	
	Male	20	48%	
Age groups	15 to 29	13	31%	
	30 to 64	14	33%	
	65 or older	15	36%	
Physical Activity Frequency Level	Low	16	38%	
	Average	14	33%	
	High	12	29%	
Municipality Type	The Capital	6	14 %	
	Capital Municipalities	SE Advantage	5	12%
		SE Disadvantage	4	10%
	Major City Municipalities	4	10%	
	Provincial Municipalities	SE Advantage	4	10%
		SE Disadvantage	2	5%
	Countryside Municipalities	SE Advantage	5	12%
		SE Disadvantage	4	10%
	Rural Municipalities	SE Advantage	4	10%
		SE Disadvantage	4	10%

SE: Socioeconomic

Appendix C briefly introduces each participant, offering a glimpse into their unique life circumstances and personal interests. These bios go beyond statistics, bringing to life the diverse backgrounds that make up the participant characteristics in our study.

04.02 Data Generation

Interview guide

I developed a semi-structured interview guide based on the research aims, which allowed for flexibility in conversation while also maintaining focus on the topics at hand, as advocated by Kvale (2007). Being semi-structured, the interview guide served as an outline for the interview with suggestions for questions (Smith & Sparkes, 2016).

The interview began with a briefing where I introduced myself as a PhD student at the University of Southern. This was followed by a presentation of the 'Moving Denmark' project, financed by the Nordea Foundation. The primary objective of this project was to delve into the movement habits of adults, emphasising deciphering the roles of motivation, barriers, and opportunities in influencing diverse forms of physical activity. Subsequently, an overview of the interview's content was provided. Participants were informed that the conversation would revolve around their life narratives, focusing particularly on their physical activity behaviour and underlying motivation. To foster open dialogue, participants were reassured that their responses had no predefined correctness, urging them to speak candidly about their experiences. Lastly, the interview addressed crucial ethical aspects. The participants were briefed about the expected length of the interview, the methodology of audio recording, the steps taken to ensure data anonymity, and their rights concerning participation and opting out.

After the introduction, basic demographic information was collected from participants to establish their current social and personal context.

Following this, the guide facilitated participants in segmenting their life stories into chapters, drawing on a life book interview technique by Lieblich et al. (1998). In this activity, participants were asked to mark and name significant chapters of their lives on a sheet representing the years they have lived — from birth to their current age. I said,

Now, we will start focusing on your life story.

All people's lives can be written down in a book. I would like you to think about your life as if we were writing a book about it. First, I want to ask you to think about the different chapters in your book. I have a piece of paper here that can help you out. The first column contains the years of your life - from zero, the day you were born, until today.

If you start from the day you were born, when does the first chapter end? Put a line there and name the chapter.

Then you move on to the next chapters of your life and mark where they start and end, and name the chapter until you reach your current age. You are free to use the number of chapters that suits your life.

See appendix E for the timeline paper. The purpose of this activity was threefold: Firstly, it established a uniform narrative structure across all interviews, assisting in keeping interviews on topic and simplifying the subsequent thematic analysis. Secondly, it served as a shared document during the interview between the interviewee and me, which we could refer to throughout the conversation. Lastly, it was a flexible tool offering a balance between structure and freedom in storytelling. While providing a consistent narrative framework across interviews, its open-ended nature allowed participants to expand on their life periods in any sequence they chose. This flexibility contributed to the richness of the data, enabling a detailed exploration of participants' experiences and attitudes towards physical activity.

In each chapter of their personal narratives, participants were questioned about their patterns of physical activity, their driving forces, and barriers they faced across the four domains of physical activity: transport, occupation, household, and recreation. The theoretical frameworks of Self-determination theory and Theory of Planned Behaviour underpinned the questions. Some probes, for example, aimed to generate insight into need satisfaction and frustration experiences, focusing on their perceptions of their environment. Moreover, participants were prompted to recall significant events that played a salient role in influencing their practice of physical activity, an approach advocated in the self-determination theory literature (Adrienne & Costabile, 2021; Phillippe et al., 2011, 2012; Philippe, 2023). Refer to Table 04.03 for an example of the interview questions within the recreation domain.

Table 04.03: Example of the interview questions within the recreation domain

Repeat for all chapters and mentioned types of physical activity

PA	Behaviour 1	Behaviour 2	PINs
How did you spend your leisure time in this chapter of your life?	Why did you [activity]?		Do you recall any specific episodes or memories from [activity] during this period?
	Was it normal to [activity] where you lived?	How did it influence you're motivation to [activity]?	
Did you exercise or engaged in sports or any other types of physical activity?	Who introduced [activity] for you?	Tell me about how it happened?	Tell me about it.
	Whose choice was it, that you [activity]?	How did it influence you're motivation to [activity]?	
	Do you think that, doing [the activity] reflected what YOU wanted and who YOU where?	How?	
	What did your family and friends think about your engagement in?	How did it influence you're motivation to [activity]?	
	Did you feel skilled at [activity]?	How did it influence you're motivation to [activity]?	
	Did you develop your skills?	How did it influence you're motivation to [activity]?	
	Why did you stop?		

PA: Physical activity, PINs: Personal Incident Narratives. The interview guide followed a structured sequence. It began with identifying various physical activities and then progressed to the first set of behavioural questions. For each response in this first set, there were corresponding follow-up questions in the second set, designed to delve deeper into the details of each behaviour. Finally, the questionnaire shifted to PINs, where participants were asked to describe specific instances or episodes that exemplified their answers to the initial behavioural questions.

The interview concluded with a debriefing, where participants were given the opportunity to make additional comments or observations. They were also informed about the next stages of the research process, including transcription, data analysis, and the potential academic publication of their data. Participants were directed to where they

could find updates on the project's progress. For the full interview guide, refer to Appendix F.

Interview situation

I conducted the interviews in 2021 (Marts to December).

Of the 42 interviews conducted, 38 were executed face-to-face, while the remaining four were conducted online. The participants themselves specifically requested these online interviews. Their preferences for online interviews were primarily driven by considerations of convenience and individual responses to the ongoing COVID-19 pandemic. To respect and accommodate the participants' comfort and safety preferences, their requests for online interviews were honoured, leading to 90% of interviews being conducted face-to-face and the remaining 10% being held online.

Interview locations were primarily held in the homes of the participants. Specifically, 33 interviews were conducted in the participants' homes. This home-based approach facilitated a relaxed environment for the participants while offering the interviewer valuable insights into their contexts. Other locations were also utilised: participants' workplaces hosted two interviews, a meeting room at the University of Southern Denmark was the location for another, a public park was chosen for one interview, and one interview was conducted in a library.

In most interview sessions, the setting was kept intimate and focused, with only the interviewer and the participant present in the space, accounting for 38 out of 42 interviews. This controlled environment was intentionally maintained to foster an atmosphere of confidentiality and trust, allowing the participant to express freely and the interviewer to engage in the conversation without external distractions or influences. However, there were exceptions to this general practice based on the preferences and requests of the participants involved. Specifically, two participants asked for interviews to be conducted in public spaces. This request was accommodated to respect the comfort and wishes of the participants. Conducting interviews in public locations introduced a different dynamic to the interaction, potentially influencing the participant's level of openness and the overall ambience of the discussion. In addition to the above, there were two instances where participants' spouses remained in the same room during the interview. The presence of a significant other might have provided emotional support to the participant, making them feel more at ease during the interview process. However, it is also crucial to consider the potential influence or bias introduced by a spouse's presence on the participant's responses, even if they were not active participants in the conversation.

During the interview process, establishing a good relation, with the interviewee was a key concern for me, echoing the principles of good qualitative interviewing where the relational aspect can greatly influence the quality of data collected (Kvale, 2007). I approached the interview as a form of dialogue (Kvale, 2007; Smith & Sparkes, 2016). Yet, it's critical to acknowledge that this dialogue wasn't an interaction of equals. As the interviewer, I was the one who controlled the interview process, dictating its pace, setting its themes, and posing questions that directed the conversation.

To this end, active listening served as a cornerstone of my approach. By giving my full attention and showing genuine interest in the interviewees' experiences, I sought to create an environment conducive to open and candid discussions. The importance of a relaxed atmosphere cannot be understated, particularly in qualitative research, where the depth of information is often correlated with the comfort level of the participant (Rubin & Rubin, 2005). Small talk served as more than just a conversational filler; it was a strategic measure to gradually ease into the core topics. Accepting offers of coffee, tea, or food was another tactic to foster a relaxed and hospitable atmosphere. These gestures helped subtly reinforce the sense of equality and mutual respect between the interviewee and myself, which is essential for a fruitful dialogue.

While my interview guide was always within reach, it was rarely the focus of my attention during the interviews. Having internalised the structure and question suggestions, the guide served as a mere artefact or safety net rather than a script to be strictly followed. This allowed for great flexibility and adaptability during the interview, enabling me to probe deeper when interesting or unexpected themes emerged. This also meant that the dialogue could evolve more organically, accommodating the unique perspectives each interviewee brought to the table.

Each participant required different kinds of support and types of questions to facilitate the generation of meaningful data. In some instances, a wider range of questions was necessary to generate thoughtful responses. In others, the interview flowed freely with minimal prompting. These variations were also evident in the interviews. This meant that I had to be prepared to adapt their approach depending on the dynamics of each particular interview. I do not think that one type of interview generated "better knowledge" than another. The interviews just needed different kinds of facilitation to generate rich knowledge.

I also used periods of silence strategically, as recommended by Kvale (2007), serving dual purposes: firstly, to allow participants the mental space to reflect on their

experiences and formulate their thoughts, and secondly, to subtly shift the power dynamic of the interview. While the structure and agenda were set by me, these periods of me being silent and letting them talk allowed the participants to exert greater control over their narrative. The duration of these silences varied significantly, ranging from brief moments to extended periods. In one extreme case, a silence on my part lasted for two hours, during which I simply listened and nodded to encourage his continuation. As unconventional as this may seem, it was underpinned by a firm commitment to let the participants take control of the interview when it facilitated the generation of data relevant to the research questions. Such periods were not passive, as I was active with my body language and listened actively, ensuring that the narrative kept generating a rich understanding of their life experiences.

Interview durations were variable, with the lengths ranging from a minimum of 77 minutes to a maximum of 178 minutes. On average, interviews lasted for approximately 127 minutes. The variability in interview length can be attributed to the different levels of engagement and the depth of discussion achieved with each participant. Further, interviews tended to be longer with older participants, as they typically had a greater number of life chapters, which naturally necessitated more time to explore and discuss during the interviews. Refer to Appendix D for characteristics of the interview situations.

04.03 Researcher Reflexivity

The concept of researcher reflexivity is crucial for ensuring the rigour and integrity of qualitative studies. Reflexivity involves continuous self-awareness about how a researcher's own beliefs, social background, and emotions influence all stages of the research process (Morrow, 2005). This is particularly pertinent when the topic under study is aligned closely with the researcher's own academic or personal interests.

A key methodological tool used in this study was the maintenance of a reflexivity log. Post-interview, I spent 10-15 minutes jotting down observations about the interview environment, the relational dynamics between the participant and myself, and any immediate insights generated. As I revisited these notes during the analysis phase, they helped in two significant ways. Firstly, they aided in contextualising the transcribed data, ensuring that the nuances and dynamics of the interview setting were not lost. Secondly, they made me cognisant of my own emotional and cognitive biases, helping me to recognise how my lived experiences might have influenced the framing of my questions or interpretation of responses. Lastly, the log served as a tool for self-examination, aiding me in recognising how my emotional state and lived experiences could

potentially bias the framing of my questions and the interpretation of responses. This was particularly helpful during what Kvale (2007) describes as the "aggressive, silent phase" of the interview study. This phase, marked by overdue timelines, mounting stress, and a sense of chaos, often precipitates a defensive posture towards queries about the study's progress (Kvale, 2007). During this turbulent period, the reflexivity log provided a space for self-reflection, helping me understand why I posed certain questions that were less effective in generating the knowledge I needed for the analysis. In essence, the reflexivity log served as both a methodological and emotional resource, assisting me in navigating the intricacies of the research process, from data collection to emotional management.

04.04 Data Analysis

Audio-recorded interviews were transcribed word-for-word. To protect participants' identities, all names and identifiable information were replaced with pseudonyms. These anonymised transcripts were then uploaded into NVivo software (Jackson and Bazeley, 2019) for analysis. Additionally, notes encompassing both descriptive and reflective observations, made immediately after each interview, were also imported into NVivo.

In this study, thematic analysis was used to code and interpret the data. The method is notably adaptable, allowing me to tailor it to the specific requirements of this study. This flexibility means that thematic analysis is suitable for various research questions, theoretical orientations, and analytical procedures (Braun & Clarke, 2022). However, it's important to note that thematic analysis is not a one-size-fits-all methodology. Braun and Clarke (2022) describe it as an overarching term encompassing a range of approaches. These can be clustered into three primary variations: coding reliability, codebook, and reflexive approaches (Braun & Clarke, 2019). While these approaches share core traits—such as the ability to identify patterns and adaptability—they differ in their underlying philosophical assumptions and procedural implementations (Braun & Clarke, 2019, 2021, 2022). For analysing the interview data, we applied a codebook thematic analysis method, specifically the framework method (Braun & Clarke, 2021, 2022; Ritchie & Spencer, 1994). Codebook approaches in Thematic Analysis, like framework, matrix, and template analysis, merge structured, early theme development with an appreciation for researcher subjectivity, thus bridging coding reliability methods and reflexive thematic analysis (Braun & Clarke, 2019, 2021).

I utilised the framework method for its structured way of managing the qualitative data. Among various qualitative analysis techniques, the framework method stood out

for its ability to systematically manage and dissect the extensive qualitative data I collected. This approach enables the early identification of themes while also being flexible enough to allow for adjustments and the inductive creation of new themes as the analysis progresses (Braun & Clarke, 2021; Braun & Clarke, 2022; Gale et al., 2013; Ritchie & Spencer, 1994). This methodology facilitated a nuanced exploration of each participant's viewpoint without sacrificing an overarching understanding of the extensive dataset.

The framework analysis consists of five iterative phases: Familiarisation, development of the framework, indexing, charting, and interpretation (Gale et al., 2013; Parkinson et al., 2016; Ritchie & Spencer, 1994).

During the *familiarisation* phase, I gained initial insights by listening to interviews and reviewing transcripts, noting preliminary impressions and ideas that could inform the subsequent analytical stages.

In the *development of the framework* for my analysis, I constructed a codebook that is structured around four primary analytical categories: Self-determination Theory (SDT), Theory of Planned Behaviour (TPB), Life and Physical Activity Behaviour. Each category consisted of a code group that again consisted of the specific codes.

The SDT category encapsulates psychological need states, including experiences of autonomy, competence, and relatedness, in both their satisfied, unfulfilled, and frustrated forms. It delves into how these psychological states, whether satisfied or unfulfilled, influence individuals' motivation and behaviour. Further, there was a core group consisting of the restoring adoptions, which were the strategies used to restore perceived need satisfaction following a period of perceived need frustration.

The TPB section of the codebook addresses behavioural beliefs, encompassing the perceived advantages and disadvantages of physical activity. It also considers normative beliefs, reflecting perceived social pressures and support for physical activity, as well as control beliefs, which include factors perceived as facilitators or barriers to physical activity.

Under the Life category, the codebook explores significant life transitions and various domains where physical activity occurs.

Finally, the Physical Activity Behaviour category captures the changes in physical activity patterns. This includes categorising physical activity into increased, sustained, or

decreased levels, providing insights into how individuals' physical activity behaviour evolve over time and in response to different psychological and environmental influences.

This structured approach in the codebook aims to provide a comprehensive and nuanced understanding of the factors influencing physical activity behaviour, grounded in well-established psychological theories and the realities of everyday life experiences. In Table 04.04 an overview of the codebook, including a description of each code, is provided.

Table 04.04: Codebook, including descriptions of each code

Category	Group	Code	Description
SDT	Psychological Need States	Autonomy frustration	Experiences reflecting a sense of being controlled by contingencies outside of the self (eg. through rewards or perceived obligation).
		Competence frustration	Experiences reflecting a sense of non-effectance or lack of mastery, incompetence, and lacking skills.
		Relatedness frustration	Experiences reflecting a sense of social alienation, exclusion, loneliness, and lack of support for personal choice and volition.
		Autonomy Unfulfillment	Experiences indicating a lack of self-direction and personal choice, characterised by an absence in opportunities to exercise volition or control.
		Competence Unfulfillment	Experiences indicating an absence of efficacy and skillfulness, marked by limited chances to demonstrate or enhance abilities and expertise.
		Relatedness Unfulfillment	Experiences signifying an insufficiency in social connection and belonging, characterised by a shortage of meaningful social interactions or environments supportive of interpersonal connectedness.
		Autonomy satisfaction	Experiences reflecting a sense of volition, choice, personal agency, optimal challenge, and sense of behaviour emanating from the self.
		Competence satisfaction	Experiences reflecting effectance, mastery, and opportunities for using and extending skills and expertise.
		Relatedness satisfaction	Experiences reflecting connectedness, a feeling of being accepted by others, and that they support your choice.

	Restoring Adaptions		Strategies used to restore perceived need satisfaction following a period of perceived need frustration.
TPB	Attitudes	Advantages	Associations of physical activity with desirable consequences.
		Disadvantages	Associations of physical activity behaviour with undesirable consequences.
	Subjective norms	Approve	Perceived social pressure and support to perform the physical activity.
		Disapprove	Perceived social pressure to not perform physical activity.
	Perceived behavioural control	Facilitators	Factors perceived to facilitate physical activity
		Barriers	Factors perceived to inhibit physical activity.
Life	Life transitions		Periods or events in one's life involving a significant change to lifestyle.
	Life domains	Transport	When one is physically active when travelling from a to b
		Occupation	When one is physically active in daycare, in an education institution or working
		Household	When one is doing practical work and physically active chores at home
		Recreation	When one is physically active but is not occupied, doing practical work and chores at home, or travelling from a to b.
Physical Activity Behaviour	Increased PA		A noticeable increase in the frequency, duration, or intensity of physical activities.
	Sustained PA		A consistent frequency, duration, or intensity of physical activities.
	Decreased PA		A reduction in the frequency, duration, or intensity of physical activities

SDT: Self-determination Theory

TPB: Theory of Planned Behaviour

PA: Physical activity

During the *indexing* phase, I systematically labelled transcript segments using NVivo, adhering to the pre-established codebook. This was done deductively, applying a structured theoretical lens from the codebook to the data for focused analysis. However, codes within the code group 'Life Transitions' were generated inductively from the dataset.

During the *charting* phase, I organised the coded data into three separate matrices using NVivo, creating one matrix for each of the three papers.

In the analysis for paper 1, the framework was meticulously structured into a matrix within NVivo, where each row was dedicated to a distinct life transition, such as beginning school or leaving home. The columns were systematically organised to include codes pertaining to attitudes, subjective norms, and perceived behavioural control, alongside categories denoting changes in physical activity, specifically 'Increased PA,' 'Sustained PA,' and 'Decreased PA. This matrix layout offered a structure, enabling a detailed exploration of how various life transitions influence both beliefs and physical activity levels.

In the analysis for paper 2, the data indexed in NVivo was organised into a matrix for a comprehensive, cross-referential analysis. In this matrix, each row corresponded to a distinct domain of physical activity, specifically 'Transport,' 'Occupation,' 'Household,' and 'Recreation.' The columns consisted of the codes from the need state group within the SDT category.' This provided a structured platform to explore how experiences of psychological need satisfaction, fulfilment, and frustration manifest across various contexts of physical activity. This matrix served as an instrumental tool for the subsequent interpretative phase, allowing for a robust exploration of the intricate relationships between psychological needs and physical activity across different life domains.

In the analysis for paper 3, the constructed framework was intricately organised into a comprehensive matrix using NVivo, where each row was uniquely attributed to an individual participant, encapsulating their personal experiences. The columns were elaborately segmented to represent a variety of established psychological constructs, including all psychological need states in SDT ('autonomy frustration,' 'competence frustration,' 'relatedness frustration,' 'autonomy unfulfillment,' 'competence unfulfillment,' 'relatedness unfulfillment,' 'autonomy satisfaction,' 'competence satisfaction,' 'relatedness satisfaction'), as well as 'Restoring Adaptations.' This configuration of the matrix allowed for a detailed examination of the participants' experiences in relation to psychological need states. It facilitated a thorough exploration of the nuanced ways in which individuals perceive and respond to need frustration and unfulfillment and the diverse strategies they employ to restore their psychological needs. This methodical approach provided a foundation for exploring the dynamics of psychological need restoration, offering rich insights into the individual pathways of adapting and coping in the face of psychological threats within the context of physical activity.

During the *interpretation* phase, I focused on identifying and refining themes. This process was inductive, where I explored how the participant's physical activity beliefs and motivation were influenced within specific intersections of different life codes and theoretical concepts. Through this analysis, I identified common patterns and insights and formulated initial themes based on these observations. The analysis evolved to be more inductive over time, with an iterative refinement of these emergent themes to accurately reflect the complexities and nuances in the participants' experiences. This involved adjusting the scope of certain themes for clarity and, where necessary, merging or dividing them to better fit the data. The naming and descriptions of the themes were continually revised to ensure they authentically represented the data.

The process of the analysis was intricate and evolving, often requiring adjustments to initial thematic ideas. By employing a recursive method—consistently returning to the original data—I maintained the flexibility to alter or discard generated themes. This approach also allowed me to stay receptive to new interpretations of physical activity beliefs and motivation and to ensure that the final themes authentically reflected the participants' lived experiences.

Member checking, a process where participants validate the findings, was not used in this study. The rationale for this approach is based on Chase's (1996) viewpoint that the analysis should be driven by the researcher's interpretation. The responsibility lies with the researcher to form conclusions from the data using their theoretical knowledge and reflective consideration rather than relying on participants to verify the results.

04.05 Ethical Considerations

The study followed the Declaration of Helsinki's ethical guidelines. Before recruiting any participants, the Institutional Review Board of the University of Southern Denmark, Research and Innovation Organisation (RIO) granted approval. This was documented under protocol code 10.680 on 08.11.2019.

Participants received detailed information regarding the study's objectives, methodology, and their expected involvement. This information was provided both in the email invitation and at the start of the interview. Subsequently, they were requested to provide verbal consent to participate, with the assurance that they could withdraw from the study at any time without facing any consequences. I made a firm commitment to keep participants' information confidential. This meant that any details that could identify them would not appear in any publications or presentations arising from the study. To ensure this, I gave participants pseudonyms, effectively hiding their real identities.

During the interviews, it became apparent that many participants were sharing sensitive experiences. To ensure the participants' well-being, I remained attentive to their emotional state throughout the interview. Whenever I sensed distress, I offered them the option to pause the interview. I only resumed the conversation after they felt comfortable to proceed, thus allowing them to exercise control over their level of engagement and the interview's pace. When sensitive experiences were narrated, my approach was to provide empathetic support without delving deeper into those experiences, prioritising the participant's comfort. Additionally, I made certain that participants were aware of and had access to the support they might require.

All data from the study, such as transcripts and recordings, were stored securely on a computer that was password-protected. Only the main research team had access to the data. When presenting the study's findings, I strived to accurately represent what participants had shared while also ensuring our results met academic standards for precision and reliability.

05 Findings

In this section, I will first summarise the findings from the three papers, each contributing to the understanding of the dynamics between the life that we live and or physical activity beliefs and motivation. Following these summaries, I will synthesise key insights across the papers.

05.01 Paper 1. Beliefs within and across life transitions

In Dalgas et al. (2023a), we explored how life transitions influence Danish adults' physical activity beliefs and behaviour. I identified six influential life transition: Beginning school, leaving home, starting a career, forming a romantic relationship, having a child, and retiring. The transitions led to changes in roles, social environments, and daily routines, which influenced attitudes, subjective norms, and perceived behavioural control towards physical activity. Notably, most transitions resulted in decreased physical activity, with exceptions being leaving home and retirement, where participants generally sustained or even increased their physical activity. Below I will present the key findings on each life transition.

Beginning school marked a substantial shift in the daily lives of the participants. In terms of the participants' intention of being physically active, the sedentary environment of formal education led to a change in subjective norms, where sedentary behaviour became the societal expectation. This influenced perceived behavioural control, as the structured environment limited the opportunities for spontaneous physical activity. However, the participants were also introduced to physical education in this transition, which had a dual impact. For some, it positively influenced their attitudes towards physical activity, by offering a range of sports and activities where they could excel. This enhanced their perceived behavioural control. For others, especially those who felt less athletically inclined, the experience led to negative attitudes and reduced their perceived behavioural control over physical activity. The negative attitudes were often long-term.

Upon leaving home, the participants experienced increased domestic responsibilities and greater use of active transportation, such as walking or cycling. These changes positively influenced their perceived behavioural control, as they experienced more

autonomy in their daily routines. However, the transition often led to a decline in organised sports due to shifts in social environments, which influenced their subjective norms in related to physical activity.

Starting a career introduced new job-related demands and responsibilities that often led to a decrease in physical activity. The constraints of a professional schedule negatively influenced the participants' perceived behavioural control over their physical activity. However, some workplaces promoted a physical activity-friendly environment, which shifted the participants' subjective norms in a positive direction, thereby mitigating some of the transitions negative influences on the participants' physical activity beliefs.

Forming a romantic relationship led to a reassessment of priorities and daily routines among many of the participants. The participants subjective norms shifted as they felt they needed to allocate more time to their partners, which also influenced their perceived behavioural control towards maintaining physical active. This generally led to a decline in physical activity levels. However, in cases where the partner were supportive or physically active themselves, the transition had a positive influence on the participants subjective norms and, in turn, on their attitudes towards physical activity.

The transition of having a child brought about the most pronounced changes in the participants' lives. The participants faced increased responsibilities and time demands related to childcare, which severely influenced their perceived behavioural control over especially recreation physical activity. The participants' subjective norms were also influenced as societal expectations to prioritise child-rearing over personal physical activity became salient. However, increased physical activity related to domestic chores was also noted, suggesting a shift in the types of physical activity the participants practiced.

The transition to retirement generally led to increased levels of physical activity, which were attributed to the newfound free time and fewer daily responsibilities. This positively influenced the participants perceived behavioural control over their physical activity. Moreover, as the participants aged and became more conscious of the health benefits of physical activity, their attitudes underwent a positive transformation. This change was particularly evident in their increased focus on the importance of maintaining physical function, driven by their anticipation of the adverse consequences of inactivity. This heightened understanding reinforced their positive attitude towards physical activity during retirement.

This paper contributed to the overall aim of the study by generating a rich understanding of the influence on life transitions on individuals physical activity beliefs and behaviour. The results suggest that each transition presents unique challenges and opportunities which influences individuals' physical activity behaviour through their influence on the individuals' attitudes, subjective norms and perceived behavioural control.

05.02 Paper 2. Need States Within and Across Domains

In Dalgas et al. (2024), we explored variations in need satisfaction, frustration, and unfulfillment within and across domains of physical activity, including transport, household, occupation, and recreation. Below I will present the results within each domain.

Within the transport domain, a dominant theme was the utilitarian perspective the participants had toward transport activities such as cycling. They generally viewed as obligatory rather than enjoyable, which led to prevalent experiences of autonomy unfulfillment. However, instances of autonomy satisfaction were noted, particularly when the participants experienced a sense of control and freedom through their transportation choices. External factors, including weather conditions and distance, played a significant role in shaping the participants' autonomy experiences. As especially weather conditions were subject to frequent changes, the state of the participants need for autonomy were also. Competence experiences were generally overshadowed by the functional nature of transport activities, though some participants found a sense of mastery in skilfully navigating urban traffic. The solitary nature of transport activities limited relatedness experiences among the participants, though younger individuals did report experiences involving social engagement within the transport domain.

In the household domain, many participants viewed chores as obligatory, which led to widespread experiences of autonomy unfulfillment. Yet, some participants found personal meaning in these tasks, transforming them into sources of autonomy satisfaction. Competence satisfaction within household activities was infrequent, with only a few participants expressing experiences of skill development in specific tasks such as cooking and home repairs. Relatedness satisfaction was more pronounced, particularly in shared household tasks, which fostered a sense of community and emotional connection. However, a lack of cooperation and support, particularly among participants with many household responsibilities, led to experiences of relatedness frustration.

In the occupational domain we identified varied autonomy experiences among the participants. Their autonomy experiences were heavily influenced by how the characteristics of their job aligned with their personal interests. Some individuals experienced

autonomy frustration because their personal interests were misaligned with the requirements of their job. Others experienced autonomy satisfaction in roles that offered task variety. In these cases, they felt that they could choose to solve tasks that resonated with their interests. Competence satisfaction was identified in narratives where the job facilitated skill development and mastery. Experiences of relatedness satisfaction was identified in accounts where workplace social support and camaraderie were present, which enhanced a sense of community.

In the recreation domain, we found that autonomy experiences ranged from unfulfillment and frustration to satisfaction. Some of the participants felt a duty or responsibility to engage in physical activity for future health, which aligned with their values, aligned with their values, indicating an experience of need satisfaction. However, some of them found the activity boring, resulting in experiences of need unfulfillment. Competence experiences also varied, with individuals expressing satisfaction from achieving personal goals and frustration or unfulfillment due to physical limitations or unmet expectations in relation to skill development. Relatedness experiences were marked by strong social connections and communal activities among the participants, though some experienced relatedness unfulfillment when anticipated social interactions did not occur. A few narratives reflected experiences of relatedness frustration due to feelings of exclusion.

This paper contributed to the overall aim of the study by providing insights into how individuals' physical activity motivation varied within and across life domains. In the paper we suggest that the interplay between the contextual factors of each domain and individual perceptions of need satisfaction, unfulfillment and frustration influence individual's physical activity motivation.

05.03 Paper 3. Restoring Psychological Needs

In Dalgas et al. (2023b), we presented a rich exploration of the process of restoring psychological needs after incidences of need unfulfillment and frustration. Theoretically, this paper was underpinned by Self-determination Theory. Our findings suggest that four interconnected phases form the restoration process: Discrepancies between actual and desired need states, experiencing negative affect, initiating plans for action, and action.

The first phase, discrepancies between actual and desired need states, were the starting point, setting off the participants' process of psychological need restoration. In this phase, the participants recognised a gap between their current psychological need state

and their desired state. This recognition could manifest as either need frustration or need unfulfillment. Need frustration typically arose from external contingencies, where participants' experiences were influenced by the actions of others'.

The second phase, negative affect, played a reinforcing role in the restoration process, accentuating the cognitive recognition of need frustration or unfulfillment. Experiencing need frustration often exhibited intense affect responses among the participants, because their psychological needs were directly thwarted by external forces. Conversely, the participants' affect after incidences of need unfulfillment was more moderate and reflective.

The third phase, initiating plans for action, involved that the participants developed strategies to change their psychological need states. The approaches varied based on whether the need state was frustration or unfulfillment. In cases of need frustration, the strategies often involved avoiding or withdrawing from the need-thwarting context. In contrast, the participants' dealing with need unfulfillment typically involved more proactive and reflective strategies. In these instances, the participants engaged in internal deliberations, weighing various factors and options to find a way to restore their unfulfilled psychological needs. Some participants changed the setting they practised the activity (e.g. changing to a new team), while others took up other types of physical activities. The strategies varied, influenced by social dynamics, personal resources, or internal deliberation.

In the last phase, the action phase, the participants engaged in their chosen strategy to restore their psychological needs. Participants experiencing need frustration due to the actions of others often chose to flee from the activity by disengaging from or avoiding it. In contrast, those participants, who had experienced incidences of need unfulfillment, typically chose to fight back by making adjustments within their environment or switching to new activities.

We further identified a tendency among the participants to react differently to psychological need frustration based on whether their physical activity participation was voluntary or obligatory. In scenarios where participation was voluntary (e.g. in sports clubs), individuals often chose to directly cease the activity causing frustration. On the other hand, in obligatory contexts, such as physical education classes, individuals were more likely to employ avoidance strategies, such as feigning illness, to escape participation. Those participants who experienced need frustration in voluntary activities were more inclined to engage in other physical activities later, whereas those experiencing

frustration in obligatory settings demonstrated a prolonged aversion to sports and exercise, suggesting lasting effects on their attitudes towards physical activity.

This paper contributed to the overall aim of the study by providing insights into how individuals restore their basic psychological needs after incidences of need frustration and unfulfillment. This restoration process underscores the dynamic nature of psychological need states, and the varied pathways individuals take to restore their psychological needs. The findings suggest that when individuals experience need frustration and unfulfillment in the context of physical activities, an intrinsic motivation to restore psychological well-being becomes activated. Throughout the restoration process, the distinction between need frustration and need unfulfillment remains pivotal. Need frustration, driven by external forces, often leads to withdrawal or avoidance strategies, while need unfulfillment prompts more proactive and reflective strategies.

05.04 Synthesis

Synthesising the findings of the three papers within this study, it is evident that the life that we live matters for our physical activity beliefs, motivation, and behaviour. However, our findings indicate that it was not only the current circumstances of the individual's life (e.g. life transitions and how life domains supported the psychological needs) that mattered for their physical activity motivation. It was also evident that their early physical activity experiences (e.g. experiences of need frustration in physical education) and future anticipations (e.g. anticipation of improved health and well-being) tended to have a profound influence.

In the following, I will synthesise the findings of the papers under three theses that recurred across the papers: The trajectories of early physical activity experiences, the circumstances of the current life, and the anticipation of the future.

The Trajectories of Early Physical Activity Experiences

The identification of the theme, the trajectories of early physical activity experiences of enduring influences of early physical activity, is primarily grounded in the findings of Dalgas et al. (2023a; 2023b). This trajectory, from childhood encounters with physical activity to adult behaviour, is framed by an interplay of key concepts from Theory of Planned Behaviour and Self-determination Theory. Specifically, the trajectory is influenced by the satisfaction, frustration, or unfulfillment of the psychological needs, which in turn shape motivation. This motivation then influences attitudes, subjective norms, and perceived behavioural control, which collectively guide the formation of intentions and result in specific physical activity behaviour.

For instance, negative early experiences, such as exclusion or discomfort during physical activities, often lead to experiences of psychological need frustration. Experiences of need frustration can prompt individuals to restore their psychological needs by adopting avoidance or flight strategies, opting out of physical activity participation and instead seeking need restoration elsewhere. This re-orientation might lead to a long-term intention to avoid physical activity (Dalgas et al., 2023b). These formative experiences further have an influence on the individual's attitudes towards and perceived behavioural control over physical activity that extends into adulthood (Dalgas et al., 2023a). The tendency to develop a long-term aversion was most pronounced among participants who had experienced need frustration in environments where their participation was obligatory (e.g. physical education), whereas the participants who experienced need frustration in voluntary environments, like sports clubs, were more likely to transition to other physical activities later in life.

This demonstrates that initial negative or challenging encounters in physical activity, especially if the participation is obligatory, can lead to a trajectory of avoidance, disengagement, or redirection of interests away from physical activities, thus having a profound and long-lasting influence on an individual's choices related to physical activity.

The Circumstances of the Current Life

The integration of findings from Dalgas et al. (2023a, 2024) suggests that the circumstances of the current life of individuals have a profound influence on their physical activity beliefs and motivation.

In Dalgas et al. (2023a), we found that life transitions fundamentally alter an individual's life circumstances by redefining their social roles and associated responsibilities, which necessitate a reallocation of how they need to spend their time, energy, and resources. These shifts have a profound influence on their intention to be physically active, as they lead to changes in attitudes (evaluation of physical activity's desirable and undesirable consequences), subjective norms (the perceived social pressure and support regarding physical activity), and perceived behavioural control (factors perceived to facilitate or inhibit physical activity) (Dalgas et al., 2023a). We found that life transitions such as starting a career, leaving home, forming a romantic relationship, and becoming a parent inherently brought about an increase in responsibilities in individuals' lives. Retirement generally decreased the responsibilities in individuals' lives (Dalgas et al., 2023a).

Beginning school, starting a career and retirement primarily caused changes in the occupational domain, but with spillover effects to other domains. Beginning school and

starting a career often reshape subjective norms, embedding societal expectations of sedentary behaviour within the occupation. This is evident in educational settings and desk-bound jobs. Physically active jobs had the opposite effect. The structured nature of these environments can further diminish perceived behavioural control over physical activity, restricting opportunities for engagement. Conversely, retirement can enhance perceived behavioural control over engagement in physical activity, given the reduction in occupational constraints.

Transitions in the household domain, such as leaving home and becoming a parent, offer unique challenges and opportunities. Leaving home can increase autonomy, potentially fostering positive attitudes towards physical activity by enabling personal control over lifestyle choices, including active transport and household tasks. Parenthood, while increasing physical demands within the household, can constrain recreational activities, influencing perceived behavioural control due to the new responsibilities (Dalgas et al., 2023a).

In the Dalgas et al. (2024) study, we identified distinct patterns across the domains of transport, household, occupation, and recreation in relation to psychological need states. The transport and household domains often led to experiences of autonomy unfulfillment due to the obligatory nature of the activities within the domains. The occupational and recreational domains were more mixed in whether they supported, thwarted, or acted indifferent toward the participants' needs.

The cumulative effect of increased responsibilities and high degrees of need unfulfillment across these domains makes maintaining physical activity motivation particularly challenging.

Despite the challenges posed by life transitions, increased responsibilities, and high degrees of need unfulfillment across domains, there are instances where individuals successfully maintain their physical activity and find need satisfaction within the transport, occupation, and household domains. These instances highlight the resilience and adaptability of individuals in integrating physical activity into their lives, even amidst demanding circumstances. Our findings indicate that successfully maintained physical activity through life's transitions involved a blend of positive attitudes, adaptability, and support from their social network

Anticipation of the Future

Our findings (Dalgas et al., 2023a, 2023b, 2024) further indicate a profound influence of anticipation of future outcomes on individuals' physical activity beliefs, motivation, and

behaviour. This insight sheds light on the dynamic interplay between individuals' current life scenarios and their anticipations of the future.

In the study focusing on life transitions (Dalgas et al., 2023a), we encountered individuals who, upon facing the inevitable changes that come with ageing, began to reassess the role of physical activity in their lives. This awareness induced a shift in their attitudes toward physical activity, where it became an investment in their future health and independence. For some of the participants, this was driven by a keen anticipation of future physical limitations and the desire to mitigate them. Seen through the lens of the Theory of Planned Behaviour, this indicated that individuals' anticipation of the future influences their attitudes, subjective norms, and perceived behavioural control towards physical activity.

However, the findings of Dalgas et al. (2024) show that some individuals perceive physical activities necessary for maintaining health as obligatory tasks rather than enjoyable pursuits. While maintaining physical activity might be experienced as meaningful and in alignment with one values, there also a tendency that individuals engaged in physical activities out of a sense of duty or obligation rather than intrinsic desire or personal interest. Essentially, while individuals recognise the importance of these activities for their health, the motivation behind their engagement is driven by perceived obligation, not by an innate desire to perform the activity. This approach to physical activity indicates an utilitarian view on physical activity, where health outcomes are prioritised over the enjoyment or inherent satisfaction derived from the activity itself.

Together, these insights illustrate the relationship between individuals' motivation for physical activity, their perceptions of autonomy, and the role of future-oriented thinking in shaping their motivation for physical activities. While the anticipation of future health benefits can lead to a more autonomous motivated physical activity, the perception of physical activity as an obligatory task for health maintenance can cause experiences of need unfulfillment.

06 Discussion

In the following discussion, I will reflect on and discuss the study's findings in relation to the existing literature. In the first part of the discussion, I will reflect on some of the study's most salient findings. After that, the implications of the study's findings for the theories used, Self-determination Theory and Theory of Planned Behaviour, will be discussed. A discussion of the limitations and strengths and suggestions for future studies follows this.

06.01 Reflections on the Findings

The synthesis of the study's findings suggests that within and across life, individuals' physical activity beliefs and motivation are influenced by past experiences, current circumstances and future anticipations. In the following, I will reflect on these findings in relation to the existing literature. I will touch on past experiences and future expectations briefly, focusing more on a detailed discussion of present circumstances. The sections are interlinked, with insights from both past and future enhancing our comprehension of how current circumstances influence physical activity beliefs and motivation.

Past Experiences

Previous research (e.g. Telama et al., 2005) establishes a clear link between levels of physical activity in childhood and physical activity in adulthood, which suggests a long-term impact of early life experiences on physical activity behaviour. Our findings (Dalgas et al., 2023a, 2023b) expand on this, suggesting how both positive and especially negative experiences in childhood can influence an individual's physical activity trajectory.

Our findings in Dalgas et al. (2023b) might explain the psychological mechanism behind this. In response to need frustration, individuals often adopt a "flight" response. It involves actively withdrawing from situations perceived as psychologically threatening, especially when external factors like restrictive environments or unsupportive social dynamics are present. This response can manifest as disengaging from challenging tasks, avoiding difficult social interactions, or leaving threatening environments altogether (Dalgas et al., 2023b). This response aligns with observations from other studies (Maner

et al., 2006; DeWall et al., 2009; Radel et al., 2014; Fang et al., 2017, 2018, 2021, 2022), who reported that adopting a withdrawal approach is a frequent tactic to avoid additional experiences of psychological need frustration. Thus, the lasting disconnection from physical activity we found in Dalgas et al. (2023a; 2023b) might be a self-protective mechanism allowing individuals to avoid distress, especially if the need frustration were experienced in an obligatory setting.

Therefore our findings (Dalgas et al., 2023b) suggest that the link between levels of physical activity in childhood and physical activity in adulthood identified in the existing literature (e.g. Telama et al., 2005) could be due to long-term influences of early life experiences on physical activity beliefs and motivation. It could be interpreted as a prolonged 'flight' response to the experiences of need frustration, where individual' continue to avoid physical activity into adulthood as a way to steer clear of the distress or discomfort they associate with the activity (Dalgas et al., 2023b). Overall, this finding underscoring the significant role of early physical experiences in setting the individuals' physical activity trajectory.

The Present Circumstances

The present circumstances that individuals find themselves in are contingent on a combination of life transitions and domain-specific environmental influences on need states. Below I will discuss how the individuals' present circumstances within life transition and life domains, respectively, influence their physical activity beliefs an motivation.

Present Circumstances within Life Transitions

The present circumstances that individuals find themselves in within their life transition significantly influence their physical activity beliefs and motivation. Dalgas et al. (2023a) have contributed to an understanding of this by examining how these transitions, such as beginning school, starting a career, and having a child, influence an individual's engagement in physical activity. Consistent with findings from Allender et al. (2008), Engberg et al. (2012), Gropper et al. (2020), and King et al. (1998), we observed that physical activity behaviour is subject to fluctuations during these key life transitions (Dalgas et al. 2023a). Our study advances the understanding of physical activity behaviour changes within life transitions by providing insights into various influencing factors. Different life transitions, such as moving out of the parental home, forming romantic relationships, or transitioning into retirement, introduce unique responsibilities and associated resources. These changes influence individuals' subjective norms and perceived behavioural control, shaping their physical activity patterns.

Thus, the present circumstances individuals find themselves in play an important role in shaping their physical activity beliefs and motivation. Dalgas et al. (2023a, 2024) contribute significantly to this understanding by examining the nuanced ways in which the present life influences an individual's engagement in physical activity. While certain life transitions (e.g. beginning school, starting a career, and having a child) tend to diminish physical activity beliefs motivation, it was not all the participants who followed this tendency. This indicates that they also do represent opportunities for increasing physical activity motivation (Dalgas et al., 2023a, 2024).

Domain-specific Environmental Influences on Need States

The present circumstances are also contingent upon environmental influences on need states. This includes how different domains of physical activity support the fulfilment of psychological needs (See Dalgas et al., 2024).

Prior research has primarily concentrated on single domains, and mostly the recreation domains (Craike, 2008; Gerber et al., 2018; Kang et al., 2020; Lloyd & Little, 2010; Lochbaum & Jean-Noel, 2016; Wang, 2017) and occupation domain. However, in the occupation domain, it is primarily the physical education context that has been investigated (e.g. Cid et al., 2019; Lochbaum & Jean-Noel, 2016; Ntoumanis & Standage, 2009; Pedersen et al., 2018, 2019; Salazar-Ayala & Gastélum-Cuadras, 2020; Standage et al., 2003; Thomas et al., 2021). Studies in the transportation domain are limited. However, there have been survey validation studies in this domain (Burgueño et al., 2020). We have not been able to identify studies within the household domain.

Our study expands upon this work by exploring how basic psychological needs are satisfied, unfulfilled, or frustrated across a broader range of physical activity domains. This includes not only recreational activities but also daily life activities like transportation, occupation, and household. Given that research in domains such as active transport, household, and occupational related to physical activity is limited, our study provides critical insights into these less explored areas. By encompassing these varied domains, we offer a holistic view of how psychological needs are experienced in the diverse domains of physical activity.

The study by Dalgas et al. (2024) explored the satisfaction, dissatisfaction, frustration, and unfulfillment of basic psychological needs across four domains of physical activity, revealing distinct experiences in each. In the transport domain, autonomy was predominantly unfulfilled, with participants viewing activities like cycling more as a necessity than a choice, driven by external needs. The competence aspect was not a major focus, except for instances where navigating urban environments on a bicycle provided a

sense of mastery for some. Relatedness in transport was generally limited due to its solitary nature, though younger participants found social aspects in activities like cycling with peers. In the household domain, chores were mostly seen as obligatory, leading to autonomy unfulfillment, yet when imbued with personal meaning, they became satisfying. Competence discussions were rare, but activities like cooking and gardening provided some skill development opportunities. Relatedness satisfaction emerged from shared household activities, fostering a sense of community, although unequal task distribution sometimes led to frustration. The occupational domain exhibited varied experiences in autonomy, with some participants feeling constrained by job demands, while others found alignment with personal interests. How et al. (2013) and Ward et al. (2008), demonstrated that offering choices in physical education programs greatly enhances autonomy satisfaction. This concept could be similarly beneficial in workplace settings, allowing employees greater control over their work, including choice in tasks, projects, and methodologies. Implementing such an approach could facilitate the alignment of work tasks with employees' personal interests and values, which, according to our study (Dalgas et al., 2024), might lead to increased autonomy satisfaction. Competence was again not widely discussed, but job roles offering skill development were seen positively. Social support in the workplace notably contributed to a sense of relatedness, especially in team-based environments. In the recreation domain, autonomy experiences varied from viewing physical activities as obligatory for health (often leading to experiences of need unfulfillment) to engaging in activities aligned with personal values (often leading to need satisfaction). Competence satisfaction was linked to achieving personal goals, while frustration arose from unmet expectations or physical limitations. Relatedness was typically satisfied through strong social connections in group settings, aligning with findings of (Raabe & Readdy, 2016). Relatedness unfulfillment occurred when expected social interactions did not materialise (Dalgas et al., 2024).

Future Anticipations

The synthesis of our findings from Dalgas et al. (2023a, 2023b, 2024) provides an understanding of how the anticipation of future outcomes – influences physical activity behaviour. The anticipation of future outcomes manifests as a proactive change in attitudes towards physical activity due to future health considerations. Essentially, the foresight of future physical limitations and health needs prompts individuals to re-evaluate and often prioritise their engagement in physical activity. Thus, many participants practised physical activity out of a sense of responsibility for their future lives, engaging in it as a duty towards their future selves. This sense of responsibility could both feel internally motivated and be linked to feelings of guilt and obligation.

A study by Kinnafick et al. (2014) highlights the significant role of guilt and obligation in the adoption of physical activity. However, their ability to sustain long-term engagement in physical activity is less certain, as suggested by Pelletier et al. (2001).

Thøgersen-Ntoumani and Ntoumanis (2006) highlight the dual nature of guilt-based motivation, suggesting it can lead to both adaptive and maladaptive outcomes. This nuanced view is reflected in the Dalgas et al. (2023a, 2023b, 2024) studies, where the anticipation of future states like health challenges instance, might lead to a proactive changes in attitude towards physical activity, as seen in Dalgas et al. (2023a). This change is driven by the anticipation of future health benefits and the desire to maintain independence. This signifies an adaptive outcome of forward-looking perspectives.

Seeing this from a Self-determination Theory perspective, this finding might reflect an experience of autonomy satisfaction in relation to one's overall health condition, or what could be termed general life autonomy. This occurs when an individual feels that engaging in physical activity is a choice they make for their overall health and well-being. They recognise and value the benefits of the activity for their health and quality of life, which gives them a sense of personal control and satisfaction.

On the other hand, we find that the same individual simultaneously can experience 'autonomy frustration' or 'autonomy unfulfillment' in relation to a specific physical activity. This can happen if they feel compelled to engage in a particular type of activity which they may not enjoy or find meaningful. Therefore, our results indicate that it is possible for a person to feel self-determined with and need satisfied within their overall decision to be physically active for their health while simultaneously experiencing need unfulfillment or frustration within the specific form of activity they are participating in. The findings align with hierarchical models of psychological needs (Vallerand, 1997) showing that while individuals may feel autonomy satisfaction by the overall decision to pursue physical activity for health, they can simultaneously experience need unfulfillment and frustration within specific activities. These findings might provide an explanation for the observed dual outcomes of guilt-based motivation found by Kinnafick et al. (2014) and Thøgersen-Ntoumani and Ntoumanis (2006).

This interpretation of the findings indicates that while the anticipation of future states is a significant driver of physical activity beliefs and motivation, it needs to be supported by positive experiences of need satisfaction within the specific activity.

06.02 Implications for the Theories

The study's findings have implications for both of the applied theories, Theory of Planned Behaviour and Self-determination theory. For Theory of Planned Behaviour, we suggest life transition as a background factor and emphasise the importance of considering background factors as influencers on attitudes, subjective norms, and perceived behavioural control, and not just use them as control variables. Lastly, we advance Self-Determination Theory by suggesting how the process of restoring psychological needs after incidences of need frustration and unfulfillment unfolds.

Theory of Planned Behaviour

According to Theory of Planned Behaviour, background factors (e.g. personality traits, socio-structural variables, past behaviour, information, knowledge, and other individual differences) indirectly influence attitudes, subjective norms, and perceived behavioural control (Ajzen, 2020; Hagger & Hamilton, 2021). However, existing research has often overlooked the substantial impact these factors have on health behaviour across different populations and contexts by only using them as control variables (Hagger & Hamilton, 2021). Hagger and Hamilton (2021) demonstrated that socio-structural variables can directly and indirectly affect behavioural intentions and actions. They showed that socio-structural variables influenced behaviour through their impact on the components of Theory of Planned Behaviour, particularly perceived behavioural control (Hagger & Hamilton, 2021). These findings highlight the need to consider background factors not just as control variables but as significant influencers of attitudes, subjective norms, and perceived behaviour within the Theory of Planned Behaviour framework. Our findings support Hagger and Hamilton's (2021) notion of the importance in considering background factors, and further expand on them by suggesting a new background factor that is subject to change across an individual's life: Life transitions.

Previous studies have used the Theory of Planned Behaviour to understand physical activity changes during key life transitions, such as retirement (Barnett et al., 2012), parenthood (Hamilton & White, 2010), and career shifts (Kirk & Ryan, 2012). While our findings align with the findings of these studies, our approach expanded the scope of exploration by examining a wider array of life transitions and their effects on physical activity. We found that each life transition has a distinct influence on physical activity behaviour, shaped by changes in attitudes, norms, and perceptions of control (Dalgas et al., 2023a). In essence, our research enhances the Theory of Planned Behaviour framework by suggesting the integration of the concept of life transitions as a background factor that can enhance our understanding and predictions of behavioural

intentions. Thus, the findings of Dalgas et al. (2023a) offer a deep understanding of the dynamic nature of behaviour change in response to life transitions.

Self-determination Theory

This study has advanced self-determination theory by generating novel insights into the process of restoring psychological needs (see Dalgas et al., 2023b). Our study contributes to and advances the existing literature (e.g., Fang et al., 2017; Maner et al., 2007; Radel et al., 2011) in several ways:

First, our study expands upon previous research by exploring the restoration of psychological needs within a real-life setting, specifically focusing on physical activity behaviour. By grounding our study in real-life contexts, we bridge the gap between theoretical conceptualisations need restoration and its real-life significance (Dalgas et al., 2023b).

Another significant contribution of our study is the distinction we make between need frustration and unfulfillment within the context of need restoration. While past research has often treated these states interchangeably, our study highlights the importance of differentiating between them. This distinction aligns with recent developments in the Self-determination theory literature (Bhavsar et al., 2020; Huyghebaert-Zouaghi et al., 2021; Ntoumanis, 2023). By recognising unique pathways for restoring psychological needs after frustration or unfulfillment, we contribute to a more dynamic model of Self-determination theory, emphasising the presence of human agency. This perspective is pivotal in understanding how individuals navigate and interact with their surroundings to fulfil their psychological needs (Dalgas et al., 2023b).

Moreover, our study explores how different psychological needs might interact with each other during the restoration process. Past research has typically examined the restoration of individual psychological needs in isolation (e.g., autonomy, competence, relatedness), but our study takes a more holistic approach. We investigate how these needs might intersect and influence one another during the restoration process. This broader perspective offers a more comprehensive view of the need restoration process, acknowledging the interplay between different needs and how they collectively contribute to an individual's well-being and motivation (Dalgas et al., 2023b).

In addition to these contributions, our study sheds light on the role of negative affect in the restoration process. While the existing restoration process literature has not adequately addressed this aspect, our findings suggest that experiencing negative affect plays a crucial role in refining individuals' perceptions of discrepancies between actual

and desired need states. This aligns with the theoretical framework of cybernetic control processes (Carver & Scheier, 1990, 2012), that emphasise feedback mechanisms' significance in behavioural self-regulation. Negative affect, in our study, is not merely a passive psychological consequence but serves as a functional signal, guiding individuals to take action to address the deficiency in their psychological needs. This perspective adds depth to our understanding of how affective states actively influence the restoration process (Dalgas et al., 2023b).

Furthermore, our study offers insights into the initiation of action plans during the restoration process by highlighting the influence of social dynamics, opportunities, and available resources. These insights align with Carver and Scheier's feedback theory of self-regulation (1990), which emphasises the role of external factors, including social interactions, in shaping behavioural responses. By acknowledging the impact of external stimuli on the initiation of action plans, our study enriches the existing literature on the restoration process (Dalgas et al., 2023b).

Lastly, our study distinguishes between different action tendencies in response to need frustration or unfulfillment, categorising them into 'flight' responses in situations of external contingencies and 'fight' responses in cases of internal factors or need unfulfillment. This differentiation draws upon the Approach and Avoidance Behaviour framework (Corr, 2013) and provides a deeper understanding of the coping mechanisms individuals employ in response to specific challenges. This nuanced perspective allows us to identify distinct pathways for coping with different types of need states, which previous literature, as earlier mentioned, has not differentiated (Dalgas et al., 2023b).

Thus, our study significantly advances the restoration process literature within Self-determination Theory. By employing qualitative methods, focusing on real-life contexts, differentiating between need frustration and unfulfillment, exploring the interaction of psychological needs, acknowledging the role of negative affect, and considering the influence of social dynamics and distinct action tendencies, we contribute to a more dynamic understanding of how individuals restore their psychological needs after incidences of need frustration and need fulfilment within the framework of Self-determination Theory.

06.03 Limitations and Strengths

I believe this study has several strengths that significantly contribute to its academic and practical value in the field of physical activity behaviour and motivation. However, it is important to acknowledge that it has limitations. While posing challenges to the

research, these limitations enable insights and directions for future studies. The distinctions between the strengths and limitations are not always black and white. In many instances, what may be a limitation can simultaneously serve as a strength. By comprehensively evaluating both the strengths and the limitations, we can better understand the nuances of the study and appreciate the context in which its findings should be interpreted.

Limitations

The limitations of this study encompass a range of methodological and contextual factors, which will be detailed further in the following sections. These include the narrow scope of concentrating solely on Danish adults, the issue of researcher fatigue, the potential for recall biases, the challenge of addressing three distinct research themes within a single interview session, and the possible inadequacy of the interview questions in fully exploring the study's key constructs.

The exclusive focus on Danish adults

The exclusive focus on Danish adults in this study presents a limitation that potentially impacts the broader applicability and generalisability of the findings. This limitation stems from the unique cultural, social, and economic nuances specific to Denmark, all of which may influence the populations' individual physical activity beliefs and experiences. This conditional specificity raises questions about the extent to which the findings of this study can be applied to other demographic or cultural contexts. As Flick (2015) highlights, transferring insights from one cultural setting to another is not always seamless due to variations in social norms, values, and life conditions.

For example, Denmark's infrastructure is highly conducive to active commuting. With Denmark's extensive bike lanes and pedestrian-friendly urban designs, the ease of engaging in regular, informal physical activity (Christiansen et al., 2014) could contrast with countries where such infrastructure is lacking, potentially leading to different activity patterns, beliefs and motivation. Additionally, Denmark has a Danish Act on Non-formal Education and Democratic Voluntary Activity, which supports a culture of communal and accessible physical activities (see retsinformation.dk). Such a structured, inclusive approach towards physical activity is not universally present, which might make the Danish context distinct in terms of community engagement in the population's participation in physical activity. Moreover, Denmark's healthcare system and public health initiatives significantly emphasise preventive health measures, including the promotion of physical activity (see Sundhedsstyrelsen, 2018). This approach, which may not be equally prevalent in all countries, likely influences the general attitude towards and the regular practice of physical activity among Danish adults (Boles et al.,

2014). Finally, the climate and seasonal variation in Denmark, characterised by long summer days and shorter winter days, also shape the patterns of physical activity. The changing seasons might affect both the type of activities preferred and the frequency of engagement, a factor that might not be as pronounced in countries with more stable climates (Turrisi et al., 2021).

Therefore, while the findings of this study offer valuable insights into the behaviour and motivation of Danish adults, caution must be exercised when attempting to generalise these findings to adults from other countries or cultural backgrounds. The cultural, social, and economic context of Denmark may present unique conditions that are not necessarily replicable or relevant in other settings.

87 hours and 33 minutes of interview

One of the primary limitations of this study concerns the extensive scope of data collection, involving in-depth interviews with 42 participants, which cumulatively amounted to 87 hours and 33 minutes. This large-scale approach, while enriching the research with diverse perspectives, has introduced several methodological and practical challenges.

Maintaining a high level of engagement and attentiveness throughout all the interviews presented a significant challenge, mainly due to the constant vigilance required to prevent the onset of interviewer fatigue. As Smyth and Williamson (2004) note, fatigue poses a risk to the consistency and quality of data collection. Each interview, irrespective of its order, required a consistent level of rigour and enthusiasm, pushing the limits of my endurance and dedication. This situation necessitated continuous self-awareness and adaptability to maintain a uniformly high data collection standard. Additionally, establishing a meaningful connection with each of the 42 participants required a careful balance between empathetic engagement with individual stories and effectively managing the numerous participant relationships, as highlighted by Smyth and Williamson (2004). I aimed to ensure participants felt understood, necessitating a nuanced and attentive approach to each interaction. This aspect of the study demanded meticulous attention to keep every interview focused and productive. The process was both exhilarating and exhausting, at times challenging my capabilities. There were moments where managing the data generation process might have impacted the depth of data collected despite my efforts to uphold high standards.

Furthermore, the task of managing the substantial volume of data from these interviews was huge. The processes of transcribing, coding, and analysis required immense time and focus. I often found myself contending with the vast amount of data, striving not to

overlook any critical details. A constant concern was the possibility of missing subtle patterns or key insights, particularly as I sought to capture the full depth and breadth of the narratives shared. As Braun and Clarke (2022) assert, the rigour and credibility of qualitative research depend significantly on the researcher's ability to conduct thorough and consistent data analysis. Fatigue can impede the researcher's effectiveness in coding and interpreting data, potentially leading to missed nuances or a less detailed analysis. Such occurrences could culminate in a less comprehensive understanding of the study's findings, as Smyth and Williamson (2004) have indicated.

Recall biases

A notable limitation of this study is the reliance on retrospective accounts from participants, which inherently poses the risk of recall bias. Participants were requested to reflect on their past experiences and behaviour during various life transitions, a process that depends heavily on the accuracy and completeness of their memories. This reliance on memory can introduce several potential issues impacting the validity of the data collected.

Firstly, the accuracy of recollection can vary significantly among individuals. While research by Bauer and McAdams (2000) indicates that people generally remember significant events related to need satisfaction and frustration, the precision and detail of these recollections can differ. Some participants may have struggled with accurately recalling their experiences, potentially leading to incomplete or skewed narratives. This issue is particularly relevant in studies where the time lapse between the experiences in question and the interviews is substantial, as memories can become less precise over time. Furthermore, the retrospective nature of the accounts may have led participants to focus disproportionately on certain events or experiences they perceived as most memorable or significant (Hitchcock et al., 2020). This selective recollection could result in a narrative that overlooks less prominent but still relevant experiences, thereby impacting the comprehensiveness of the data.

Additionally, the current emotional state of participants at the time of the interview could influence their recollections. As Schwarz and Sudman (2012) note, present emotions and attitudes can colour past experiences, leading to a narrative that may be more reflective of the participant's current perspective rather than an accurate portrayal of past events. This phenomenon could result in biased narratives that do not fully represent the participants' actual experiences or beliefs at the time in question.

Three studies in one interview

A further limitation of this study was the incorporation of three distinct research

focuses within a single interview session. This multi-faceted approach, while ambitious in its attempt to gather a broad spectrum of data, posed several challenges that could have impacted the depth and quality of the information obtained.

The decision to address three separate studies within one interview had implications for both the interviewer and the participants. From the interviewer's perspective, managing and navigating through the complexities of three different research topics in a single interview session required a good overview. There was a constant need to balance the time allocated to each study, ensure smooth transitions between different topics, and maintain a clear focus throughout the interview. This juggling act risked diluting the interviewer's attention, potentially leading to less in-depth exploration of each theme. For participants, the inclusion of three studies in one interview may have been overwhelming or confusing. Participants might have found it challenging to shift their focus and thoughts between different research areas, which could have affected the coherence and depth of their responses.

Additionally, the breadth of topics covered in a single interview may have limited the time available to delve deeply into each specific study area. In qualitative research, depth of understanding often comes from detailed exploration and probing of participants' experiences and perceptions (Kvale, 2007; Smith & Sparkes, 2016). The need to cover a wide range of topics within a limited time frame could have resulted in more superficial coverage of each area rather than a thorough and nuanced exploration.

Furthermore, the diverse nature of the three studies introduced a level of complexity that might have challenged the data analysis. Synthesising and interpreting data from three different research focuses within a single set of interviews requires careful consideration to ensure that each study's distinct insights and findings are captured and represented.

As a consequence of the study's holistic approach to the context of the participant's life, some of the interview questions may not have been adequate. Thus, while these questions were crafted to explore psychological need states in the context of physical activity, they might not be sufficiently comprehensive to thoroughly examine all facets of these needs across the various domains of physical activity. This gap in the interview design was particularly noticeable in the exploration of the needs for competence and relatedness. The questions, as formulated, may have lacked the depth and breadth necessary to fully capture the complexity of these psychological needs. Competence and relatedness are multifaceted constructs and adequately probing them requires a nuanced and detailed line of questioning. The inability of our questions to delve deeply into

these areas means that certain aspects of how individuals experience and interpret their competence and relatedness in the context of physical activity may not have been fully uncovered or understood, especially within the domains of transport, occupation, and household.

Furthermore, the approach to identifying instances of need unfulfillment was predominantly inductive. This means that, rather than having direct and focused questions aimed at uncovering unfulfilled psychological needs, the study relied on participants to bring up these aspects spontaneously during the interviews. While this approach can provide genuine insights, it also has limitations. Without direct questions targeting the unfulfillment of psychological needs, some participants might not have considered or articulated experiences of unfulfillment in their responses. As a result, the study potentially missed capturing a broader spectrum of unfulfillment experiences and perceptions related to psychological needs. This approach, therefore, may have restricted the exploration and understanding of how unfulfilled needs manifest and are perceived by individuals across different domains of physical activity. The absence of targeted questions about need unfulfillment could lead to an incomplete understanding of the role and impact of these unmet needs within the broader context of physical activity (Dalgas et al., 2023b).

Strengths

The strength of this study is anchored in a multifaceted approach that combines rigorous qualitative methods, a substantial sample size, the strategic use of theoretical frameworks, and significant conceptual contributions. Each of these elements plays a critical role in enhancing the study's depth, breadth, and overall impact in the field of physical activity behaviour research.

Qualitative methodology

The use of qualitative methodology is particularly significant given the prevailing dominance of laboratory and quantitative studies in applications of Self-Determination Theory (Vansteenkiste, 2020) and Theory of Planned Behaviour (Renzi & Klobas, 2008). In addition to laboratory and quantitative studies, qualitative interviews offer a rich understanding of physical activity, which is currently limited (Dalgas et al., 2023b). Thus, the use of qualitative interviews enabled me to tap into the rich, detailed narratives of individuals, a process that Smith and Sparkes (2016) have highlighted as invaluable for comprehending complex behaviour.

A central element of this study is the exploration of contextual and psychological factors that shape physical activity behaviour. This involves delving into the motivation,

perceptions, and experiences that drive an individual's engagement with physical activity within domains and during significant life transitions. The use of life story interviews is particularly effective in this regard (Atkinson, 2001). It allows me to construct a comprehensive and evolving picture of an individual's relationship with physical activity over time, providing insights into the dynamic nature of their engagement and how their beliefs and motivation change.

Moreover, my study delves into the personal meanings and interpretations individuals assign to their physical activities. This aspect is crucial, as it acknowledges that physical activity behaviour is not only influenced by external contextual factors but is also significantly shaped by internal processing and perception mechanisms. This focus on individual narratives reveals the intricate ways in which people relate to and understand their physical activity, contributing to a more in-depth understanding of physical activity beliefs and motivation.

The flexibility inherent in qualitative research is another notable strength of my approach (Kvale, 2007). It allows me to be responsive and adaptive, exploring emerging themes or insights that surface during interviews. This adaptability leads to a richer, more comprehensive understanding of physical activity behaviour.

A Robust Pool of Potential Participants

A key strength of our study lies in effectively addressing the difficulties in recruiting interview persons. The extensive pool of potential participants identified from the Moving Denmark survey (N=48,488) enabled us to compensate for non-responders by recruiting individuals with equivalent participant profiles. This approach ensured that the diversity and representativeness of our sample were maintained, allowing for comprehensive and robust insights into the research topics.

Sample Size

The study's considerable sample size of 42 participants, especially in the context of its heterogeneous nature, stands as a notable strength. This larger sample size is essential in effectively capturing the wide array of perspectives and experiences inherent in a diverse group. The importance of such a sample size in qualitative research involving heterogeneous groups is well-supported by the recommendations of Guest et al. (2006). They advocate that a larger sample size is crucial in qualitative studies with diverse participant groups to ensure the richness, robustness and comprehensiveness of the results. This approach ensures that the study's findings are well-rounded and reflective of the varied experiences of the participants.

Focusing holistically on context

In our study, focusing on three contextual areas (life transitions, life domains, and the interplay between the social environment and the individual) has significantly enhanced our understanding of the participants' entire life context. This methodology has been instrumental in piecing together detailed narratives that encompass not only the participants' physical activity behaviour but also their beliefs and motivational factors, set against the backdrop of their wider life experiences. In alignment with the study's epistemological underpinning this has provided a comprehensive, context-aware perspective on subjective experiences. This focus has enriched our understanding by adding depth and detail to how individuals lives influence their physical activity behaviour.

Inclusion of ordinary people

Another strength of our study lies in its focus on the everyday experiences of ordinary individuals. Unlike other qualitative Self-determination studies that typically have targeted specific demographic groups (e.g. patients, school children, older adults and other social groups) (e.g. Dendle et al., 2022; González-Cutre et al., 2020; Sotos-Martínez et al., 2022), our study encompasses a broad spectrum of people from various points in life, each with their own unique experiences and perspectives on physical activity. Our study's inclusive nature ensures that its findings are relevant to a wide range of individuals, providing insights that apply to various life stages and lifestyles. Such information could enhance the effectiveness of public health promotion, ultimately benefiting overall public health.

Use of Theoretical Frameworks

Another strength lies in the study's rootedness in established theoretical frameworks. The integration of these theories provided a structured framework, lending rigour and an analytical lens to our exploration of physical activity beliefs and motivation. The use of these established theories not only structured our analysis but also implied that our approach and conclusions are based on a solid foundation of existing knowledge. Moreover, the theoretical grounding of our study extends beyond academic contributions, offering practical implications as well. Insights derived from a theory-based approach can inform the development of more effective interventions and guide future research directions. Understanding the theoretical underpinnings of physical activity behaviour enables the design of targeted interventions and healthcare practices that effectively address the key factors influencing such behaviour (Hagger et al., 2020).

06.04 Future Directions

Future Directions for Study Designs

Our findings in relation to the dynamic nature of individuals' physical activity beliefs and motivation across different life transitions underscore the importance of longitudinal research in understanding the dynamic nature of physical activity within and across life. Longitudinal research allows for the examination of changes over time. This is particularly relevant when studying physical activity, as our findings show, that individuals' motivation, ability, and opportunities to engage in physical activity can fluctuate significantly throughout their lives. Longitudinal studies can capture these changes and provide insights into the causal relationships and processes underlying them (Bryman, 2016). Thus, the appliance of qualitative longitudinal studies can provide a more holistic understanding of how life changes interact with individuals' physical activity beliefs and motivation. Applying a qualitative longitudinal research design could counteract potential recall biases in retrospective accounts. This approach would allow researchers to track changes in physical activity behaviour and motivation over time, reducing reliance on participants' memory accuracy. Additionally, the use of diaries (see Unterhitzberger & Lawrence, 2022) or ecological momentary assessment (see Shiffman et al., 2008) could provide real-time data, offering a more immediate and potentially more accurate account of participants' experiences.

Future study designs should thoughtfully embrace either holistic, contextual studies or more focused investigations. Each approach addresses different yet complementary aspects of understanding physical activity behaviour, contributing significantly to the field. Holistic, contextual studies are instrumental in capturing the broad panorama of factors that influence physical activity behaviour. These studies, by encompassing a wide array of variables, are particularly adept at illustrating how multiple factors interact and shape behaviour, thus providing essential insights for creating broad-scale interventions and policies (Bernardi et al., 2019). This approach is invaluable for identifying overarching patterns and trends, which is crucial understanding the collective impact of various factors on physical activity behaviour. Conversely, there is a parallel and equally critical need for more focused studies. These investigations delve into specific aspects of physical activity behaviour, providing detailed insights into particular phenomena. For instance, focused research can explore the impact of distinct life transitions on physical activity motivation, examine the influence of specific environmental settings (e.g. within the transport and household domains where previous research has been limited), or investigate the role of specific psychological factors (e.g. the process of restoring psychological needs after incidences of psychological need frustration and

unfulfillment). This detailed exploration allows for a deeper understanding of the nuances and intricacies of physical activity behaviour. Since the two types of approaches can provide complementary perspectives and knowledge, it is beneficial that both approaches are represented separately in future studies to preserve their unique perspectives and contributions. This further directly addresses the challenge of exploring multiple research themes within a single interview. By structuring interviews to concentrate on specific themes in separate sessions, each aspect of physical activity behaviour can be explored more thoroughly. This reduces the risk of overwhelming both the participant and the researcher, ensuring that each theme receives the attention and depth it deserves. It also prevents the dilution of focus that can occur when trying to cover multiple topics in one sitting, enhancing the quality and coherence of the data collected. Developing detailed and specific questions in focused studies tailored to delve into the nuances of psychological needs and motivation related to physical activity further helps overcome the limitations of inadequate interview questions. This approach ensures that complex constructs like competence and relatedness are thoroughly explored, addressing any gaps in the current understanding and capturing the multifaceted nature of these constructs as they manifest in different domains of physical activity.

Leveraging the strength of using established theoretical frameworks, future studies should continue to apply and possibly integrate multiple theories (For example Theory of Planned Behaviour and Self-determination Theory). This approach can provide a more nuanced understanding of physical activity behaviour and motivation and could lead to the development of new theoretical models that better capture the complexity of these phenomena.

Expanding on the understanding of how life transitions and domains influence physical activity behaviour; there is a significant need for future research to develop and evaluate interventions and initiatives that are sensitive to these transitional phases and different domains. Such research should aim to design and test interventions and initiatives tailored to the unique challenges and opportunities that various life transitions and domains present. The goal is to create interventions and initiatives that are contextually relevant and responsive to individuals' specific needs and circumstances. These interventions should be based on a thorough understanding of the psychosocial factors influencing physical activity within and across life. Based on the present study's findings, important factors include both earlier experiences, current circumstances, and future anticipations. Future research in this area has the potential to significantly advance our understanding of how to effectively promote physical activity across and within life.

Future Directions For Theory of Planned Behaviour and Self-determination Theory

For the Theory of Planned Behaviour, a future direction based on our study's findings would be the incorporation of life transitions as a key background factor. This addition would acknowledge that life transitions have distinct influences on attitudes, subjective norms, and perceived behavioural control (Dalgas et al., 2023a). By integrating life transitions, Theory of Planned Behaviour can offer a more nuanced and dynamic understanding of how behavioural intentions are formed. Additionally, Theory of Planned Behaviour could benefit from moving beyond treating background factors as control variables. Recognising the direct and indirect background factors has on behaviour would enhance the applicability of Theory of Planned Behaviour and relevance across both different populations and contexts, providing a richer, more comprehensive understanding of behavioural motivation and actions (Hagger & Hamilton, 2021).

Self-determination Theory could be advanced by focusing more on the process of psychological need restoration, especially within real-life contexts. This could bridge the gap between theoretical conceptualisations and practical applications, offering deeper insights into how individuals respond to need frustration in everyday life. Moreover, distinguishing between need frustration and unfulfillment, as Dalgas et al. (2023b) suggest, introduces a nuanced understanding within Self-determination theory. The exploration of different coping mechanisms and behavioural responses to experiences of need frustration would allow for a more nuanced understanding of how individuals adapt and respond to different life circumstances, which could add further depth to Self-determination Theory. Understanding how different psychological needs interact during the restoration process could also offer a more holistic view of the process (Dalgas et al., 2023b). Furthermore, integrating insights about the role of negative affect and the influence of external stimuli, such as social dynamics and available opportunities, in the restoration process would enhance Self-determination Theory (Dalgas et al., 2023b).

Implications for Future Practice

Our findings also have implications for future practice. Overall, future practice should focus on creating flexible, context-sensitive interventions that acknowledge the unique challenges and opportunities of different life transitions. By supporting psychological needs across various domains and enhancing early experiences in physical activity, we can foster long-term motivation and engagement in physical activity. Below I will describe three different focus points for future practice: Recognise and adapt to the shifts in responsibilities and resources during different life transitions; use domain-sensitive approaches to adapt to life transitions; and, be aware that early life physical activity

experiences might shape long-term behaviour.

Recognise and adapt to the shifts in responsibilities and resources during different life transitions

Our findings indicate that life transitions are marked by shifts in responsibilities and available resources that significantly can influence how each domain contributes to an individual's overall physical activity. Thus, in light of our findings, future directions for practice in promoting physical activity should focus on recognising and adapting to the shifts in responsibilities and resources that occur during different life transitions. This approach acknowledges that each life transition presents unique challenges and opportunities for physical activity. Interventions and supports should be flexible, considering the changing prominence of each domain in an individual's life during different transitions. This approach ensures that interventions are grounded in the lived experiences and challenges tied to specific life transitions, increasing their relevance and effectiveness.

Use domain-sensitive approaches to adapt to life transitions

Our study further underscores the issue of autonomy unfulfillment being salient in the active transportation, occupation, and household domains (Dalgas et al., 2024), negatively influencing physical activity motivation (Bhavsar et al., 2019; Cheon et al., 2019; Huyghebaert-Zouaghi et al., 2023; Ntoumanis, 2023). During most life transitions, we observed that individuals tend to allocate more time to the occupational and household domains, often at the expense of physical activity in other domains (e.g. beginning school, leaving home, starting a career, and having a child). This shift highlights the need for a domain-sensitive approach that adapts to the changing dynamics of individuals' lives.

Teixeira et al. (2020) offer a guide to Self-determination Theory-aligned techniques for supporting psychological needs that could be adapted to specific domains. For example, in the transport domain, fostering autonomy might involve creating opportunities for individuals to express their views on transportation and explore various options. Competence could be supported by promoting self-monitoring habits, while relatedness might be enhanced by forming community groups or forums for discussion. In the household domain, enhancing autonomy could involve a distribution of task, so most of them align with personal values. Competence could be supported through positive feedback on task completion. Relatedness could be fostered by acknowledging feelings around household responsibilities, and supporting each other in getting things done. In the occupational domain, fostering autonomy involves non-coercive communication, with clear communication of job roles and expectations supporting competence. Relatedness could be enhanced by understanding and actively listening to employee

concerns. For recreation, providing a range of enjoyable activities and encouraging participation in clubs or groups can enhance autonomy, competence, and relatedness (Dalgas et al., 2024).

Be aware that early life physical activity experiences might shape long-term behaviour

This study highlights that experiences with physical activity in early life influence individuals' long-term behaviour. Early experiences of need frustration in physical activity can lead to long-lasting negative attitudes towards physical activity and impede participation in later life. It's essential, therefore, to enhance the quality of these early experiences and address individuals' basic psychological needs within physical activity settings from a young age. By ensuring that initial experiences, such as in physical education, are fulfilling and supportive, we can effectively prevent the development of negative attitudes towards physical activity. Applying a quality-focused, psychological need-supportive approach to physical activity across life domains can aid individuals in sustaining or increasing motivation and engagement across domains of physical activity, countering the trend of reduced physical activity motivation due to increased occupational and household responsibilities.

Further, it's important to be aware that less physically active individuals might have had negative experiences with physical activity in the past. This awareness is key to understanding their current attitudes and participation in physical activities.

07 Conclusion

This thesis aimed to generate a rich understanding of how individuals' physical activity beliefs and motivation are influenced within and across life. This aim was utilised through three objectives: (1) To understand how life transitions influence physical activity beliefs and behaviour, (2) to understand variations in psychological need satisfaction, frustration, and unfulfillment across the domains of physical activity, and (3) to understand the process of restoring psychological needs after incidences of need frustration and unfulfillment.

The findings of the study offer a comprehensive understanding of how various life transitions influence Danish adults' physical activity beliefs and behaviour. The study identified six influential transitions: Beginning school, leaving home, starting a career, forming a romantic relationship, having a child, and retiring, each bringing about significant changes in social roles and associated responsibilities. These changes, in turn, influenced participants' attitudes, subjective norms, and perceived behavioural control towards physical activity, often leading to a reduction in activity intentions, except in the cases of leaving home and retiring, where an increase or maintenance in intention was observed. The findings from each life transition reveal the interplay between societal expectations, personal autonomy, and the environment in shaping physical activity beliefs and motivation.

Further, the findings suggest that psychological need satisfaction, frustration, and unfulfillment manifest distinctly across the domains of physical activity, thus influencing individuals' motivation distinctly. Particularly notable is the utilitarian view of transport and household chores leading to autonomy unfulfillment, whereas personal meaning and shared tasks could transform these experiences into sources of need satisfaction. Occupational satisfaction hinged on job alignment with personal interests and the presence of social support. In recreation, the obligation felt towards physical activity for future health, alongside the varying degrees of competence and relatedness experienced, underscored the complex relationship between personal values, physical limitations, and social interactions in shaping physical activity motivation. These findings underscore that not all domains of physical activity are equally need-supportive. However, the findings also highlight the opportunities for experiencing need satisfaction

within each domain.

Lastly, the findings suggest that the process of restoring psychological needs after incidences of need frustration and unfulfillment are distinct. After incidences of need unfulfillment, individuals tend to 'fight back' by proactively seeking out new activities or making lifestyle adjustments to restore their psychological needs. In contrast, 'flight' characterises the response to need frustration, where individuals tend to avoid or disengage from the threatening situation. Additionally, we found that responses to need frustration vary significantly depending on whether the need frustration was experienced in a voluntary or obligatory setting, implying that the setting of the frustration plays an important role in determining the longevity of the adopted restoration strategies. Consequently, this study underscores the enduring influence of initial experiences in physical education on long-term attitudes towards physical activity.

Together, our findings indicate that within and across life, individuals' physical activity beliefs and motivation are influenced by a combination of past experiences, present circumstances, and future anticipations. Past experiences, especially in childhood, play a significant role in establishing a lasting influence on an individual's physical activity beliefs, motivation, and behaviour. These experiences, whether positive or negative, set the trajectory for an individual's engagement in physical activity. Present circumstances, such as life transitions and the level of support within various domains, have a substantial influence on physical activity beliefs, motivation, and behaviour. Additionally, environmental factors within specific physical activity domains (e.g. occupation, transport, household, and recreation) influence how individuals' psychological needs are satisfied, unfulfilled, or frustrated, ultimately influencing their physical activity motivation within each domain. Looking forward, anticipations of future outcomes, particularly related to health, can lead to a shift in attitudes towards physical activity. While future health anticipations can drive physical activity motivation, the quality of this motivation and its sustainability depend on experiencing need satisfaction within the chosen activities.

This study advances Theory of Planned Behaviour by challenging the traditional use of background factors as mere control variables advocating for their recognition as dynamic influencers of attitudes, subjective norms, and perceived behavioural control. Furthermore, by differentiating between need frustration and unfulfillment, the thesis contributes to a more nuanced understanding of Self-Determination Theory, emphasising human agency in overcoming psychological need frustration and unfulfillment.

This work further provides practical insights for practical application, particularly in designing interventions, initiatives and strategies to enhance physical activity engagement. The study contributes to the field by offering a nuanced understanding of the factors influencing physical activity beliefs and motivation, providing a foundation for developing context-sensitive, need-supportive interventions, initiatives and strategies that can accommodate the complexities of real-world settings. It underscores the importance of acknowledging life transitions and their influence on physical activity behaviour, suggesting that interventions, initiatives and strategies need to be adaptable to these changes. Further, the study also points out how early life experiences significantly influence long-term physical activity habits, suggesting that positive initial engagements with physical activity can encourage a lifelong commitment to an active lifestyle. Lastly, the research advocates for a domain-sensitive approach to supporting physical activity, taking into account the unique challenges and opportunities presented by different life domains such as transport, occupation, household, and recreation. By focusing on the satisfaction of basic psychological needs across all these domains, interventions, initiatives and strategies can be more effective in motivating sustained physical activity.

08 Literature

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09 Appendices

Appendix A: Distribution of Municipalities Across Ten Municipality Types

Appendix B: Interview invitation

Appendix C: Participant Bios

Appendix D: Interview situation characteristics

Appendix E: Life Story Activity – Timeline

Appendix F: Interview guide

Appendix A: Distribution of Municipalities Across Ten Municipality Type

Municipality Type		Municipalities	
The Capital		Copenhagen	
Capital Municipalities	Socioeconomic advantage	Allerød	
		Dragør	
		Egedal	
		Frederiksberg	
		Furesø	
		Gentofte	
		Greve	
		Hørsholm	
		Lyngby-Taarbæk	
		Rudersdal	
		Solrød	
		Vallensbæk	
		Socioeconomic disadvantage	Albertslund
			Ballerup
Brøndby			
Gladsaxe			
Glostrup			
Herlev			
Hvidovre			
Høje-Taastrup			
Ishøj			
København			
Rødovre			
Tårnby			
Major City Municipalities		Aarhus	
		Aalborg	
		Odense	
Provincial Municipalities	Socioeconomic advantage	Herning	
		Hillerød	
		Holstebro	
		Horsens	

		Kolding
		Roskilde
		Silkeborg
		Vejle
		Viborg
	Socioeconomic disadvantage	Esbjerg
		Fredericia
		Helsingør
		Køge
		Næstved
		Randers
		Slagelse
Contryside Municipalities	Socioeconomic advantage	Favrskov
		Frederikssund
		Gribskov
		Hedensted
		Ikast-Brande
		Lejre
		Middelfart
		Odder
		Rebild
		Skanderborg
		Stevns
		Syddjurs
	Socioeconomic disadvantage	Assens
		Faxe
		Fredensborg
		Faaborg-Midtfyn
		Halsnæs
		Holbæk
		Kerteminde
		Nordfyns
		Nyborg
		Ringsted
		Sorø
		Vejen

Rural Municipalities

Socioeconomic
advantage

Billund
Brønderslev
Fanø
Jammerbugt
Mariagerfjord
Ringkøbing-Skjern
Svendborg
Varde Kommune

Socioeconomic
disadvantage

Bornholms
Frederikshavn
Guldborgsund
Haderslev
Hjørring
Kalundborg
Langeland
Lemvig
Lolland
Læsø
Morsø
Norddjurs
Odsherred
Samsø
Skive
Struer
Sønderborg
Thisted
Tønder
Vesthimmerland
Vordingborg
Ærø
Aabenraa

Appendix B: Interview invitation



Kære xxxx

Vi skriver til dig, fordi du i efteråret 2020 besvarede et spørgeskema fra Syddansk Universitet vedrørende dine bevægelsesvaner i undersøgelsen Danmark i Bevægelse. Mange tak for din besvarelse, der indgår i analyserne af danskernes bevægelsesvaner, som du kan læse mere om her: https://www.sdu.dk/da/forskning/danmark_i_bevægelse

Sidst i spørgeskemaet satte du kryds ved, at vi gerne må kontakte dig til et uddybende interview om din fysiske aktivitet i fritiden. Det er derfor vi skriver til dig nu, fordi vi håber, at du har lyst til at stille op til et interview derom.

Interviewet og den efterfølgende analyse deraf gennemføres af Birgitte Westerskov Dalgas, der er Ph.d.-studerende på Syddansk Universitet. Interviewet vil handle om, hvordan det liv, du har levet, har påvirket dine bevægelsesvaner og din motivation for fysisk bevægelse. Interviewet forventes at vare 2-3 timer. Interviewet vil selvfølgelig være anonymt og dit navn vil derfor ikke fremstå nogen steder. Vi håber, at interviewet kan gennemføres i perioden [datoer], hvor Birgitte kommer til [by].

Hvis du har lyst til at deltage i interviewet, beder vi dig besvare denne mail samt gerne angive, hvornår det passer dig bedst at blive interviewet.



Med venlig hilsen

Birgitte Westerskov Dalgas, Ph.d.-studerende
Thomas Viskum Gjelstrup Bredahl, Lektor
Karsten Elmose Østerlund, Lektor
Bjarne Ibsen, Professor

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Appendix C: Participant Bios

Alberte is a 27-year-old civil engineer who lives in The Capital. She is engaged in an average frequency of physical activity, mainly through her passion for CrossFit. While she juggles her career demands, her commitment to fitness remains steady. Alberte is currently in a relationship and has no children.

Anders, who is 28 years old, lives in a countryside area noted for its socioeconomic advantages. His physical activity frequency level is characterised as low, however, he plays football and does practical work around his house. He is in a relationship and has one child.

Andreas is a 16-year-old gymnasium student residing on the outskirts of a major city with his parents. He has an average frequency of physical activity. He used to play football but shifted his focus to training for a half-marathon, which he completed successfully. However, the completion of this goal has left him unsure about his future physical activity plans.

Anette is 72 years old and lives near a major city. She has a high frequency of physical activity and is deeply involved in local senior sports. She also has a long history of scouting and enjoys spending time with her grandchildren.

Bjarne is a 60-year-old experienced teacher residing in a capital municipality that has socioeconomic disadvantages. He maintains a high frequency of physical activity, underlined by his daily cycling commute to work and his involvement in organising children's sports events. Bjarne is an enduring figure in his community, both physically and socially engaged.

Camilla, a 17-year-old gymnasium student, recently moved to her own apartment in a countryside municipality with socioeconomic disadvantages. She has a high frequency of physical activity, participating in handball and fitness, and also works as a jump instructor. Despite her busy schedule, Camilla makes sure her apartment is functional, focusing on cleanliness and quick meal preparation.

Charlotte is 52 years old and lives in a capital municipality with socioeconomic advantages. She has an average frequency of physical activity, involving herself in various sports like rowing, gymnastics, and running. However, sustaining her motivation for these activities has proven challenging over time.

Dagmar is a 75-year-old retired gymnasium teacher who resides in a rural municipality with socioeconomic advantages. She has an average frequency of physical activity. Since her retirement, she has dedicated herself to voluntary work and environmental conservation, frequently choosing to cycle as a means of transportation.

Elvira, 75, is a retired teacher living in a provincial municipality with socioeconomic advantages. She has an average frequency of physical activity. Her early love for sports led her to competitive athletics, but she now has to balance this passion with the responsibility of taking care of her ill husband.

Emil is 21 years old and lives in a countryside municipality with socioeconomic disadvantages. He has an average frequency of physical activity. Currently taking a gap year after gymnasium, he recently engaged in gym workouts. However, his true passion is boxing, which he had to pause because of a nose operation.

Erik is a 65-year-old retired military officer who lives on a farm in a countryside municipality with socioeconomic advantages. He has an average frequency of physical activity. Although he is now less active in sports due to commitments at his farm, his past is filled with a variety of physical activities including skiing, hiking, swimming, volleyball, and cycling.

Flemming is 51 years old and resides in a rural municipality with socioeconomic disadvantages. His physical activity level is low, focusing mainly on birdwatching. He often ventures into nature, walking and cycling to observe and document different bird species.

Frederik, 28, is currently posted abroad, but usually, he lives in The Capital and maintains a high frequency of physical activity. He works as an analyst at an Embassy, using his background in anthropology and sociology. Frederik is not primarily driven by career ambitions but focuses more on personal growth and continuous learning. He is engaged in a variety of physical activities, including football, badminton, climbing, and surfing.

Hanne is 75 years old and works as a consultant. She has a low frequency of physical activity. A career-driven doctor, she has lived in several countries and is a highly independent individual. She has raised her children alone after her now ex-husband refused to share household responsibilities. Although once a tennis player, she is now part of a running group and is learning crawl swimming.

Ingemarie, 71, resides on the outskirts of The Capital with her husband. She has a high frequency of physical activity. A retired physiotherapist, she has various interests including art and drawing. Ingemarie loves the summer season for its beach trips and long bike rides, while winters are reserved for museum visits.

Jens is a 58-year-old IT specialist living in a provincial municipality with socioeconomic disadvantages. He has a low frequency of physical activity. Jens had a career shift from law enforcement to the IT sector, particularly after his son was diagnosed with severe illness. Looking forward to his retirement, Jens plans to travel and engage in activities that were postponed due to the pandemic.

Julie is 28 years old and lives in a capital municipality with socioeconomic disadvantages. She has a low frequency of physical activity, mainly due to her current pregnancy. She is on maternity leave and is a soon-to-be mother of her second child. Julie finds her motivation for physical activities in various aspects such as the need for fresh air and specific fitness goals.

Karen, 64, lives in a countryside municipality with socioeconomic disadvantages and maintains an average frequency of physical activity. A veterinarian with nearly four decades of experience, she became increasingly health-conscious following her daughter's birth and a back surgery. Today, she is actively engaged in cycling and strength training.

Kasper is 34 years old and resides in The Capital. He has an average frequency of physical activity. Deeply committed to his work, he also maintains a strong physical training regimen, focusing on strength training. Kasper also enjoys padel and running.

Kristine, 31, lives with her husband and child in The Capital. She has a low frequency of physical activity, primarily due to her current maternity leave. Although her active lifestyle has been temporarily paused, she plans to re-engage with her physical pursuits in the future.

Lars is a 51-year-old blacksmith living with his teenage daughter in a rural municipality with socioeconomic disadvantages. He has a high frequency of physical activity. A long-time enthusiast of football and handball, he recently stepped down as a handball coach due to a new relationship but continues to enjoy nature runs.

Laura, 17, lives in a socioeconomically disadvantaged countryside municipality with a low frequency of physical activity. A gymnasium student, she engages in various physical activities including Les Mills group training, strength training, and running. Despite challenges, including relegation in teams, she finds motivation in training and competing.

Lene, a 66-year-old retired teacher with a low frequency of physical activity, lives in a socioeconomically advantaged capital municipality. She has adopted daily walks around a local lake and has been part of a gymnastics group for the last three years, citing social interaction as a major motivator.

Linda, 60, lives in a socioeconomically disadvantaged rural municipality and maintains a high frequency of physical activity. Divorced and living alone, she is employed at a petrol station and remains an active individual participating in weekly dance activities and courses.

Lis, 79, resides in a socioeconomically advantaged rural municipality with an average frequency of physical activity. A retired teacher, she recently moved to an apartment but still tends to her family farm.

Lisbeth, a 69-year-old retiree with a low frequency of physical activity, resides in a socioeconomically disadvantaged capital municipality. Active in volunteering, she enjoys walking and domestic chores, along with visits to zoos or amusement parks.

Louise, 26, lives in a socioeconomically disadvantaged rural municipality with a low frequency of physical activity. Employed as a pedagogue, she often opts for walks as her mode of commute and is passionate about scouting.

Maria, 41, resides in The Capital with her family and maintains a low frequency of physical activity. Originally from Southern Europe, she holds a full-time office job and has persistent concerns about her physical appearance.

Marie-Louise, 40, lives on a family farm in a socioeconomically advantaged rural municipality with a low frequency of physical activity. Deeply committed to her work, she integrates physical activities into her daily routine, such as walking during work hours.

Mathias, 24, resides in a major city and has an average frequency of physical activity. A medical student, he enjoys a diverse range of sports including running and disc golf, valuing both competitive and social elements.

Mathilde, 21, lives alone in a major city with a low frequency of physical activity. Currently studying English, she found personal growth through music and later re-engaged with physical fitness through strength training after experiencing school bullying.

Mette, 30, resides in a socioeconomically disadvantaged capital municipality with a high frequency of physical activity. A care assistant, she values the flexibility of her work as a substitute and engages in various physical activities such as fitness classes and parent-child handball.

Mogens, 70, lives in a socioeconomically disadvantaged provincial municipality with a high frequency of physical activity. A retired chairman of an industry association, he sets personal goals in cycling and running, attributing high value to recognition and success.

Mona, 65, resides in a socioeconomically advantaged countryside municipality with a low frequency of physical activity. A personal assistant, she enjoys the extra time freed up by not commuting to work.

Niels, 68, lives in a socioeconomically advantaged provincial municipality with an average frequency of physical activity. A retired engineer, he transformed his lifestyle through exercise and medication adjustments following a cardiac event.

Ole, 72, resides in a socioeconomically advantaged rural municipality with a high frequency of physical activity. A retired teacher, he transitioned from team sports like football and handball to senior tennis due to injuries.

Per, 52, lives in a socioeconomically advantaged capital municipality with a low frequency of physical activity. Working in law, he struggles with work-life balance and values his summer house.

Poul, 79, resides in a socioeconomically advantaged capital municipality with an average frequency of physical activity. A retiree and ballet enthusiast, he also practices military-style exercises by the sea.

Svend, 69, lives in a socioeconomically advantaged countryside municipality with a low frequency of physical activity. A retired electrician, he finds joy in walking and spending quality time with his grandchildren.

Søren, 29, resides in a socioeconomically advantaged provincial municipality with a low frequency of physical activity. An adventurous pilot, his negative view of physical activity is shaped by past adverse experiences in physical education.

Tobias, 20, lives alone in a socioeconomically advantaged countryside municipality with a high frequency of physical activity. An environmental technology student, he refocused on his physical training after experiencing a motivational dip due to a cancelled marathon.

Trine, 61, resides in a socioeconomically advantaged provincial municipality with a high frequency of physical activity. A paediatrician, she maintains her physical and mental health through movement therapy and aims to walk 10,000 steps a day during the summer.

Appendix D: Interview situation characteristics

Pseudo-nym	Gender	Age	Form	Location	People present	Length (Min)
Alberte	Female	27	Face-to-face	Participant's home	Birgitte; Alberte	118
Anders	Male	28	Face-to-face	Participant's work place	Birgitte; Anders	104
Andreas	Male	16	Face-to-face	Meeting room at SDU	Birgitte; Andreas	112
Anette	Female	72	Face-to-face	Participant's home	Birgitte; Anette	162
Bjarne	Male	60	Face-to-face	Participant's home	Birgitte; Bjarne; Spouse	167
Camilla	Female	17	Face-to-face	Participant's home	Birgitte; Camilla	145
Charlotte	Male	52	Face-to-face	Participant's home	Birgitte; Charlotte	162
Dagmar	Female	75	Face-to-face	Participant's home	Birgitte; Dagmar; Spouse	132
Elvira	Female	75	Face-to-face	Participant's home	Birgitte; Elvira	140
Emil	Male	21	Face-to-face	Participant's home	Birgitte; Emil	89
Erik	Male	65	Face-to-face	Participant's home	Birgitte; Erik	138
Flemming	Male	51	Face-to-face	Participant's home	Birgitte; Flemming	99
Frederik	Male	28	Online	-	Birgitte; Frederik	138
Hanne	Female	75	Face-to-face	Participant's home	Birgitte; Hanne	90

Ingemarie	Female	71	Face-to-face	Participant's home	Birgitte; Ingemarie	142
Jens	Male	58	Face-to-face	Participant's home	Birgitte; Jens	124
Julie	Female	28	Online	-	Birgitte; Julie	81
Karen	Female	64	Online	-	Birgitte; Karen	144
Kasper	Male	34	Face-to-face	Participant's work place	Birgitte; Kasper	168
Kristine	Female	31	Face-to-face	Participant's home	Birgitte; Kristine	88
Lars	Male	51	Face-to-face	Participant's home	Birgitte; Lars	109
Laura	Female	17	Face-to-face	Participant's home	Birgitte; Laura	77
Lene	Female	66	Face-to-face	Participant's home	Birgitte; Lene	162
Linda	Female	60	Face-to-face	Participant's home	Birgitte; Linda	112
Lis	Female	79	Face-to-face	Participant's home	Birgitte; Lis	162
Lisbeth	Female	69	Face-to-face	Participant's home	Birgitte; Lisbeth	94
Louise	Female	26	Face-to-face	Participant's home	Birgitte; Louise	155
Maria	Female	41	Face-to-face	Public park	Birgitte; Maria; the passer-by	95
Marie-Louise	Female	40	Face-to-face	Participant's home	Birgitte; Marie-Louise	170
Mathias	Male	24	Face-to-face	Participant's home	Birgitte; Tobias	108

Mathilde	Female	21	Face-to-face	Participant's home	Birgitte; Mathilde	114
Mette	Female	30	Face-to-face	Participant's home	Birgitte; Mette	106
Mogens	Male	70	Face-to-face	Participant's home	Birgitte; Mogens	151
Mona	Female	65	Face-to-face	Participant's home	Birgitte; Mona	142
Niels	Male	68	Face-to-face	Participant's home	Birgitte; Niels	11
Ole	Male	72	Face-to-face	Participant's home	Birgitte; Ole	142
Per	Male	52	Face-to-face	Participant's home	Birgitte; Per	149
Poul	Male	79	Face-to-face	Participant's home	Birgitte; Poul	178
Svend	Male	69	Face-to-face	Participant's home	Birgitte; Svend	122
Søren	Male	29	Face-to-face	Library	Birgitte; Søren; the passer-by	132
Tobias	Male	20	Online	-	Birgitte; Tobias	82
Trine	Female	61	Face-to-face	Participant's home	Birgitte; Trine	137

Appendix E: Life Story Activity - Timeline.

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Appendix F: Interviewguide

Theme	Content / Question
Presentation of researcher	Birgitte Westerskov Dalgas, PhD student
Presentation of project	<p>Moving Denmark</p> <p>The project aims to gain new insights into adults' movement habits, as well as the influences of motivation, motives/barriers and opportunities on various forms of movement.</p> <p>You have already contributed significantly to the study with your participation in the survey. Then you have been so kind to agree to participate in this follow-up interview as well. Thank you.</p>
Presentation of the content of the interview	<p>Today, I will ask you to tell me your life story, and we will talk about your physical activity habits and motivation within life transitions and lifestyle contexts.</p> <p>There are no right or wrong answers. I am interested in your life and your experiences.</p>
Time frame	The interview will last approximately [?] hours.
Audio recording	I would like to audio record the interview on two Dictaphones. The recordings are only used internally for the purposes of the analysis. Is that okay with you?
Anonymization	Your statements will be de-identified so that people who are not very familiar with you and your life story can't associate them with you.
Volition	It is voluntary for you to participate, and you can withdraw your consent.
Questions	Do you have any questions or comments about the research project or interview?
Consent	Before we begin the interview, I would like to ask: Do you consent to participate in the interview? AND: May I have your consent to use the information and statements you give me in this interview in the papers I will write?
Demography	<p>Will you start out by telling me a bit about yourself?</p> <p>Name, Age, Education, Employment, Family</p>
Chapters of life	<p>Now, we will start focusing on your life story.</p> <p>All people's lives can be written down in a book. I would like you to think about your life as if we were writing a book about it. First, I want to ask you to think about the different chapters in your book. I have a piece of paper here that can help you out. The first column contains the years of your life - from zero, the day you were born, until today.</p> <p>If you start from the day you were born, when does the first chapter end? Put a line there and name the chapter.</p> <p>Then you move on to the next chapters of your life and mark where they start and end, and name the chapter until you reach your current age.</p> <p>You are free to use the number of chapters that suits your life.</p> <p>Now, we will take a closer look at each of your chapters. The focus will be on:</p> <p>How you moved</p>

Theme	Content / Question
Behavior questions	How you were motivated
	The impact of the social context in which you lived.
	How did you do in this chapter of your life?
	Did you do any physical activity during this chapter of your life?
	Why did you [activity]?
	Was it normal to [activity] where you lived?
	How did it influence your motivation to [activity]?
	Who introduced [activity] for you?
	Tell me about how it happened?
	Whose choice was it, that you [activity]?
	How did it influence your motivation to [activity]?
	Do you think that, doing [the activity] reflected what YOU wanted and who YOU where?
	How?
	What did your family and friends think about your engagement in?
	How did it influence your motivation to [activity]?
Did you feel skilled at [activity]?	
How did it influence your motivation to [activity]?	
Do you recall any specific episodes or memories from [activity] during this period? Tell me about it.	
Why did you stop?	
Comments to add	Do you have any comments to add?
Thanks	Thank you for your story, and answers on my questions.
And now...	<p>What will happen now is that the audio recording will be transcribed and then the interview will subsequently be analyzed. The analysis will result in articles which hopefully will be published in international scientific journals.</p> <p>Otherwise, feel free to contact us later if you have questions, comments, or concerns.</p>

10 Papers

Paper 1 (Under review at Journal of Health Psychology)

Dalgas, B. W., Hamilton, K., Elmoose-Østerlund, K., & Bredahl, T. V. G. (2023) The Influence of Life Transitions on Physical Activity Beliefs and Behaviour. Manuscript submitted for publication.

Paper 2 (Accepted)

Dalgas, B. W., Elmoose-Østerlund, K., & Bredahl, T. V. G. (2024) Exploring Basic Psychological Needs Within and Across Domains of Physical Activity. *Journal of Qualitative Studies on Health and Well-being*. <https://doi.org/10.1080/17482631.2024.2308994>

Paper 3 (Under review at Motivation Sciences)

Dalgas, B. W., Ntoumanis, N., Elmoose-Østerlund, K., & Bredahl, T. V. G. (2023) Exploring the Process of Restoring Psychological Needs After Incidences of Frustration and Need Unfulfillment. Manuscript submitted for publication.

10.01 Paper 1

Dalgas, B. W., Hamilton, K., Elmoose-Østerlund, K., & Bredahl, T. V. G. (2023) The Influence of Life Transitions on Physical Activity Beliefs and Behaviour. Manuscript submitted for publication.

Paper 1

The Influence of Life Transitions on Physical Activity Beliefs and Behaviour

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Abstract

Using a qualitative design, we explored how life transitions influence people's physical activity beliefs and behaviour using the Theory of Planned Behaviour. Life story interviews with 42 participants revealed six salient life transition periods which affected physical activity behaviour, either in a disruptive way resulting in decreased activity levels or in a facilitative manner, providing opportunities for increased activity engagement. The identified life transition periods uniquely influenced individuals' attitudes, subjective norms, and perceived behavioural control beliefs, thus affecting motivations toward physical activity. Specifically, starting school or a career, forming a romantic relationship, and having a child primarily shaped subjective norm and perceived behavioural control, while leaving home was especially influential on perceived behavioural control and retirement on attitudes and perceived behavioural control. Consistent themes across the transition periods included time constraints and opportunities to be active, supportive social contexts, access to facilities, and having a need to be active.

Keywords: Physical activity behaviour; life transitions; Theory of Planned Behaviour, behaviour change; life course; interview study.

Introduction

The benefits of regular physical activity (PA) are well-established, encompassing physical health improvements like reduced mortality risk and chronic disease prevention, as well as psychological and social gains such as enhanced self-esteem and more satisfying social interactions (Eime et al., 2013; Lee et al., 2012; Reiner et al., 2013; Warburton and Bredin, 2017). Despite these benefits, there remains a significant global prevalence of physical inactivity, with 27.5% of adults aged over 18 years old being inactive in 2016 (Guthold et al., 2018) and worryingly further rises in inactivity rates post COVID (Tison et al., 2020). One avenue to better understand the issues surrounding people's PA behaviour is to explore the beliefs driving the behaviour using psychological theories of behaviour change (Hagger et al., 2020). A prototypical theory that has been well used to understand the influences on PA behaviour at an individual level is the Theory of Planned Behaviour (TPB) (Ajzen, 1991; Fishbein and Ajzen, 1975; Hagger et al., 2002).

According to TPB, one's intention to engage in a behaviour is the most proximal predictor of health-related behaviour. Intention encapsulates the motivational factors influencing a behaviour and signifies the readiness or determination to enact a behaviour. An individual's likelihood of engaging in a specific behaviour increases in proportion to the strength of their intention to do so (Ajzen, 1991). According to the theory, individuals' intention to perform the behaviour is mediated through three kinds of belief-based constructs of behaviour, attitude, subjective norm, and perceived behavioural control (Ajzen, 1991; Fishbein and Ajzen, 1975). When individuals have positive attitudes toward a behaviour, believe that others expect them to engage in that behaviour, and perceive they have control over their actions, their intention to perform the behaviour is strong and, thus, a greater likelihood of behavioural performance (Ajzen, 1991; Fishbein and Ajzen, 1975; Hamilton, 2010).

The attitude construct refers to an individual's evaluative assessments concerning the behaviour, whether positive or negative. An individual's attitude is shaped by beliefs about the expected outcomes and the evaluations of these outcomes. If the expected outcomes align with personal values and are perceived positively, a favourable attitude emerges. The subjective norm construct refers to the perceived societal pressures or normative beliefs an individual has concerning the behaviour. If an individual perceives that important individuals or groups of people in their life endorse or expect them to perform the behaviour, they will be more likely to align with those expectations. The perceived behavioural control construct refers to the extent to which people believe that they have the ability and resources to engage in the behaviour, considering

possible barriers or facilitators. If these control beliefs are conducive to behavioural performance, then action is more likely (Ajzen, 1991).

The TPB also emphasises the role of background factors. Background factors are considered indirect influences on intentions and behaviour through their influence on attitudes, subjective norms, and perceived behavioural control (Ajzen, 2020; Hagger & Hamilton, 2021). These include, for example, personality traits (intrinsic patterns of thought, emotion, and action), socio-structural variables (e.g., age, gender, race, socio-economic status, and education), past behaviour (historical behaviours that become predictors of current and future behaviours), information and knowledge (depth and breadth of one's understanding of a specific behaviour), and other individual differences (e.g., personal values, unique life experiences, and cultural and political beliefs) (Ajzen, 2020). However, applications of the TPB often neglect the importance of background factors and thereby give limited attention to research showing that engagement in health behaviours varies across populations, contexts, and environments (Hagger and Hamilton, 2021). In a recent study, Hagger and Hamilton (2021) demonstrated socio-structural variables to exert both direct and mediated effects on behavioural intentions and behaviour; the socio-structural variables influenced behaviour through their influence on the components of the TPB, particularly perceived behavioural control. These effects of background factors on intentions and behaviour highlight the importance of understanding the influence of global constructs such as attitudes, subjective norms, and perceived behavioural control alongside socio-structural factors when designing interventions aiming to support PA behaviour.

While the influence of these factors on individuals' behaviour is important, it is equally relevant to understand the influence of these variables on people's behaviour within critical life transition periods. Research has highlighted that the stability of PA behaviour over the life course is low, with fluctuations evident during different life transitions (Engberg et al., 2012; Gropper et al., 2020). Life transitions, such as beginning school (Garcia et al., 1998; Gyurcsik et al., 2006; Horn et al. 2008; Raymore et al., 2001), getting married (Allender et al. 2008; Engberg et al., 2012; Gropper et al., 2020; King et al., 1998), becoming a parent (Allender et al. 2008; Corder et al., 2020; Engberg et al., 2012; Gropper et al., 2020; McIntyre and Rhodes, 2009), and entering retirement (Allender et al., 2008; Barnett et al., 2012; Gropper et al., 2020) have been suggested as important periods in people's lives where substantial change may occur, including changes on PA behaviour. While these studies suggest life transitions and associated changes influence PA, a rich understanding of the underlying psychological mechanisms and processes behind these behaviour changes is sparse (Corder, 2009; Gropper et al., 2020). Theoretically, life transition periods can be speculated to influence the more

distal background factors posited in the TPB, which, in turn, may affect people's attitudes, subjective norms, and perceived behavioural control. For instance, starting school or a job can expose individuals to new social groups, which might influence their subjective norms (i.e., their perceptions of what others think they should do) in relation to their behaviour; in this context, their PA.

Understanding the beliefs individuals hold toward PA performance during salient life transition periods may assist interventionalists and healthcare professionals to develop effective programs addressing life transition challenges and promoting sustained PA (Gropper et al., 2020). Effective interventions require identifying both modifiable factors, like attitudes toward PA, and unmodifiable factors, such as life transition, to understand their behavioural impact, with the latter providing reference to key target groups to target (Hagger et al., 2020).

The Current Study

Applying the TPB as the theoretical framework, this study *aims* to explore how life transitions, as an expression of changes in background factors, influence the PA beliefs and behaviour of Danish adults. Specifically, the focus is on how salient life transition periods influence people's attitudes, subjective norms, and perceived behavioural control, and subsequently, how these beliefs influence their PA behaviour. From this knowledge, we hope to gain rich understandings of changes in PA behaviour during life transitions and offer actionable insights for developing contextually relevant and effective interventions. To achieve this aim, in-depth life story interviews using a codebook thematic analysis, known as framework analysis (Braun and Clarke, 2021b; Ritchie and Spencer, 1994), was used to understand the relationship between life transitions, social cognitions, and PA behaviour. Through this approach, we anticipated identifying patterns in the data that highlight underlying psychological mechanisms and processes by which life transitions influence PA behaviour.

Methods

Design and participants

To explore how life transitions might influence people's PA beliefs and behaviour, this study adopted a qualitative research design. This approach offers an opportunity to gain nuanced understandings through the subjective experiences of individuals undergoing life transitions and the ways in which these experiences influence PA (Kvale, 2007). The use of a semi-structured individual interview design also allows for a balance between structure and flexibility, maintaining a focus on the research aim while allowing

for exploration of the participants' experiences in a holistic manner (Kvale, 2007; Brinkmann and Kvale, 2014; Lieblich et al., 1998). Overall, we conducted 42 semi-structured individual interviews to gain insights from Danish adults on how their PA beliefs and behaviour were influenced by life transitions.

Participants for this interview study were selected from a subset of 48,488 individuals who, after completing a questionnaire on PA habits in the larger 'Moving Denmark' survey involving 163,136 Danish adults (15+ years), expressed interest in further participation. The interview persons were selected for the purpose of developing a range of insights into the influence of beliefs on PA participation within life transitions, using maximum variation sampling (Gray, 2004; Schreier, 2018) based on PA frequency level, gender, and age.

PA frequency level indexes were created for recreation, occupation, household, and transportation domains. Participants were split into quintiles and rated 1-5 based on their PA levels, where 1 is least and 5 is most active. These scores formed a comprehensive PA frequency index, categorising respondents into 'low' (bottom 20%), 'medium' (middle 60%), and 'high' (top 20%) participation groups. Participants were also segmented into three age groups - 15-29, 30-54, and 65+ years, reflecting key life stages in Denmark, from pre-parenthood to post-retirement. Combining these criteria (PA level, gender, and age), 18 sample groups were formed, including groups such as "Low activity, Male, aged 15-29" or "High activity, Female, aged 65 or older."

Participants were invited via email by the first author due to their participation in the Moving Denmark survey, for an in-depth interview about their PA beliefs and behaviours. The email explained the study's focus on understanding the relationship between their life experiences and PA, including their beliefs and motivations. The first author's role in conducting the interviews was highlighted, and participants were informed that interviews would last approx. 2-3 hours, with a guarantee of anonymity. Due to a low initial response, invitations were sent in batches of 5-10. Out of 436 invitations, 58 agreed to participate. After conducting 42 interviews and achieving sufficient information power (Braun and Clarke, 2021a; Malterud et al., 2016), the interviewing process was concluded despite further interest, thereby prioritising the richness and relevance of the data within the constraints of resource efficiency. The final sample consisted of 42 participants; 19 male and 23 female. PA frequency levels were categorised as 16 low, 14 average, and 12 high. Age of participants included 15 aged 15-29 years, 13 aged 30-64 years, and 14 aged 65 years or older. For further details on participant demographics, see the supplementary material.

Ethical approval for conducting this study was granted by an Institutional Review Board prior to participant selection and recruitment. Verbal informed consent was obtained from all participants.

Data collection

Based on the research aim, we developed a semi-structured interview guide. Broad questions regarding participant background details and current life situations opened the interview. Participants were then asked to map their transitions through life using a procedure suggested by Lieblich et al. (1998), where participants are asked to think about their life as a book with chapters and to title each chapter. Questions focussing on PA behaviour; reasons for PA behaviour; and motives, barriers and experiences with PA were then asked within each life chapter. The interview guide was pilot tested prior to conducting the interviews to ensure question clarity and understanding (see supplementary material for the full interview guide).

In 2021, the interviews were conducted by the first author, a female PhD student with a Master's degree and formal training in interview techniques. With experience from previous qualitative studies as a research assistant, she approached the interviews with an open mind, focused on minimizing bias and authentically capturing participants' experiences without preconceived influence. The average interview length was 130 minutes. Most of the interviews were conducted face-to-face ($n = 38$), with four participants, due to convenience or COVID-19 related issues, requesting an online interview using a video platform. Most of the face-to-face interviews were conducted in the participants' home ($n=35$). In most interviews, only the interviewer and the participant were present ($n=38$). However, two interviews took place in public locations at the request of the participants. In another two interviews, participants' spouses stayed in the same room.

The audio-recorded interviews were transcribed orthographically, and identifying information was removed from the transcript and pseudonyms were assigned before being uploaded to NVivo (Jackson and Bazeley, 2019). Post-interview field notes were also compiled and uploaded to NVivo. These notes were not only descriptive but also analytical and interpretative in nature, allowing room for researcher reflexivity.

Data Analysis

We applied the codebook thematic analysis method, known as the framework method (Braun and Clarke, 2020, 2021b; Ritchie and Spencer, 1994), for analysing the interview data due to its systematic approach to organising qualitative data. While this method allows for themes to be established early, it also accommodates refinements and the

generation of new themes inductively throughout the analysis process (Braun and Clarke, 2020, 2021b; Gale et. al., 2013; Ritchie and Spencer, 1994). This allowed us to explore and understand the individual perspectives of the participants without losing a holistic view of the large amount of data.

The framework analysis involves five phases: Familiarisation, development of the framework, indexing, charting, and interpretation (Gale et. al., 2013; Ritchie and Spencer, 1994; Parkinson et. al., 2016). In the familiarisation phase of our study, the first author listened to interviews and read transcripts to form initial impressions and identify preliminary patterns in participants' narratives. This laid the groundwork for developing a coding framework focused on three major themes: life transitions, beliefs, and PA behaviour. Life transitions were defined as periods in a person's life where significant lifestyle changes occurred, and data were analysed within these periods. Beliefs were analysed according to the TPB framework and included attitudes (associations of PA with desirable or undesirable outcomes), subjective norms (perceived societal pressures about PA), and perceived behavioural control (perceived ease or difficulty of engaging in PA). The data were further analysed according to PA profiles; increased PA, sustained PA, and decreased PA. During indexing, the first author applied this framework to the dataset using NVivo, segmenting and labelling the data. While 'life transitions' was a predetermined broad theme, specific sub-themes like beginning school and retiring were generated inductively. In the charting phase, a matrix in NVivo facilitated cross-comparison, with rows for life transitions and columns for subcodes and PA outcomes. Finally, in the interpretation phase, we analysed patterns across these intersections, exploring how specific transitions like 'beginning school' influenced beliefs and PA behaviours. This comprehensive analysis aided us in refining initial themes, enhancing our understanding of the interplay between life transitions, beliefs, and PA behaviour.

Results

We identified six significant life transitions leading to shifts in roles, social environment, built environment, and/or daily routines in participants' life stories: beginning school, leaving home, starting a career, forming romantic relationships, having a child, and retiring. These life transitions influenced participants' attitudes, subjective norms, and perceived behavioural control towards PA as well as their PA behaviour. The result section aims to highlight both the prevalent patterns and unusual occurrences in relation to how each life transition influenced PA beliefs and behaviour.

Beginning school

Beginning school marked a significant transition in the lives of participants as they were introduced to a more structured learning environment and new social groups. Their new role as early students had important impacts on their beliefs and behaviours toward PA.

The first change was in the occupation domain. Free play in kindergarten was substituted with more sedentary learning time during the school day, influencing their subjective norms and perceived behavioural control. For example, Mogens recalled, "Suddenly, one had to sit still. There was no more climbing up and down walls and the like. It was just 'Ordnung Muss Sein' [German for 'Order must prevail']." As Mogens' quotation indicates, the transition to school, was a transition into an environment where the societal expectation was to "sit still", implying a shift in subjective norms, with the understanding that the 'accepted' behaviour in a school setting is predominantly sedentary and a felt pressure to comply. Simultaneously, the shift from free play to structured sedentary learning time led the participants to perceive opportunities to be physical active as less accessible during their school hours, therefore influencing their perceived behavioural control over being physically active.

As the participants transitioned into school, they were also introduced to a more structured PA environment through physical education classes. Physical education shaped participants' attitudes and perceived behavioural control over PA, manifesting in different ways based on their individual experiences and competencies. For some, physical education offered a showroom for different kinds of sports, helping them discover activities they were good at and enjoyed. Lis, for instance, said,

In school, we had physical education. I wasn't good at throwing, so ball games weren't for me. But then we had the high jump and long jump. I was good at that. I was good at jumping far and running fast. Jumping high. I thought it was fun. When you're good at something, you tend to like it. And then I discovered that there was an athletics club in the neighbouring municipality, and I started there.

In this case, the school environment positively introduced her to various physical activities and sports. Her experiences in physical education led to the discovery of her skills in high jump, long jump, and running, fostering enjoyment in athletics, and enhancing a positive attitude towards it. This discovery also likely boosted her confidence in her athletic abilities, positively influencing her perceived behavioural control. Not everyone, however, experienced the school environment as having a positive role in

introducing them to different types of PA and sports, which influenced their attitudes and perceived behavioural control towards PA negatively. Søren, for example, noticed,

I have always been chubby. In fact, my BMI says that I am overweight. It has probably also left its mark in elementary school and physical education. I was not as agile as some of the others. I was never the first one chosen when teams were picked, and that leaves its mark. It has probably affected my desire to engage in sports and exercise up until today. It probably still does.

Søren's experiences of being less agile than his peers, and consistently being one of the last chosen for teams, led to negative feelings towards physical education specifically, and PA in general. His statement reflects a lasting negative attitude fostered by his early experiences. Moreover, being overweight and less agile than his peers led him to believe that PA was more difficult for him, influencing his perceived behavioural control in a negative direction.

The transition to school also introduced the participants to new opportunities for organised sports after school hours within the recreation domain. Many participants reported increased opportunities for and participation in organised sports during leisure; the increased local availability of and participation in organised sports during leisure time were common themes, shaping their perceptions of both subjective norms and perceived behavioural control. Mona, for example, reported high availability of organised sports during her early school years. She recalled, "Every village on Funen had a girls' football team. There were barely five kilometres between all the small towns there. There were soccer clubs everywhere. I mean, [town] was really a good soccer town. Everyone practised it." Mona's statement illustrates a profound influence on her subjective norms. The availability of football clubs in every village signalled to her that participation in sports, particularly soccer, was expected and accepted within her community. Simultaneously, the accessibility of these clubs influenced Mona's perceived behavioural control. The proximity of clubs provided her with a sense of ease in her ability to engage in football.

Leaving home

The life transition of leaving home marked a salient shift in the lives of the participants. Moving from being primarily dependent on their family to be more independent, this transition is characterised by both increased responsibility and autonomy. The participants described how they undertook more work in the household domain, used more active transportation, and adapted to new social environments. In terms of changes in PA behaviour, the participants predominantly reported that they decreased their participation in PA during leisure time, while they increased active transportation and PA

at home. We found that changes in their perceived behavioural control played a significant role on their PA behaviour in this transition phase.

One change was that the participants now had the full responsibility of managing their household, meaning increased domestic chores such as grocery shopping, cooking, cleaning, and washing clothes. For most participants, managing daily tasks independently increased their sense of control and thus influenced their perceived behavioural control. Mette, for instance, said,

I thought it was fantastic to manage my own life. I really liked living alone. Having to deal with various practical things by myself. Shopping for groceries, making sure to wash my clothes, and keeping track of whether I had enough money for food for the entire month. I was probably more physically active then.

Mette's positive attitude towards managing household tasks independently reflects a general trend among the participants. They found more enjoyment in doing household tasks during the transition of leaving home compared to other life transitions. This increased enjoyment could be attributed to the shift from relying on others to becoming more independent, which fostered a sense of accomplishment and positively influenced their attitudes towards these tasks and the resulting PA.

Moreover, leaving home often induced changes in the transportation domain. For most participants, leaving home meant moving to urban environments where they could use active transportation for daily commuting. Short distances to schools, workplaces, and amenities, combined with the lack of availability of a car, contributed to the significant use of active transportation among the participants during their leaving home life transition. For instance, Hanne transitioned from using a car to cycling after moving to the city, which made her PA a necessary part of her daily routine. She described it as,

I started my studies [...] a bit after the first part, I was allowed to move into a room in the city, and then I cycled. Until then, I drove a car, but when I moved into the city and had to take care of myself more, I cycled to the university and around the city.

Hanne's account suggests that her shift to a more urban environment significantly changed her perceived behavioural control over her mode of transportation. Cycling became not only a viable but also a necessary option for her.

Also, participants discussed the need to adapt to new social environments in the recreation domain when they left home. For those who previously had engaged in organised sports, leaving home often led to the discontinuation of their sports participation. For

example, Mona stopped practising soccer due to the perceived absence of opportunities and insufficient community inclusion when she moved to a big city. She recalled,

When I was 19, I moved to [town] to study. That was when I stopped playing soccer because I could not make it to practice on weekdays anymore. I really missed it terribly. It was like coming to a bigger city and just having to study... When I moved to [town] the following year, I tried to start again and find joy in it, but I couldn't. The city was just too big. There wasn't anyone who included me in the community, or maybe I gave up too quickly. I gave up. I couldn't find a club where I felt included. It was lost when I moved to the big cities.

Mona's move to a bigger city led to a perceived lack of opportunities and a sense of not being included in the community, influencing her perceived behavioural control and PA behaviour in a negative way. Mona's account also illustrates how the change in her new environment influenced her attitudes towards PA, with the sense of loss and exclusion leading to a negative attitude towards engaging in soccer in her new city. Participants who engaged in more individual activities, such as running or cycling, less saliently reported a negative influence. Thus, the influence of the life transition of leaving home on PA during recreation seems to be contingent upon the type of activity and associated social dynamics.

Starting a career

Starting a career marked another transition in the participants' lives. They faced new demands and responsibilities related to the occupation domain. The influence of this transition on their PA beliefs and behaviour varied. For the majority of participants, PA during leisure time decreased due to new work demands, while for others, it increased because they got new opportunities for being physically active within the workday or PA organised by their workplace. In this life transition, shifts in perceived behavioural control and subjective norms seemed salient, and thereby played a role in shaping their PA behaviour.

A significant change for participants starting a career was the new demands and responsibilities related to their job (the occupation), influencing their perceived behavioural control over their PA in the recreation domain. Jens, a police officer, had to cease his badminton activity due to the demands of his three-shift work schedule. He said,

When I was 25, I had to stop playing badminton because I worked on a three-shift schedule. It required much planning. Sometimes I would go straight from working the night shift and play on a team. Other times, I had to take a vacation day. I also had to cancel because I had to work overtime. It just didn't work, so I stopped when the season was over.

Jens' statement provides an example of how a demanding work schedule, as part of his police officer career, negatively influenced his perceived ability to maintain his badminton practice, and thereby his perceived behavioural control. Despite his positive attitude toward badminton, the constraints of his career posed significant challenges to his perceived behavioural control. Consequently, he stopped playing.

Furthermore, participants' subjective norms towards PA were also identified to influence their PA behaviour during this life transition. Participants who did not feel supported by their social environment were more likely to decrease their PA levels during this life transition. Marie-Louise, who worked full-time as an accountant, illustrates the influence of subjective norms and perceived behavioural control on PA levels. She said,

To work full-time as an accountant means 60 hours per week or more. When I started working, my PA decreased dramatically because I worked so many hours. I definitely don't want to wear a pedometer because it's not pretty. I rarely know any accountants who exercise on the side. It's a terrible profession in that regard.

Due to the demands of her work, Marie-Louise found it difficult to find time to be physically active, which influenced her perceived behavioural control over being physically active. Consequently, she experienced a significant reduction in her PA. The lack of value placed on PA within her occupation also contributed to her decreased practice of PA, since she lacked social support at her workplace for engaging in PA. Marie-Louise's story, therefore, demonstrates the ways in which work demands and norms can interact to influence PA beliefs and consequently behaviour.

Conversely, for some participants, a new career increased their PA levels. Anette, for example, started playing badminton when she discovered her new workplace offered company sports. She recalled,

Badminton came into the picture when I moved to [town] and got a job where there were company sports. Previously, I had only played backyard badminton, but I wanted to try it. We played once a week, and then we met with the other departments around the country for a tournament once a year. Friendship with my colleagues meant a lot to me. It was a good workplace.

For Anette and other participants who reported increased PA levels during this life transition, opportunities to be physically active during their working day or in activities organised by their workplace were identified as factors that eased the difficulties of being physically active after starting a career, thus their perceived behavioural control. Moreover, the presence of company sports can shift subjective norms positively, fostering a culture where PA is valued and encouraged. Anette's statement illustrates the

positive role the work environment can play in shaping employees' PA beliefs when placing PA on the agenda.

Forming a romantic relationship

Forming a romantic relationship was also identified as a life transition that caused significant changes for participants. Forming romantic relationships were often accompanied by a reorganisation of daily routines and a reassessment of priorities and focus. These changes seemed to primarily influence participants' subjective norms and perceived behavioural control, thereby changing their intention to be physically active. Participants described that in this transition they generally decreased their PA level; however, some of the participants stated that they sustained or increased their PA. We identified the most profound changes in the participants accounts of recreation PA. Lars, for example, decreased his participation in handball when he decided to restart an on-and-off romantic relationship. He said,

In April, I found a new girlfriend. We actually met each other in 2013, and we've tried a few times, but we haven't really been able to make it work. Now it's possible again because I've simply stopped playing handball. I wanted to continue, but handball took up many hours a week, and now I want something else. Now, I want to spend time with her.

The dynamics of Lars' romantic relationship resulted in a reassessment of his priorities and focus. As Lars (re-) entered into a romantic relationship, he felt obligated to dedicate more of his recreation time to his partner, reflecting a shift in his subjective norms. He believed that his new girlfriend would prefer him spending time with her rather than at his handball practice. The effect of this shift in subjective norms, in turn, influenced Lars' perceived behavioural control. With the added commitment to his romantic relationship, allocating the time required to maintain his handball practice became challenging, leading him to quit. Thus, the shift in his subjective norms, together with perceived behavioural control, shaped Lars' intention to discontinue with handball. Contrary, Maria increased her PA when she formed a romantic relationship with a partner who was more active than she was. She stated,

We found each other. He's more active than I am. In a way, he inspires me. It may not be the most romantic way, but more because I feel guilty: that I should also... But that motivation probably counts as well.

Maria's increase in PA was primarily due to changes in her subjective norms and perceived behavioural control. Her subjective norms were influenced by her partner, as she clearly thought he would approve of her being physically active. In addition, she said that her partner encouraged and supported her efforts to be more physically active, which eased her perceived behavioural control.

Having a child

Having a child had a salient influence on the participants PA behaviour. The arrival of a child tended to disrupt daily schedules and shift prior priorities. Participants discussed how they suddenly had to deal with irregular sleep patterns, feeding times, and childcare. Time once spent on personal activities, including recreational PA, where now dedicated to the care and nurturing of a child. None of the participants reported an increase in PA level after having a child. All reported a significant decrease in recreational PA, although some were able to maintain at least some level of PA. However, the participants reported increased PA in the household domain, doing more domestic chores and childcare-related activities. Marie-Louise, for instance, narrated,

My daily routine involves getting the children ready and taking care of the horses, mostly preparing myself for work at the computer [...] In the evenings, dinner is made and chores are done. On weekends, I take on more tasks, such as doing laundry [...] If you tracked my physical activity, you'd see I hardly sit still.

Marie-Louise's PA is highly influenced by her family obligations. Marie-Louise's account of her daily routine - facilitating her children's day, meal preparation, and laundry - represents her obligations and thus pressures linked to parenthood. These shifts in subjective norms, although parenthood-oriented, profoundly influenced her PA behaviours in relation to domestic work.

In general, participants reported that they struggled to balance recreation, work, home, and family responsibilities after having a child. They perceived that their new role left little or no time to focus on themselves and engage in recreational PA, which significantly influenced their recreation PA perceived behavioural control. For example, Maria, who practised fitness before having a child, noted:

We rented a shared apartment and established ourselves and just enjoyed this period where you... what do you call it... Two incomes and no kids [...] It was nice. Freedom and money [...] It's the period in my life when I've been strongest. I was really strong [...] It stopped when I had a child [...] Priorities and everyday life was suddenly completely different, where someone else is in charge and there is a great responsibility. I never really got going again.

However, a significant part of the transitions' influence on PA behaviour can also be attributed to changes in subjective norms. The participants reported feeling pressure from societal expectations to prioritise tasks in the household domain, that is taking care of the needs of their child over their own PA, and many felt guilty for taking time away from their child to engage in recreation PA. This was particularly prominent among the female participants. For instance, Marie-Louise noted:

You have to make sure not to lose yourself, but there are probably many people who think that's what you should do. I am more than just a mother. I know that some people need to say that it's the only label they need. It's not the only label I need. I am many things. Mother is one of them. I am proud of that. I am also proud that I am an accountant. I am proud to be a rider. I am proud that I am a nature person. I am Marie-Louise, and being a mother is one of my facets. It can quickly become the only facet you have, and people can have a hard time understanding why you don't want it as your only facet.

Marie-Louise found her way back to horse riding after she had her second child. It is notable that it was possible for some participants to find a way to pursue their interests even with competing demands on their time. Marie-Louise said,

I actually started riding again when Julia was 8 years old and Ida was 1 year old. But I do it in combination with one of the days I work late and still don't come home for dinner. So I go out and ride at 9 pm at night. My children are asleep anyway, so it doesn't take time away from them. It only takes time away from my husband, and when he knows how happy I get when I've been with the horse, it's actually better that I come home late.

Marie-Louise's positive attitude towards horse riding motivated her to find a way of fitting it into her schedule, and with that, easing her perceived behavioural control, which allowed her to increase her engagement in horse riding despite being a mother.

Retiring

The retired participants noted that their lives changed significantly as they transitioned into retirement. After leaving their job, participants discussed having more time and energy in the recreation and household domains as well as fewer responsibilities in the occupation and transport domain. However, age-related health challenges also emerged. These changes mainly influenced their attitudes towards and perceived behavioural control over PA. All participants increased their recreational PA levels after retirement. More time and energy and fewer responsibilities allowed the participants to engage in physical activities more easily; thus, they primarily influenced their recreational-related perceived behavioural control. For example, Anette said,

I stopped working when I was 65 years old. That was my retirement age. That was probably when I started practising more sports because there was more time for them. Tennis, for example, was something that came in when I retired. I had not played before, but I wanted to learn it. I also did some yoga. We became a part of our senior sports club here in town. I go on long walks. So my movement pattern definitely changed as I retired.

Anette's mention of becoming a member of a senior club illustrates another important change when becoming a retiree that many of the retired participants mentioned;

recreation opportunities. These participants perceived many local opportunities available to enable having a physically active senior life. Thus, these changes primarily influenced their perceived behavioural control.

Alongside changes in perceived behavioural control, the transition to retirement also induced shifts in attitudes towards household and recreation PA. Annette's stated,

We think a lot about how important it is to move because we see how hard it is for people who do not do it to stand up from sitting down, or stand on a staircase, if windows need to be cleaned or something. We are very aware that we still want to be able to do it, also when we get older. Those thoughts came with our retirement.

Annette's statement suggests she developed an understanding of the negative consequences of physical inactivity (e.g., difficulty in moving) and the benefits of PA (e.g., maintaining physical functionality), enhancing her evaluation of the outcomes of being physically active. This shift in beliefs and evaluations signified a change in attitudes, making her more favourably disposed towards PA.

Discussion

Through the lens of TPB, the present study explored how life transitions influence PA beliefs and behaviour among Danish adults. The present study contributes to the current literature by providing a rich understanding of how background factors, in this context life transitions, might influence PA. Findings provided an insight into how life transitions, including beginning school, leaving home, starting a career, forming romantic relationships, having a child, and retiring, can shift people's PA beliefs, and thus, result in fluctuations in PA behaviour.

Previous literature that has investigated the role of life transitions on PA levels (Allender et al. 2008; Barnett et al., 2012; Corder et al., 2020; Engberg et al., 2012; Garcia et al., 1998; Gropper et al., 2020; Gyurcsik et al., 2006; Horn et al., 2008; King et al., 1998; McIntyre and Rhodes, 2009; Raymore et al., 2001) have suggested that life transitions tend to decrease PA behaviour, except for retirement (Gropper et al., 2020). This study echoes this tendency, yet also provides subjective accounts where other life transition phases may provide opportunities to increase PA and identifies potential psychological processes explaining how people's PA beliefs and behaviours may change in each life transition. Specifically, we found that these life transitions led to alterations in attitudes, subjective norms, and perceived behavioural control, which in turn,

influenced individuals' PA behaviour. Some overarching themes were consistently identified and varied across the life transitions, including time constraints and opportunities for PA. For example, the structured environments of school and high-demand jobs often limit available time for PA, whereas retirement usually provides more free time, thus facilitating increased activity. The social context also influenced PA across life transitions, with the influence of peers in school, partners in romantic relationships, and colleagues in the workplace shaping subjective norms and perceived behavioural control, influencing PA in both positive and negative ways. In addition, access to facilities and opportunities varied with life transitions. While school provided structured opportunities like physical education classes, retirement might offer more leisure time to utilize community sports facilities. Furthermore, the necessity of certain activities during different life stages also influences PA. The domestic responsibilities that come with leaving home or the parental duties following the birth of a child are examples where the need to perform certain tasks can impact the time and inclination towards PA. With the identification of these themes, the study presents a more in-depth view of how PA is influenced across different life transitions that not only enhance our understanding of individual transitions but also highlights broader patterns and shifts in beliefs that influence PA throughout the life course.

Previous studies using the TPB have made significant contributions to the PA literature by focusing on specific life transitions, such as entering retirement (Barnett et al., 2012), becoming a parent (Hamilton and White, 2010; Rhodes et al., 2014; Rhodes et al., 2021), or changing career paths (Kirk and Ryan, 2012). Our study complements this field of research by taking a holistic approach, exploring how various life transitions influence PA beliefs. This extended view enriches our understanding of the relationship between life transitions and PA beliefs, and thus, behaviour. We found that each life transition carries a unique influence on PA-related attitudes, subjective norms, and perceived behavioural control, and that the various changes associated with life transitions is what shifts people's beliefs and therefore changes their PA behaviour. This highlights the importance of considering background factors not just as control variables but as significant influencers that shape attitudes, subjective norms, and perceived behavioural control in the TPB framework.

Our study dovetails with the research by Hagger and Hamilton (2021), which investigated the influence of socio-structural variables such as age, gender, education, and income on health-related behaviours. Their study revealed that these background factors impact behaviour through social cognition constructs, including perceived behavioural control. For instance, their research found that age indirectly affects health behaviour, mediated by social cognition constructs. Our research delves deeper into how specific

life experiences influence these behaviours. For instance, we examine how participation in organised sports during school is shaped by prior experiences in physical education classes. Similarly, the impact of starting a new career depends on the nature of the job, and the effect of entering a relationship can vary positively or negatively depending on the partner involved. Moreover, our study underscores that these influences differ across various domains, providing a more precise and comprehensive understanding of the intricate ways in which our findings contribute new insights, extending beyond what is detailed in other studies. While Hagger and Hamilton's (2021) work underscore the importance of background factors in shaping behaviour across diverse populations, our study extends this by demonstrating the importance of life transitions and identifying how specific factors and circumstances related to life transitions influence PA beliefs and behaviour throughout an individual's life course.

We found that perceived behavioural control consistently declines across transitions, driven by shifts in routines, responsibilities, and time. This aligns with prior research (Downs and Hausenblas, 2005; Hagger et al., 2002; McEachan et al., 2011), stressing the significance of perceived behavioural control as playing a key role on PA behaviour, yet the current study adds the nuance of life transition-specific influences. The influence of life transitions on attitudes and subjective norms towards PA is markedly inconsistent, contrasting with the more uniform decline in perceived behavioural control. Each life transition presents unique challenges and opportunities that shape these constructs in a dynamic fashion. For example, school environments may negatively alter subjective norms but also offer avenues for positive attitude formation through physical education. Similarly, work environments and romantic relationships can either positively or negatively influence attitudes and norms, contingent upon various contextual factors.

Our study corroborates and extends the work of Hagger and Hamilton (2021), highlighting that the constructs are dynamic, particularly during life transitions. This has practical implications for the design of tailored, contextually relevant interventions. By acknowledging the influence of background factors on PA behaviour, interventions aiming to increase PA by using social cognition techniques, can be more finely tuned to the specific challenges and opportunities that different life transitions present. Further, the present study points towards windows of opportunity for sustained or increased PA within each life transition. This suggests that with the right strategies, persons can adjust their PA beliefs during these transitions in a positive way. For example, since the school environment tends to elevate sedentary behaviour, interventions could focus on enhancing the quality and enjoyment of physical education classes. By improving the subjective norms around PA at an early age, more positive attitudes that persist into adulthood may be gained. Similarly, understanding that new parents face a reduced

sense of behavioural control due to childcare responsibilities can inform the design of interventions that incorporate PA into childcare routines. By grounding interventions in the lived experiences and challenges tied to specific life transitions, we can increase the likelihood of their effectiveness. This nuanced approach ensures that interventions resonate with the individual's current life situation, making it more likely that they will engage with, and benefit from, the offered support.

Strengths, limitations, and future directions

A strength of this study is the use of qualitative methods, specifically in-depth life story interviews, which allowed for a deeper and more nuanced understanding of individuals' experiences and perspectives on PA during life transitions. This type of method provides rich data that cannot be obtained through quantitative methods, making it possible to understand the complex and multi-faceted influences on PA. Moreover, by using a qualitative approach, it was possible to gain insight into the subjective experiences of individuals undergoing life transitions and how these experiences influence PA patterns. This is particularly relevant, as there is a limited understanding of the role of life transitions on the psychological processes guiding PA behaviour. Another strength of this study is the use of a theoretical framework, the TPB, for understanding PA behaviour. The theory is well-used and provides a comprehensive yet parsimonious explanation of how attitudes, subjective norms, and perceived behavioural control influence behaviour (Downs and Hausenblas, 2005; Hagger et al., 2002; McEachan et al., 2011). This theory was highly relevant to the present study as it acknowledges the importance of considering both proximal and background factors in understanding behaviour, making it possible to gain a more nuanced understanding of why individuals may engage in PA or not during life transitions.

The study, however, is not without limitations. One key limitation was the use of retrospective accounts, where participants were asked to reflect on their experiences and behaviours during previous life transitions. Participants may have had difficulty recalling past experiences and their related beliefs and behaviours, thus leading to inaccurate responses, a lack of complete data, or a focus on certain events that were considered most memorable. Furthermore, additional limitations included relatively low participant numbers within each distinct life transition period, which might limit the generalisability of the findings. The low response rate, resulting from the need to contact many individuals to recruit 58 participants, introduces potential selection and non-response biases, affecting representativeness and possibly skewing results. These limitations collectively suggest a need for cautious interpretation of the findings and highlight areas for improvement in future research.

Notwithstanding study limitations, current findings have potential implications for practice and intervention design. Most importantly, the findings point to the need for targeted interventions that are tailored to the challenges and opportunities presented by salient life transitions. For example, interventions for school children could focus on enhancing the quality of physical education to improve subjective norms, while strategies for new parents could incorporate PA into childcare routines to mitigate the reduction in perceived behavioural control.

Current findings also open several avenues for future research. Given the dynamic nature of people's beliefs and behaviours across different life transitions, longitudinal designs could offer more in-depth insights into these evolving relationships over time. Further, future studies could investigate the interplay between multiple background factors, such as socioeconomic status or social support systems, and their influence on PA behaviour within life transitions. Future research might also benefit from recruiting a more diverse sample, for example, different cultural groups, to test the applicability of the observed patterns in various populations.

This study has generated insights into how life transitions reshape PA beliefs and behaviour across life. Key shifts in social roles and associated changes in occupational roles, recreational habits, household responsibilities, and transportation patterns coalesce to redefine individuals' PA beliefs and behaviour. These findings underscore the interplay between life transitions and PA, advancing our understanding of PA's complexity throughout life, and setting the stage for more in-depth exploration in future studies, and advocating for tailored, transition-sensitive interventions rather than generic solutions.

Declarations

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Declaration of conflicting interests

The Authors declare that there is no conflict of interest.

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Data sharing statement

Data are not publicly available to preserve individuals’ privacy under the European General Data Protection Regulation. Data is available on request. Ethics approval, participant permissions, and all other relevant approvals were granted for this data-sharing.

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10.02 Paper 2

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Paper 2

Exploring Basic Psychological Needs Within and Across Domains of Physical Activity

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Abstract

Purpose: This study explored variations in adults' experience of satisfaction, unfulfillment and frustration of basic psychological needs within and across four domains of physical activity: Transport, household, occupation, and recreation. *Methods:* We utilised a qualitative approach, conducting semi-structured interviews with a diverse group of 42 Danish adults. The participants ranged in age from 16 to 79 years (mean age 49 years, SD 21 years), gender (45% men, 55% women), and physical activity levels (38% low, 33% average, 29% high). Data were analysed using a thematic analysis, applying Self-Determination Theory as the guiding framework. *Results:* In the Transport domain, while most activities were seen as utilitarian necessities, autonomy satisfaction emerged for some through control over their means of transport. In Household domain, tasks were generally viewed as obligatory; however, activities with personal significance led to autonomy satisfaction and skill development. Occupation-wise, physical activity satisfaction varied, with the nature of the job impacting feelings of autonomy and competence. For Recreation domain, personal choice dictated autonomy satisfaction, with competence and relatedness varying according to goal achievement and social interactions. *Conclusion:* The variations in the findings across domains indicate the effectiveness of applying strategies tailored to specific domains for enhancing need satisfaction.

Keywords: Lifestyle contexts; Qualitative research; Motivation; Self-determination Theory; Contextual variations

Introduction

A considerable number of people fail to achieve the recommended physical activity guidelines (Sallis et al., 2016; Guthold et al., 2018), despite the evident individual and societal burden of physical inactivity (Jayasinghe et al., 2021; Duijvestijn et al., 2023) and the proven benefits of physical activity (Warburton & Bredin, 2017). Thus, it is crucial to understand what drives physical activity.

Physical activity can be practised in a multitude of ways, reflecting diverse contexts and situations that individuals encounter daily. A systematic approach to understanding this diversity is encapsulated in the concept of "domains" (Sallis et al., 2006; Bauman, 2012; MacNiven et al., 2012; Chu et al., 2015). Herein, physical activity is categorised into four distinct domains, recreation, transport, occupation, and household, each representing unique contexts of individuals' everyday lives. The 'recreation' domain captures voluntary activities undertaken during leisure time, such as jogging or organised sports. The 'transport' domain involves movement between locations, whether walking to the supermarket or cycling to work. The 'occupation' domain focuses on professional activities and school, such as physically demanding labour in construction and physical education in school. Lastly, the 'household' domain centres on domestic chores and tasks, like gardening or vacuuming. Each of the domains of physical activity, in their unique way, significantly contributes to and plays a vital role in shaping an individual's overall physical activity engagement, thus highlighting potential intervention points to promote physical activity (Bauman, 2012; MacNiven et al., 2012; Chu et al., 2015).

Motivation serves as a key driver for initiating and maintaining physical activity within various domains (Bauman, 2012; Roberts & Treasure, 2012). One prosperous perspective on motivation is provided by the Self-Determination Theory (SDT), which has proven particularly effective for understanding motivation and behaviour within physical activity contexts (Standage et al., 2012; Teixeira et al., 2012; Ryan & Deci, 2017). Central to SDT are the concepts of autonomous and controlled motivation. Autonomous motivation is derived from an individual's inherent interests and values, characterised by a sense of authenticity and personal endorsement of actions. This form of motivation encompasses two key aspects: intrinsic motivation, where activities are pursued for the inherent satisfaction and pleasure they provide, and internalised extrinsic motivation, which involves engagement in activities that, while initially extrinsic, align with one's personal values, such as exercising for health in line with a value of well-being (Ryan & Deci, 2017). Contrarily, controlled motivation arises from external pressures and contingencies, such as rewards, punishments, or internalised feelings of obligation or guilt (Ryan & Deci, 2017). In the context of physical activity, autonomous motivation is

closely associated with positive outcomes such as sustained engagement in physical activities, resilience, adaptive behavioural patterns, increased vitality, and overall well-being (Teixeira et al., 2012; Ng et al., 2012; Rouse et al., 2011). Intrinsic motivation is particularly significant for physical activity participation, as it is the only form of motivation that has been directly linked to objectively measured levels of physical activity (Kalajas-Tilga et al., 2020). Conversely, controlled motivation is linked to adverse effects, such as maladaptive behaviours, diminished satisfaction with life, lowered self-esteem, and increased susceptibility to depressive symptoms (Ng et al., 2012; Rouse et al., 2011). SDT posits that an individual's type of motivation (autonomous or controlled) is influenced by the perceived satisfaction or frustration of three basic psychological needs: Autonomy, competence, and relatedness. The need for autonomy refers to the desire for self-direction and ownership of one's actions. Competence entails the need to be effective in one's endeavours and to have opportunities for skill and capability enhancement. Relatedness is the need to feel connected and accepted by others (Ryan & Deci, 2017). Environments that support an individual's psychological needs tend to promote experiences of need satisfaction, which in turn are likely to foster autonomous motivation. Conversely, environments that thwart these psychological needs often lead to a perception of need frustration, which is likely to result in controlled motivation or even amotivation (Ryan & Deci, 2017). In addition to need satisfaction and need frustration recent studies have introduced a third need state, termed need unfulfillment (Reeve et al., 2023; Bhavsar et al., 2020). This state exists in a liminal space between need satisfaction and frustration, characterised by a sense of the psychological needs being overlooked or set aside (Ntoumanis, 2023; Huyghebaert-Zouaghi et al., 2021). While need unfulfillment is not as detrimental as need frustration, it nonetheless has been linked to suboptimal functioning and outcomes that are less conducive to fostering autonomous motivation and well-being (Reeve et al., 2023; Ntoumanis, 2023).

Several studies have investigated the relationship between basic psychological need satisfaction and physical activity behaviour in specific domains of physical activity, such as the recreation domain (Craike, 2008; Lloyd & Little, 2010; Lochbaum & Jean-Noel, 2016; Wang, 2017; Gerber et al., 2018; Kang et al., 2020), the occupation domain (Standage et al., 2003; Ntoumanis & Standage, 2009; Lochbaum & Jean-Noel, 2016; Pedersen et al., 2018; Cid et al., 2019; Pedersen et al., 2019; Salazar-Ayala & Gastélum-Cuadras, 2020; Thomas et al., 2021), and the transportation domain (Burgueño et al., 2020). Qualitative research into basic psychological needs in recreational physical activity reveals several factors influencing these needs. Autonomy, a critical need, is shaped by external elements like weather conditions (Huang et al., 2023), personal commitments (Raabe & Readdy, 2016), and coaching styles (Beddoe et al., 2023). It is also affected by internal factors, notably health conditions (Huang et al., 2023). The need for

competence is similarly influenced: physical constraints and health issues can limit this sense of competence (Huang et al., 2023), and the satisfaction of competence in one activity doesn't necessarily extend to others, as it is highly context-specific (Raabe & Readdy, 2016). Additionally, peer feedback plays a positive role in enhancing competence in physical activities (Beddoe et al., 2023). The need for relatedness in recreational physical activities is significantly impacted by the level of support from family and friends (Beddoe et al., 2023; Huang et al., 2023) and the feeling of belonging to a team (Raabe & Readdy, 2016). Qualitative studies investigating basic psychological needs in occupational physical activity have primarily focused on the physical education context. These studies have generally emphasised the importance of creating a PE environment that nurtures students' autonomy, competence, and relatedness, thereby enhancing their overall motivation and engagement (White et al., 2021). In enhancing autonomy within PE, offering students a variety of activity choices and incorporating novel tasks are effective strategies (Abildsnes et al., 2017). To foster competence, Aniszewski et al. (2019) suggest tailoring activities to different skill levels and providing constructive feedback. For relatedness, positive peer relationships can be encouraged through teamwork and a community-focused class environment (Mitchell et al., 2015). Additionally, teacher-student interactions that demonstrate personal interest and understanding (Sparks et al., 2015), significantly enhance relatedness. Qualitative basic psychological need research in household or transportation physical activities on these needs is limited.

This body of work offers a solid foundation for understanding how the fulfilment of basic psychological needs can significantly influence physical activity behaviour in these domains. However, to our knowledge, no studies have, to this date, explored the basic psychological needs in the household domain of physical activity. Further, the knowledge in the current literature is largely domain-specific, with limited exploration into the differences between them. By not exploring these findings across different domains, we miss the opportunity to understand how the dynamics of basic psychological needs and physical activity behaviour may differ from one context to another. Therefore, the next step in this line of inquiry is a research approach that concurrently examines both within-domain variations and across-domain differences in the expressions of basic psychological needs. By doing so, it will be possible to explore the specific and general aspects of how the environment influences fulfilment of the basic psychological needs within and across various physical activity contexts. This dual focus could lead to the development of interventions that are not only sensitive to the unique characteristics of each domain but also adaptable to the broad spectrum of physical activity contexts.

A study by Sheldon and Niemiec (2006) calls for adopting a broader perspective, suggesting that individual well-being does not just depend on the perceived satisfaction of basic psychological needs within a single life domain. Instead, their findings underscore the importance of achieving a balanced perceived need satisfaction across all life domains, emphasising that each domain is important for obtaining overall well-being (Sheldon & Niemiec, 2006). In the context of physical activity, understanding the balanced perceived satisfaction of autonomy, competence, and relatedness across various domains is vital. This approach offers a deep insight into what motivates individuals to engage in physical activity, which not only has the potential to enrich our theoretical understanding but also bears practical implications by informing the design of more holistic, effective interventions that account for variations in individuals' experiences across all domains of physical activity.

The current study

Building upon the foundation of Self-determination theory, this study *aims* to explore Danish adults' experience of satisfaction, unfulfillment and frustration of basic psychological needs within and across four domains of physical activity, including transport, household, occupation, and recreation. Specifically, the focus is on variations in satisfaction, unfulfillment and frustration of basic psychological needs within and across four domains of physical activity. We expect that the satisfaction, unfulfillment, and frustration of basic psychological needs will exhibit distinct variations both within and across the four domains of physical activity - recreation, transport, occupation, and household. We believe insights on these variations can generate a rich understanding of individuals physical activity behaviour, recognising the diverse contexts in which these behaviours occur. The insights generated might be instrumental in designing interventions that are tailored to specific aspects of adult life.

We have selected qualitative methods to explore the individuals experiences of psychological need satisfaction, unfulfillment and frustration within and across domains of physical activity. This approach is essential for capturing in-depth insights into individual experiences and perceptions, a necessity in the realm of physical activity (Smith & Sparkes, 2016). Our decision is supported by prior research, which indicates that narratives about satisfying or unsatisfying experiences are often rich in details pertaining to basic psychological needs (Sheldon et al., 2001; Jang et al., 2009). To gather data, we have utilized semi-structured interviews (Brinkmann & Kvale, 2014). This method is chosen for its effectiveness in eliciting detailed and nuanced accounts, crucial for exploring the interplay between environmental factors, psychological needs, and physical activity behavior. For the analysis of this data, we employ framework analysis (Braun & Clarke, 2021; Ritchie & Spencer, 1994), a methodology renowned for its systematic yet

flexible approach. This technique allows for a comprehensive examination of themes and patterns in the data, facilitating a deeper understanding of the psychological mechanisms influencing physical activity behavior across various life domains. By integrating qualitative interviews with framework analysis, we aim to gain substantial insights into the motivational factors underlying physical activity behavior. This knowledge is pivotal in designing domain-specific interventions to enhance physical activity, addressing individual needs within these diverse contexts effectively. Our study, therefore, seeks to contribute meaningfully to the literature on physical activity, motivation, and psychological needs.

Methods

Participants

The sample was drawn from a national Danish survey study with 163,133 respondents. Within this group, 48,488 respondents indicated their willingness to be considered for this subsequent interview study. From this pool, we recruited 42 Danish adults to participate in the interview study. The participants were sampled using a purposeful maximum variation sampling method (Gray, 2004) to be able to explore diverse viewpoints and experiences (Patton, 2002; Schreier, 2018). The sampling was based on a maximum variation in the participants' physical activity frequency level, gender, and age. Participants were classified according to their gender, with categories including men and women. In terms of age, they were grouped into three distinct age brackets: 15-29 years, 30-64 years, and those aged 65 and above. The details regarding participants' gender and age were sourced from a national database. Physical activity frequency levels, defined as the number of times participants engage in physical activities per week, were calculated from the participant's answers in the survey. These were calculated across the four domains of physical activity, recreation, occupation, household, and transport and then categorised as low, average, and high relative to the responses from all participants in the survey data. To enhance the diversity and representativeness of our participant pool, we carefully selected individuals from a wide range of municipalities across Denmark. These municipalities were varied not only in their geographical locations but also in the average socio-economic status of their residents. This approach ensured a comprehensive geographical distribution and a diverse socio-economic representation in our study. This strategy was instrumental in providing insights into the diverse experiences and practices of physical activity among Danish adults. Exclusion criteria for the interview study included individuals who did not provide consent to be contacted regarding an interview study and those with medical conditions that severely limited their ability to engage in physical activity. Additionally, those who did not complete

the initial survey or had missing data in relevant fields were excluded from the selection process.

The first author extended email invitations to 436 potential participants, highlighting their previous participation in the survey as the basis for the invite. The email elucidated the study's focus on examining motivation for physical activity. The email also identified the first author as the person who would conduct the interviews. Out of the emails sent, we received 58 affirmative responses indicating willingness to participate in the study. We conducted interviews iteratively, with a keen focus on achieving both within-group and across-group diversity based on our predefined categories of physical activity frequency, gender, and age. Upon completing interviews with 42 participants, we determined that data saturation had been reached, signifying that additional interviews were unlikely to yield new or unique insights. At this juncture, despite having more interested participants, we made the decision to conclude the data collection process. This approach was taken to ensure that the study's findings were not only robust and comprehensive but also achieved in an efficient manner, both in terms of time and resources, both for the authors and the potential participants.

In the interview study involving 42 participants, the age distribution was as follows: 36% were between 15 and 29 years old, 31% were aged 30 to 64, and 33% were 65 or older. Regarding gender, 45% of the participants were men, and 55% were women. In terms of physical activity frequency, 38% of the participants engaged at low levels, 33% had an average frequency, and 29% participated at a high level.

Data generation

We chose a semi-structured interview design to develop detailed and rich insights (Brinkmann & Kvale, 2014). The interview guide was structured to gather detailed insights into participants' physical activity habits and related perceived need satisfaction and frustration. The interview guide was piloted before use. The interview began with introductions from the researcher and demographic questions. Subsequently, participants were asked about their physical activity habits, associated influences on their psychological needs and specific experiences within recreation, transport, occupation, and household domains of physical activity during their lives. Table 1 shows the main interview questions targeting the psychological needs of autonomy, competence, and relatedness across the four domains of physical activity.

Table 1. Main interview questions that are related to basic psychological needs.

Transport	Whose choice was it, that you [activity]? Did you like doing [activity]? Why (not)? What did your family and friends think about you [activity]? Was it normal to [activity] where you lived?
Occupation	Whose choice was it, that you [activity]? Did you like doing [activity]? Why (not)? Did you feel skilled at [activity]? Did feel that you were able to develop your skills? What did your peers think about [activity]?
Household	Whose choice was it, that you [activity]? Did you like doing [activity]? Why (not)? Did you feel skilled at [activity]? What did your family and friends think about you [activity]? Was it normal to [activity] where you lived?
Recreation	Why did you [activity]? Whose choice was it, that you [activity]? Do you think that, doing [the activity] reflected what you wanted and who you were? Did you feel skilled at [activity]? Did feel that you were able to develop your skills? Was it normal to [activity] where you lived? Who introduced [activity] to you? What did your family and friends think about your engagement in [activity]? Did you feel that you were a part of a community?

Table 1 outlines interview questions assessing autonomy, competence, and relatedness across four domains: Transport, Occupation, Household, and Recreation, to understand motivation behind activities.

Each participant was interviewed individually one time by the first author. She conducted most of the interviews face-to-face in participants' homes. However, there were a few exceptions: four interviews took place online, and two were held in public locations at the request of the participants. The interview lengths ranged from 75 to 180 minutes (average: 130). The audio-recorded interviews were transcribed and anonymised with pseudonyms before uploading to NVivo. Post-interview notes, encompassing descriptive, analytical, and interpretative elements, were also added to NVivo for researcher reflexivity.

Data Analysis

The first author conducted the data analysis in an ongoing and iterative manner using a codebook thematic analysis, the Framework Analysis, (Ritchie & Spencer, 1994; Braun & Clarke, 2020). This method was chosen for its systematic structuring of qualitative data. It permits early theme identification while also allowing for ongoing refinements and inductive theme generation (Braun & Clarke, 2021). We implemented the Framework Method in five phases: familiarisation, framework development, indexing the data, charting the data, and interpretation (Ritchie & Spencer, 1994). This approach facilitated a nuanced exploration of individual participant perspectives while maintaining an overarching view of the extensive dataset. We initiated our analysis by reviewing the transcripts and jotting down preliminary impressions and ideas. The framework for segmentation was built upon the constructs of Self-Determination Theory, specifically Autonomy, Competence, and Relatedness, considering their states of need satisfaction and frustration. This framework guided our categorisation of the data, which we subsequently charted into a table. Each row in the table represented a Basic Psychological Need construct, while columns were aligned with different domains of physical activity. The subsequent phase of interpretation was more inductive in nature, focusing on identifying patterns and developing themes within the context of Basic Psychological Needs and domains of physical activity. The concept of need unfulfillment were generated inductively during the interpretation phase of our thematic analysis.

Ethics

The study received ethical approval from an Institutional Review Board before participant recruitment. All participants were provided with a clear explanation of the study's purpose and procedures before giving informed consent. Participants were assured of their right to withdraw from the study at any point without any negative consequences, and their anonymity was protected throughout the study. When writing about the participants and using quotes in the analysis section of this paper, we have changed or omitted potentially identifying details. To safeguard participant confidentiality, all research materials were securely stored and only accessible to the research team.

Results

In the following analysis section, we explore the interview participants' experiences of satisfaction, dissatisfaction, frustration of their basic psychological needs - autonomy, competence, and relatedness within four distinct domains of physical activity: Transport, household, occupation, and recreation.

Transport

In our analysis of the participants' experiences of psychological need satisfaction, unfulfillment and frustration of their basic psychological needs within the transport domain of physical activity we predominantly identified sentiments of need unfulfillment. The participants narratives frequently highlighted the utilitarian nature of their transportation activities. A key representation of this theme was for example found in Emil's reflections on his use of the bicycle for transportation. Emil described cycling not as an activity of enjoyment but as a necessary means for accomplishing specific tasks: "It was just necessary [...] I have not really used my bike in my spare time, only when I have had to go places. It is not like I have cycled for fun." This statement indicates a perceived absence of personal choice in his engagement with cycling as transportation. The term 'necessary' where salient in participants' descriptions of active transportation, highlighting a sense of obligation. This usage indicates that active transportation was often compelled by external needs rather than internal desires or enjoyment.

While autonomy unfulfillment was prevalent, instances of autonomy satisfaction were also observed in the transportation domain, albeit less saliently. Some participants, like Frederik, experienced autonomy satisfaction through their sense of having control over personal transportation: "It is a feeling of freedom to have your own means of transportation that you control, and that can take you around the world. You can get around without being dependent on others." Frederik's emphasis on "control" and avoiding dependency on others underscores how active transportation becomes a symbol of self-reliance and autonomy. This perspective suggests that for some, managing their own transportation is an empowering experience that support their psychological need for autonomy.

The perception of autonomy within the transportation domain was found to be highly contingent on external factors, particularly weather conditions, distance, and safety. Participants often discussed how these external elements influenced their experiences in relation to their need for autonomy. Dagmar's narrative provides an example of this nuance:

It was necessary to cycle for a period because my husband was working in Odense, and he needed the car. I only perceived it that way on the days the weather was miserable because otherwise, I quite enjoyed the trip over the bridge. I prepare myself for what is going to happen and unwind from what has happened [...] I am basically very economically minded. There is no reason to drive around in a car and use a lot of gas when you can use a bike. It is not good for the environment, and it's not good for the wallet.

In this account, Dagmar initially describes cycling as a form of active transportation driven by external necessity due to her husband's use of the car. However, this perceived necessity shifts based on weather conditions. On days with unpleasant weather, Dagmar experience autonomy frustration, as her choice to cycle is influenced more by compulsion than desire. Conversely, on days with favourable weather, the same activity of cycling the exact same route takes on a different meaning for her, becoming a source of enjoyment and subsequently autonomy satisfaction. This indicates that the fulfilment of the need for autonomy is not static in the transportation domain, but dynamically influenced by external conditions.

In the transport domain, there was a notable lack of discussion around competence satisfaction, unfulfillment and frustration. This might be due to the participants experience of physical activity in the transport domain being an utilitarian necessity. However, an exception to this pattern were identified in the narrative of Frederik, who articulated a unique sense of mastery in navigating the urban environment on his bicycle, indication an experience of competence satisfaction: "I enjoy cycling quickly in the middle of a big city, finding a gap between cars. It is a good way to move for me. [...] there is an element of sport in it. Finding a gap." In this expression, Frederik portrays cycling not just as a means of transportation but as an active engagement in a challenging and dynamic environment. The enjoyment he derives from swiftly maneuvering through city traffic and identifying gaps between cars illustrates his perception of cycling as a skillful activity that extends beyond its functional purpose.

Transport activities like walking or cycling were generally framed as a solitary activity by participants. A representative example is Ole's statement, "I always cycle on my own. It is like... It is just about getting from A to B." This expression reflects the utilitarian view of cycling, focused solely on the functional aspect of commuting rather than the potential for social interaction. This reoccurring narrative of solitary transport activities may lack of opportunities for social connection and engagement, which are integral to satisfying the need for relatedness.

However, a contrasting perspective were identified in the narratives from younger participants, particularly those commuting to educational institutions. These participants often mentioned cycling with peers, highlighting a more social aspect of transport activities. For example, Anne's statement, "Often I'm accompanied by some friends. We cycle together. It's nice when you cycle together. I like that there is someone to talk to," illustrates a different experience within the transport domain. Her narrative highlights the enjoyment and social connection derived from cycling with others, contrasting with the solitary experiences described by other participants. This indicates

that while the transport domain may generally be associated with relatedness unfulfillment, there are transportation contexts, particularly among younger individuals, where social connections are established and maintained, contributing to relatedness satisfaction.

Household

In our analysis of the participants' experiences of psychological need satisfaction, unfulfillment and frustration of their basic psychological needs within the household domain of physical activity we predominantly identified sentiments of need unfulfillment.

However, it also presents opportunities for need satisfaction under certain conditions. Our analysis in the household domain prominently highlights autonomy unfulfillment among participants, with many viewing household chores as obligatory and necessary for maintaining a functional home. Marie-Louise's statement encapsulates this sentiment:

In general, I believe household work is necessary, particularly the practical tasks that need to be done, such as cleaning. Although these tasks do not please me, they are necessities that have to be done, like washing clothes or having a clean bathroom.

Her narrative, emphasising the inevitability of these chores ("have to be done") and their lack of personal satisfaction, reflects an experience of autonomy unfulfillment. This pattern of perceiving household tasks as externally imposed responsibilities, driven more by obligation than by personal choice or value, was a recurrent theme among participants, indicating a widespread experience of autonomy unfulfillment in this domain. Yet, there are instances where these tasks are imbued with personal meaning and emotional value, transforming them into autonomy satisfying activities. An example of this comes from Julie, who finds personal satisfaction and meaning in household chores. She noted,

I really like vacuuming. I mean, I really enjoy it. I really like it. [...] There is nothing better than sucking up a sandal full of sand from the daycare. It is completely therapeutic to vacuum. [...] I like doing laundry, especially when it is finished, and you pack it away. It is really nice. However, yes, I like it. I like that feeling of being able to check it off the list. You have done it. It is such a nice, relaxing feeling. Now, it is out of the way. It is done.

Her perspective diverges notably from the predominantly utilitarian view of household chores. Unlike Marie-Louise, who performs tasks out of necessity, Julie approaches the same chores with a sense of enjoyment and personal investment. She describes vacuuming as "therapeutic" and finds pleasure in completing laundry. Her enjoyment goes

beyond the physical act; it's tied to the feeling of accomplishment and the mental well-being she derives from these activities.

In the household domain, discussions on competence satisfaction, unfulfillment, and frustration was scarce. However, a few participants did break this pattern, particularly in their narratives about cooking, gardening, and home repairs. These activities offered some participants a chance to develop and demonstrate skills, hinting at moments of competence satisfaction within an otherwise necessity-driven domain. For example, Niels described his enjoyment of learning and mastering new tasks in the context of home repairs. He said: "I enjoy figuring out how to do things correctly. For example, when we had water damage, I did most of the repairs myself, learning from a carpenter." This narrative reflects a clear strive for mastery, where Niels seeks not only to complete the task but to do so with a level of proficiency and correctness. His proactive approach to learning from a carpenter and applying these new skills in a practical context illustrates a deep engagement with the task, transforming a routine household chore into an opportunity for personal development and skill acquisition.

Relatedness satisfaction was salient within the household domain. It was prominently highlighted through instances where participants engage in joint activities, fostering a sense of community, cooperation, and emotional connection. This satisfaction stems not just from the act of performing tasks together but from the shared experiences and the emotional bonds that these activities cultivate. Karen's experience in the garden with her husband exemplifies this:

It is nice to go out and do something together. My husband has always been the driving force in the kitchen garden and such, but I have also grown up with the experience of being able to produce. It occupies a significant part of our lives.

This narrative reflects the joy and contentment derived from engaging in a shared task. The garden becomes a space where both Karen and her husband contribute, not just in a physical sense, but also emotionally, by investing time and effort together. This mutual engagement goes beyond the mere act of gardening; it's about creating and sharing a meaningful experience that strengthens their bond and provides a sense of belonging. Similarly, Alberte's experiences of cooking for family and friends highlight the emotional aspect of relatedness satisfaction. Her statement, "Preparing food for others brings me immense joy. Gathering family and friends around a good meal is something I cherish," encapsulates the essence of relatedness through acts of care and affection. The act of preparing a meal becomes an opportunity to express love and care and sharing it with loved ones creates a sense of community and emotional intimacy. On the

contrary, some participants, especially among the women who were mothers, experienced a lack of cooperation and social support, particularly when the burden of tasks fell predominantly on one person. Linda's account captures this sentiment of relatedness frustration quite poignantly. She said,

Most of the [housework] was just something that had to be done. My husband was really good at starting a lot of things. Throwing many balls into the air, but who was supposed to catch them? It was me. It has been exhausting. For many years, I've had a knot in my stomach.

This quote underscores the emotional strain and feelings of isolation that can arise when one feels unsupported or alone in managing household responsibilities. Such experiences can lead to perceived relatedness frustration within the household domain. The inclusion of such sentiments among women who were mothers indicates some gendered dynamics and challenges that can affect experiences of relatedness in household activities.

Occupation

In the occupational domain of physical activity, our we identified varied experiences satisfaction, unfulfillment, and frustration of basic psychological needs among participants, especially in relation to the need for autonomy. This variety was mainly contingent on the nature of the participants job, and whether it imposes constraints or offers alignment with personal interests. In some of the participants narratives, we identified autonomy frustration. Niels' experience in the military exemplified this experience. Required to engage in physical activities that did not align with his interests, he described these duties as a forced experience: "At that time, I was not interested in the activity, so it was just something to get through. It felt forced, and I had to find my way to make it work." This statement highlights the conflict between externally imposed job demands and personal preferences, leading to a sense of being constrained by the requirements of his role. In other participants narratives we identified autonomy unfulfillment. Rikke, for example working in a sedentary role, experienced autonomy unfulfillment, contrasting starkly with her previous more active job. Her current position required her to remain mostly sedentary, which she found unsatisfying: "When I was in home care, I used to cycle and move up and down stairs and be active, and I can really feel the difference now that I just sit." The phrase "I sit and sit and sit" emphasizes the monotony of her work environment and her longing for more physical engagement, indicating a mismatch between her job's nature and her personal need for physical activity during the workday. Conversely, other participants experienced autonomy satisfaction. Anders' experience as a farmer reflects the sentiments of participants who found autonomy satisfaction in roles that offer task variety and align with their personal interests. His

focus on diverse tasks rather than the physicality of the work represents a segment of participants who derive autonomy satisfaction from engaging in work that resonates with their preferences and interests: "I appreciated working on various tasks, such as organising or creating new things."

The participants discussion of experiences of competence satisfaction, frustration, and unfulfillment were sparse. Yet, instances where participants expressed competence satisfaction were identified, especially among participants with professional that provided opportunities for skill development and mastery. A clear example is found in Anders' narrative about working as a farmer: Anders articulated, "It allows me to learn various skills, and I find it fascinating." This statement reflects his engagement in a continual learning process and skill acquisition, going beyond the basic requirements of his job. His expression "I find it fascinating" underscores his intrinsic interest in the learning process, indicating a deep sense of competence satisfaction. Anders' experience exemplifies a strive for mastery. Rather than only fulfilling his occupational duties, he actively seeks opportunities to develop and enhance his skills, illustrating a proactive approach to professional and personal growth within his role.

In the occupational domain, the expressions related to the need for relatedness among participants were somewhat limited. However, a distinct theme that were identified was the sense of social support in the workplace, contributing to relatedness satisfaction. Camilla's experience at the gym serves as a prime example of this phenomenon. Camilla articulated,

I have great friendships with the instructors and other people at the gym. We help each other out, and it is nice to be noticed and acknowledged. I really appreciate that we support and assist each other in our training.

Camilla described the importance of social support in their work environment. In her account, the underlying sense of care and affection among her colleagues is evident. By assisting and supporting each other in their training, Camilla and her colleagues demonstrated a sense of mutual concern, which contributed to their relatedness satisfaction and overall well-being in the workplace.

Recreation

In the analysis of psychological need experiences in the recreation domain, all need states were identified for each need. While some experienced autonomy unfulfillment, viewing physical activities as obligatory tasks for health maintenance, others found autonomy satisfaction through activities aligning with personal values and offering mental benefits. Competence experiences varied from satisfaction in achieving personal goals

to frustration and unfulfillment due to physical limitations or unmet expectations. Relatedness also varied, with some participants enjoying strong social connections and communal activities, while others encountered unfulfillment or frustration when expected social engagement was not realised.

In our analysis of participants' autonomy unfulfillment experiences within the context of physical activity in the recreation domain, a salient theme was generated across the many of the participants around the perception of physical activity as a necessity, particularly with an emphasis on health maintenance. This perspective was notably illustrated in Charlotte's remarks about running:

It's not about the run itself. It just needs to be done, just like cleaning. It's the accomplishment that matters. Some calories... And I know that when my heart starts pumping, I am keeping my blood pressure healthy. Preventing. I'm not young anymore, so I have to think about these things.

Charlotte's narrative highlights a sense of duty towards physical activity, likening it to a necessary chore like cleaning. Her focus on the outcome ("the accomplishment that matters") rather than the activity itself signals that her engagement in running is driven more by a sense of obligation to maintain health than by intrinsic enjoyment or desire. The phrase "it just needs to be done" underscores this sense of obligation, portraying running as an essential, albeit not particularly enjoyable, task for health maintenance. Her reflection that the activity is not about enjoyment but about achieving health-related goals ("keeping my blood pressure healthy") further emphasizes the utilitarian aspect of her physical activity. This viewpoint signifies a form of autonomy unfulfillment, where the activity, while recognized as beneficial, is not aligned with personal enjoyment or volition but is instead perceived as a boring compulsory measure for health preservation. Charlotte's experience represents a broader trend among participants who engage in physical activity more out of necessity or health concerns than from a place of intrinsic motivation or personal satisfaction.

Many participants also experienced autonomy frustration, feeling compelled to engage in physical activities not out of personal desire or enjoyment, but due to external interpersonal pressures or adverse conditions in the physical environment. This theme of being coerced into physical activity, rather than willingly participating, was recurrent in their narratives. Per's narrative is an example of this. He expressed a strong aversion to running, not because of the activity itself, but due to the circumstances under which he participates:

I hate running, to be honest, and I don't know if it has something to do with when I run it's because I have been pressured to participate in DHL again

and I haven't managed to train and my lungs, they just lag, three miles behind, you know. There's nothing fun about it.

Per's mention of being "pressured" and the physical discomfort he experiences ("lungs lagging behind") highlights how the activity becomes an unpleasant obligation rather than a choice, leading to a negative experience of autonomy frustration. Similarly, Mona's experience reflects another dimension of autonomy frustration, where factors in the physical environment play a crucial role: "In the summer, I just run here in the woods, but in the winter, it's SO dark out here. Then I stop." Her cessation of running during winter due to darkness illustrates how external conditions can thwart one's desire or ability to engage in a chosen activity, leading to autonomy frustration.

However, many of the participants also did experience autonomy satisfaction in the recreation domain. Their stories were generally characterised by voluntary participation, choice, and alignment with personal values. Lars' experience encapsulates this sense of autonomy satisfaction. He describes running as an activity that enriches his life both physically and mentally:

Running is something I found not only adds a physical aspect to your life, but it also gives you mental energy. You can feel the difference. If you have had a bad day at work, just run a lap. It can also just be a walk. Something happens.

This sense of control and personal benefit from his chosen activity illustrates autonomy satisfaction. Moreover, Lars points out the flexibility in his approach, switching between running and walking as needed, further underlining his sense of choice in his engagement in physical activity.

In the recreation domain, participants' experiences with competence in physical activities varied, encompassing both competence satisfaction, frustration, and unfulfillment. Instances of competence satisfaction were evident in narratives where participants reflected on achieving personal goals or mastering specific skills. Hanne's experience of running around Furesø Lake exemplifies this satisfaction. Her statement, "You do not have to run 25 kilometres, but it is quite fun when you run around Furesø Lake, and I have done that many times... It is a fun thing to say, 'Okay, we can actually run 25 kilometers'", conveys a sense of pride and accomplishment in achieving a significant running distance. Similarly, Karen's account of progressively increasing her exercise intensity, "It is also a pleasure to feel that you can handle it, especially when you can start building more... eventually, I can do more repetitions or add a few extra pounds here and there," reflects her satisfaction in gradually mastering and enhancing her physical

capabilities. These narratives underscore the fulfilment derived from setting and achieving personal fitness goals, embodying the essence of competence satisfaction.

Competence frustration, however, was identified in accounts where participants confront limitations or declining abilities. Mona's reflection on her decreasing speed and inability to keep up with her children, illustrates this frustration:

I do it sometimes because I feel that as I get older each year, I get slower and slower, and I think I have reached the level where I am irritatingly slow. I can no longer keep up with my children.

Her awareness of her declining physical abilities in contrast to her previous performance levels manifests as a source of frustration, highlighting the challenges of maintaining competence in the face of aging or other limitations. Competence unfulfillment was reflected in narratives where participants feel their efforts do not yield the expected progress. Frederik's experience with skateboarding is a case in point. Despite investing considerable time and effort, as he describes, he does not attain the level of skill he anticipated:

There was a year when there was a skateboard in the picture. I think I spent 7-8 months learning to do those fucking Ollies, but I decided that this is not what I should be doing. Moreover, it sounds like I did not train, but I trained a lot.

This scenario illustrates a state where despite significant effort, the expected level of skill acquisition or satisfaction from the activity is not achieved, leading to a sense of unfulfillment.

Participants' experiences of relatedness satisfaction in the recreation domain often involved activities that fostered community, connection, and mutual support. Anette's involvement in outdoor activities and scouting exemplifies this satisfaction. Her description of the scouting group, "Outdoor life provided freedom, practicality, and space for everyone, allowing us to weave social connections and get shared experiences," highlights how such activities fostered a strong sense of community and belonging. The involvement of a young man in a wheelchair and the group's support for him further underlines the inclusive and nurturing environment that enhanced their social connections. Mette's narrative about enjoying undisturbed connections during walks, "The joy of undisturbed connection was evident; no one had to check social media or be interrupted," reflects the value of unmediated, direct interaction in fostering deep, meaningful relationships. Similarly, Marie-Louise's return to horse riding, supported by her husband's understanding of the happiness it brings her, "But he knows how happy I become after being on a horse, so he thinks it's actually better just to send me out there,"

illustrates how shared understanding and support in recreational activities can enhance emotional bonds and relatedness. Relatedness unfulfillment were quite common in the narratives of those who did team sports or activities in switching groups. For example, Julie's experience in commercial fitness classes, "I started in fitness with some friends, but eventually, it was only me who showed up. So it kind of fizzled out," exemplifies the disappointment and disinterest that can ensue when the anticipated social aspect of an activity does not materialise. Her narrative conveys a sense absence of companionship, underlining how the social component is crucial for her engagement and enjoyment in physical activities. Relatedness frustration were not salient in the participants narratives about physical activity in the recreation domain, however we did identify it in a few participants narratives. Mona's experience in a football club, was an example of this: "I felt ignored. You come to a big club, and it was only because it was right next to where I lived [...] And then you get there, and I felt all alone in the world." Her expectation of being welcomed and integrated into the group was met with indifference and isolation, leading to feelings of alienation and frustration. This experience highlights how the lack of social support and acknowledgement in recreational settings can significantly impede the sense of belonging and relatedness.

Discussion

The present study explored basic psychological needs satisfaction, unfulfillment, and frustration among Danish adults, specifically within the physical activity domains: Transport, Household, Occupational, and Recreation. Grounded in Self-Determination Theory, this research sought to extend the understanding of psychological need satisfaction, unfulfillment and frustration of the basic psychological needs, autonomy, competence, and relatedness beyond a singular focus on physical activity, encompassing various life domains, including recreation, transport, occupation, and household activities.

Autonomy

Our study indicates that perceptions of physical activity — as either a necessity or a personal choice — significantly influence how individuals experience autonomy in different domains. In areas like transport, work, and household chores, physical activities are often seen as obligatory tasks rather than enjoyable pursuits. This is also true for some health-focused recreational activities, such as running for cardiovascular benefits, which participants view as essential but not particularly enjoyable. The research of Kinnaefick et al. (2014) suggests that guilt can sometimes initiate physical activity, but according to Pelletier et al. (2002), such motivations are typically not sustainable for long-

term engagement. Thøgersen-Ntoumani and Ntoumanis (2006) have found that the effectiveness of guilt-driven motivation varies, indicating that while activities motivated by necessity might not always encourage continued participation, they can still be beneficial. On the other hand, our findings highlight the importance of personal choice in enhancing the experience of autonomy. Participants who engaged in recreational activities out of personal interest, rather than obligation, experienced greater satisfaction in terms of autonomy. In the workplace, when the nature of the job aligns with an individual's interests in physical activity, it becomes a source of personal satisfaction and autonomy. The same principle applies in the household, where tasks chosen and carried out with personal significance or as part of a valued routine lead to a sense of autonomy. In transportation, the freedom to choose a mode of transport and finding personal value in that choice, like the independence of cycling or the relaxation of walking, also contributes to a sense of autonomy. These conclusions are supported by the work of How et al. (2013) and Ward et al. (2008), who found that providing choices in physical education significantly boosts autonomous motivation and physical activity levels. Long et al. (2014) reported similar findings in the realm of recreational activities, emphasizing the importance of offering choice. Our study broadens the understanding of the role of personal choice and alignment with individual values in enhancing the satisfaction of autonomy across various physical activity domains, including household and transport, in addition to previously studied domains such as physical education and recreation. Our research further aligns with existing studies by Huang et al. (2023), Raabe & Readdy (2016), and Beddoe et al. (2023), highlighting the significant impact of external factors like weather, personal commitments, and coaching styles on autonomy in recreational physical activity. In the occupational domain, the nature of one's job, especially the presence of diverse and novel tasks, as also noted by Abildsnes et al. (2017), significantly influences the need for autonomy. Additionally, we found that in the transport domain, autonomy is primarily influenced by external conditions such as weather and safety concerns. In household activities, social expectations are a key determinant of autonomy.

Competence

In our exploration of competence across we find that it is influenced by across various domains of physical activity, we have identified that it is shaped by a combination of individual aspirations, external limitations, and the surrounding social context. In the Recreation Domain, the attainment of personal fitness goals and the frustrations of unmet expectations significantly shape competence experiences. This is in line with Huang et al. (2023), who emphasize the influence of physical abilities and limitations on competence. Our study reveals that tangible measures of progress, such as distance covered or time spent, play a vital role in enhancing competence, echoing Donnachie et

al. (2017)'s findings about the motivational power of quantifiable achievements. Contrastingly, we found that the Transport Domain, characterized by its functional nature, presents limited opportunities for skill development, leading to a reduced focus on competence. In the Household Domain, we observe a shift in competence experiences based on the context. Obligatory chores, when transformed into shared or personally significant tasks, can become opportunities for skill development. This mirrors the existing literature's suggestion that environments conducive to skill-building can enhance the sense of competence (Myers, 1998). The Occupational Domain highlights how job nature influences competence. Roles that offer variety and skill development lead to experiences competence satisfaction, resonating with the idea that fulfilling work environments are those that provide continuous learning opportunities (Deci et al., 2017). Furthermore, our findings emphasise the crucial role of the social environment. In the Recreation Domain, for instance, supportive or competitive contexts significantly influence competence perceptions. This is supported by research emphasizing the importance of social factors in competence development, such as Aniszewski et al. (2019), who suggest that positive social dynamics, like teamwork and community-focused environments, can enhance the sense of competence.

Relatedness

Our findings in relation to the need for relatedness across various domains of physical activity suggests distinct ways in which social connections and environmental contexts influence this experience. In recreational activities, relatedness primarily stems from strong social bonds in group settings, yet unfulfillment arises when expected social interactions, particularly in team sports, do not occur. This emphasizes the need for inclusive and supportive social environments, echoing Beddoe et al. (2023) and Huang et al. (2023) who highlight the impact of support from family and friends, and Raabe & Raddy (2016) who stress the importance of team belonging. In contrast, the transport domain typically lacks social interaction, seen as a solitary endeavor, though younger participants report social aspects like cycling with friends. This suggests potential for more socially engaging transport experiences. Relatedness in the workplace is marked by the importance of social support, especially in team-based settings, underscoring the value of a collaborative workplace culture for job satisfaction and well-being. In household activities, shared tasks foster a sense of community and cooperation, indicating that joint household tasks can significantly satisfy the need for relatedness. However, unequal distribution of tasks, often affecting women, can lead to feelings of isolation and frustration, highlighting the need for equitable task sharing. Overall, our findings suggest that while the need for relatedness is universal, its fulfillment varies greatly depending on the activity domain, structured by the quality of social interactions and the nature of the activity.

Practical and theoretical implications

The findings of this study highlight both practical and theoretical implications. On the practical front, the prevalence of perceived autonomy unfulfillment identified in our study could negatively influence the motivation for being physically active in especially the active transportation, occupation, and household domains (Bhavsar et al., 2019; Huyghebaert-Zouaghi et al., 2023; Ntoumanis, 2023). Recognising that the environment within certain domains may not fulfil individuals need for autonomy allows for the development of targeted interventions that can either elevate these domains to become more supportive of basic psychological needs, thereby potentially leading to more effective outcomes (Bhavsar et al., 2019; Cheon et al., 2019).

In order to effectively address the basic psychological needs of autonomy, competence, and relatedness in the domains of Transport, Household, Occupation, and Recreation, it is crucial to adopt a domain-sensitive approach. Teixeira et al. (2020) have provided a comprehensive guide to techniques that align with Self-Determination Theory, particularly suitable for health-related interventions. Drawing from the guide provided by Teixeira et al. (2020), the following are examples of intervention actions tailored to enhance need satisfaction in each domain of physical activity: In the Transport domain, the goal is to foster autonomy by creating opportunities for individuals to freely express their views on transportation and explore various options that resonate with their personal preferences. This involves encouraging experimentation with different modes of transport and identifying barriers to their effective use, like safety concerns or lack of route knowledge. To support competence, it's beneficial to promote self-monitoring habits that help individuals understand their transportation choices. Relatedness can be enhanced by forming community groups or forums for discussion and support, as well as initiatives like carpooling or cycling groups to foster a sense of community. Within the Household domain, autonomy is enhanced by facilitating discussions about how chores align with personal values and providing broader rationales for these tasks. Competence is supported through positive feedback on task completion and structured approaches to household chores. Relatedness is fostered by acknowledging feelings around household responsibilities and showing interest in how these tasks are managed. In the Occupational setting, fostering autonomy involves communication that encourages autonomy and avoids implying obligation or coercion. It's important to ensure clear communication of job roles and expectations to support competence, along with setting realistic and challenging goals. Relatedness is enhanced by consistent support, understanding, and active listening to understand employee concerns. For Recreation, providing a range of enjoyable activities enhances autonomy, as does encouraging individuals to try new activities. Competence can be supported by providing constructive

feedback on skill development and promoting self-monitoring. Relatedness is fostered by creating safe spaces for questions and learning, as well as encouraging participation in clubs or groups. Future research could focus on adapting motivational and behavioural change techniques to specific physical activity domains, as this could significantly enhance our understanding of how to effectively modify physical activity behaviour.

Theoretically, this study enriches the Self-Determination Theory framework by emphasising the role of perceived need indifference within the transport, occupation, and household domains. This contributes to a nuanced understanding of individuals' psychological experiences and perspectives within diverse activities and contexts. Given the unique insights this study has brought, future research would do well to explore further the intricacies of need unfulfillment and frustration and its broader implications on motivation, well-being, and physical activity.

Limitations and strengths

This study has limitations that are important to acknowledge. One limitation is the reliance on the accounts of the participants, which may be subject to recall bias. Although research has shown that people tend to remember significant need satisfaction and frustration events (Bauer & McAdams, 2000), some participants may have had difficulty accurately recalling their experiences, leading to potential inaccuracies in their accounts. A significant limitation of our study stems from the design and scope of our interview questions. Our focus on examining differences across the four domains of physical activity meant that the questions were not designed to thoroughly explore every aspect of psychological need states within each domain. This issue was especially pronounced in our examination of the needs for competence and relatedness, where the depth of inquiry was limited. Additionally, our approach to identifying need unfulfillment was primarily inductive, meaning these aspects were not a direct focus of the interview questions. Consequently, this may have restricted the exploration and understanding of a broader spectrum of unfulfillment experiences and perceptions related to psychological needs among participants across the different domains.

Despite this limitation, this study has several notable strengths. The present study provides a rich and detailed understanding of adults' expressions of basic psychological needs satisfaction, dissatisfaction, and frustration in physical activity contexts within various domains of physical activity. Using a semi-structured interview design allowed for a flexible and adaptable approach responsive to the participants' accounts, providing detailed and rich insights into their experiences (Kvale, 2007). By using a purposeful maximum variation sampling method, a diverse range of perspectives and experiences

were represented, adding to the study's strength in terms of its sample representativeness. Further, one of this study's strengths is the sample size, which is relatively large for a qualitative study due to the heterogeneous group. A larger sample size in qualitative research is necessary for robust results when the selected group is relatively heterogeneous (Guest et al., 2006). The large sample size provided a comprehensive understanding of how individuals' experiences and perspectives vary within different domains of physical activity despite the maximum variation sampling method. Furthermore, the study's use of self-determination theory as a theoretical framework for understanding motivation and behaviour in physical activity contexts adds to its strength. Self-determination theory is a well-established and widely used theory that acknowledges the importance of supporting individuals' basic psychological needs to promote self-determined motivation and positive outcomes such as well-being (Ryan & Deci, 2017).

Conclusion

This study, grounded in Self-Determination Theory, explored the satisfaction, unfulfillment, and frustration of basic psychological needs in four physical activity domains among Danish adults. In Transport, activities were often utilitarian, lacking personal choice, but some found autonomy satisfaction through control over their transport, affected by external factors like weather. In Household, chores were generally seen as obligatory, yet some activities offered autonomy satisfaction and skill development opportunities. Relatedness in Household and Occupation was significant, with job nature influencing autonomy experiences and professional skill development contributing to competence satisfaction. In Recreation, autonomy and competence experiences varied widely, with activities chosen for health or personal values, and relatedness depended on social interaction quality. Overall, autonomy in physical activities was influenced by choice, competence by skill development opportunities, and relatedness by social environment quality. The findings of this study indicate the effectiveness of applying strategies tailored to specific domains for enhancing need satisfaction. Future research should delve into adapting motivational techniques to distinct physical activity domains for optimised behavioural change.

Declarations

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Ethics approval

The study was conducted according to the guidelines of the Declaration of Helsinki. Ethical approval was granted by the Institutional Review Board of the University of Southern Denmark, Research and Innovation Organization (RIO), prior to participant recruitment. The approval was granted on 08.11.2029 under protocol code 10.680. All individual participants included in the study provided informed consent.

Data availability statement

The data that support the findings of this study are available from the corresponding author, [BWD], upon reasonable request.

Disclosure statement

The Authors declare that there is no conflict of interest.

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10.03 Paper 3

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Paper 3

Exploring the Process of Restoring Psychological Needs After Incidences of Frustration and Need Unfulfillment

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Abstract

Background: Research on psychological need restoration after incidences of need frustration holds promise for deepening our understanding of the dynamic nature of psychological needs proposed by self-determination theory. We aimed to extend this work by exploring differences in the process of restoring psychological needs after incidences of frustration versus need unfulfillment. *Methods:* We specifically explored the restoration process in the context of physical activity. In-depth semi-structured interviews were conducted with 42 Danish adults varying in age, gender, and physical activity levels, chosen via maximum variation sampling to encompass a broad spectrum of psychological need restoration experiences. Data were analyzed using the Framework Method, a form of codebook thematic analysis, allowing for a structured yet flexible analysis aligned with Self-Determination Theory constructs. *Results:* We identified four distinct yet interconnected phases in the need restoration process: Discrepancies between Actual and Desired Need States, Experiencing Negative Affect, Initiating Plans for Action, and Action Stage. These stages offer a comprehensive framework for understanding how individuals restore their needs. *Discussion:* We discerned contrasting approaches to need restoration depending on prior experiences of need frustration due to external contingencies versus need frustration due to internal factors and need unfulfillment. Need frustration due to external contingencies typically prompts withdrawal, aligning with the avoidance strategies identified in the literature. Conversely, unfulfilled needs and need frustration due to internal factors often lead to proactive engagement, highlighting a distinct 'fight' response. These insights extend existing research, providing a nuanced understanding of the dynamic processes of need restoration.

Keywords: Basic Psychological Needs, need frustration; need unfulfillment, need restoration, psychological recovery

Introduction

Self-Determination Theory (SDT) is a psychological framework used to understand human motivation across various life domains, including education, work, health, and physical activity (Ryan & Deci, 2017). Within SDT, motivation is categorized as either autonomous or controlled. Autonomous motivation, considered as high-quality motivation, emanates from an individual's authentic self and aligns with their values and interests or results from feelings of enjoyment. On the contrary, controlled motivation, deemed as low-quality, is driven by internal or external contingency factors such as feelings of guilt, rewards, or punishments (Ryan & Deci, 2017). In the context of physical activity, autonomous motivation has been linked to a range of positive outcomes. These include increased physical activity, persistence (Ng et al., 2013; Teixeira et al., 2012), adaptive behaviors (Ng et al., 2013; Sheeran et al., 2020), vitality (Rouse et al., 2011), and well-being (Ng et al., 2013). Conversely, controlled motivation is associated with ill-being, maladaptive behaviors (Ng et al., 2013), low levels of life satisfaction and self-esteem (Ng et al., 2013), as well as depressive symptoms (Ng et al., 2013; Rouse et al., 2011).

SDT posits that the satisfaction or frustration of three basic psychological needs (autonomy, competence, and relatedness) influences the degree to which motivation is autonomous or controlled (Ryan & Deci, 2017; Quested et al., 2021). The need for autonomy refers to the need to feel volitional and responsible for one's own actions. The need for competence is the need to feel effective in interactions within one's social context and have opportunities to develop one's abilities. The need for relatedness is the need to feel connected to and accepted by others (Ryan & Deci, 2017). The social environment supports or undermines these needs. Need supportive settings encourage need satisfaction, while need thwarting social environments lead to need frustration (Ryan & Deci, 2017; Bartholomew et al., 2018). When need frustration is experienced, the motivation that underpins the behavior is controlled, subsequently leading to negative outcomes, as previously mentioned. When need satisfaction is experienced, the motivation that underpins the behavior is autonomous, subsequently leading to positive outcomes (Ryan & Deci, 2017; Quested et al., 2021). Recent research has advocated for a third psychological need state that exists in-between need frustration and need satisfaction, namely need unfulfillment (or dormant need; Reeve et al., 2023). Need unfulfillment describes a state where one feels that their psychological needs are set aside or neglected (Bhavsar et al., 2020; Huyghebaert-Zouaghi et al., 2021; Ntoumanis, 2023). Environments that are indifferent to others' psychological needs are likely to foster perceptions of need unfulfillment (Ntoumanis, 2023; Reeve et al., 2023). Research has suggested that need unfulfillment is associated with maladaptive functioning, however, it is not as

psychologically harmful as experiences of need frustration (e.g., classroom disengagement vs classroom defiance; Reeve et al., 2023).

The need restoration process

In recent years, there has been a growing interest in the need restoration process in the SDT literature. Within the need restoration process literature, it is argued that experiences of need frustration do not lead to passive suffering but activate a restorative process aiming at restoring needs and, subsequently, autonomous motivation (Radel et al., 2011; 2013; Sheldon & Gunz, 2009; van Prooijen, 2009). Previous studies focusing on the restoration of the need for autonomy have found that when individuals perceive autonomy frustration, they undergo unconscious cognitive adaptations, such as attentional biases towards autonomy-supporting situations, that predispose them to seek autonomy satisfaction once again (Radel et al., 2011; 2013; Sheldon & Gunz, 2009; van Prooijen, 2009). A study by Anicich et al. (2020) explored the restoration of autonomy under unique circumstances, examining how full-time employees navigated this process during the global pandemic. This study provided evidence that individuals begin the restoration process immediately following the onset of a stressor and continue to do so as the stressor persists. Furthermore, other studies have found that individuals whose autonomy is frustrated are likely to feel a heightened sense of intrinsic motivation when they subsequently engage in activities that support their autonomy (Radel et al., 2014). This heightened sense of intrinsic motivation is particularly noticeable in individuals who have a high autonomy orientation (Fang et al., 2022). In a similar vein, the restoration of the need for competence has also received scholarly attention. Studies have found that students with high levels of competence frustration were more intrinsically motivated in subsequent courses that could restore their competence (Fang et al., 2017) or sought to restore their competence by engaging in a less challenging subsequent task (Fang et al., 2018, 2021). Restoration of the need for relatedness has similarly been addressed in the literature, revealing patterns that parallel those found in restoration studies focusing on the need for autonomy. Research highlights that socially excluded individuals manifest heightened attentiveness to social inclusion cues. For instance, DeWall et al. (2009) demonstrated that these individuals rapidly identify smiling faces, allocating greater attentional resources to such welcoming stimuli. In addition, Maner et al. (2007) elucidated that when the need for relatedness is frustrated, individuals display a predilection for collaborative endeavors, choosing to engage in tasks with others rather than in isolation. These studies collectively suggest that upon experiencing need frustration, individuals engage in adaptive strategies to restore their psychological needs.

The literature on psychological need restoration has not distinguished between need frustration and unfulfillment, partly because this distinction has only recently been incorporated in the SDT literature. For instance, a laboratory study by Maner et al. (2006) examined the effects of social exclusion on the motivation to form new social bonds. In a series of six experiments with undergraduate students, Maner et al. found that social exclusion generally increases the desire to connect with new individuals and enhances positive behavior toward them, except towards the excluding agents or where no future interaction is expected. This indicates that individuals tend to withdraw from situations where they experience need frustration, but also that they subsequently become autonomously motivated to restore their needs in subsequent situations if the environment is more supportive. In contrast, Sheldon and Gunz (2009) explored the concept of 'unmet needs' and how the absence of need satisfaction can motivate individuals to seek experiences that will fulfill these needs. Their study 3 suggests that these needs are fundamental drivers of behavior; when unmet, they create a motivational force that compels individuals to take action to address the deficiency. While both mentioned studies found that need frustration and need unfulfillment can motivate individuals to take actions that restore their psychological needs, they highlight different pathways for the restoration process.

The current study

While the existing literature has contributed to our understanding of the role of the need restoration process, there are notable limitations that call for further exploration. First, although existing studies have done a commendable job exploring the restoration of individual psychological needs in isolation (e.g., Fang et al., 2017; Maner et al., 2007; Radel et al., 2011), they have not discussed how these needs might interact with each other. A more holistic view of the need restoration process could be achieved by investigating these interactions. Second, past research has not distinguished between need frustration and unfulfillment. By distinguishing these states in the context of need restoration, the study could contribute to a more nuanced conceptual understanding of dynamic processes of psychological needs change within SDT. Thirdly, there is a paucity of studies that focus on the restoration process within a real-life setting. The present study specifically focuses on physical activity behavior. By grounding the study in real-life contexts, the insights generated contribute to conceptual development and carry practical significance (Reis & Gosling, 2010). Physical activity behavior is linked to overall health, playing a significant role in reducing chronic disease risks, improving mental health, and enhancing quality of life (Eime et al., 2013; Warburton & Bredin, 2017). Studying physical activity behavior can inform interventions that improve public health outcomes. For instance, by understanding how individuals respond to experiences of need frustration in physical activity contexts, we can shape more effective

strategies for public health initiatives. Lastly, there is a prevailing methodological bias towards quantitative approaches in the existing literature. The incorporation of qualitative methodologies, such as in-depth interviews, would likely enrich our understanding, offering nuanced insights that quantitative methods may not be able to fully capture.

Ultimately, our study aims to make a conceptual contribution to the growing interest in the process of restoration of psychological needs that follow incidences of need frustration or need unfulfillment. A more nuanced understanding of the process of need restoration is important for theory and model refinement within the SDT literature because need restoration pathways might differ depending on whether one has experienced need frustration or need unfulfillment. Also, our study aims to provide more evidence regarding the dynamic nature of psychological needs and move beyond their current treatment as static entities.

Methods

Participants

We conducted semi-structured life story interviews with 42 Danish adults of various physical activity levels. The participants were drawn from a larger nationwide survey (N = 163,000) that investigated their physical activity participation and their perceived opportunities and motivation for physical activity. Utilizing maximum variation sampling (Schreier, 2018), we purposefully selected individuals representing diversity according to physical activity frequency levels, gender, age, and geographic locations within Denmark. Given the participants' diverse backgrounds, we expected to gather in-depth and varied insights into the processes of restoring their psychological needs, enriching our study's overall understanding.

Initial contact with the participants was made through email by the first author. She invited them to participate in the study and informed them that the study would focus on motivation for physical activity. Out of 436 email invitations sent, we received 58 positive replies. We reached data saturation after conducting 42 interviews; hence, we ended data collection then. This decision balanced robust, comprehensive findings and optimized time and resources for both researchers and participants.

The sample comprised 16 individuals with low, 14 with medium and 12 with high physical activity frequency. These frequency levels were calculated relative to the responses from the whole dataset (N = 163,000) across four domains of physical activity:

transport, occupation, household, and recreation. At each of the four domains for physical activity, indexes were calculated, where the respondents were grouped into five equally-sized groups and assigned values from 1 to 5, with 1 representing the least active 20% of the respondents and 5 representing the most active 20%. These indexes were then combined into one summative index across the four domains. The 20% least active respondents, as determined by the summative index, were labeled 'low' participation, the mid 60% were labeled 'medium' participation, and the highest 20% were labeled 'high' participation. The participant pool was balanced in terms of gender, with 19 men and 23 women, and spanned three age groups: 15-29 years (15 participants), 30-54 years (13 participants), and 65 years or older (14 participants). Participants resided in 18 different municipalities within Denmark, varying in geographical location, population density, and average socio-economic status. For further information about the participants, refer to the supplementary file.

Procedures

The semi-structured interviews were conducted by the first author using a pre-tested guide. The interview guide was based on SDT and was designed to prompt the exploration of individual experiences of need frustration, unfulfillment, and satisfaction in physical activity contexts while maintaining enough flexibility to adapt to participants' unique responses and narratives. Utilizing probes, we delved into memorable episodes that characterized their experiences, asking participants to discuss specific instances or narratives. A more detailed description of the interview guide can be found in the supplementary file. Participants were individually interviewed once, primarily face-to-face ($n = 38$), while a few interviews were conducted via a digital video platform upon the interviewees' request ($n = 4$). The interviews lasted between 75 and 180 minutes (average=130 min). For more detailed information, see the supplementary file.

Data Analysis

The interviews were audio recorded and transcribed verbatim. The transcriptions were imported into the NVivo software (version 20.7.1) for data analysis. After the interviews were conducted, field notes were taken, capturing the context, non-verbal cues, and the researcher's initial interpretations. For example, a field note detailed a participant's hesitation or enthusiasm when discussing certain topics, the researcher's own feelings during the interview, and reflections on the interaction dynamics. The field notes were subsequently integrated into the NVivo software, providing an opportunity for researcher reflexivity by allowing systematic comparison of researcher observations with interview data, enabling critical self-examination of potential biases and assumptions throughout the analysis process. We applied the Framework Method (Ritchie & Spencer, 1994), a specialized form of codebook thematic analysis (Braun & Clarke, 2020,

2021). This analytical method was selected due to its rigorous yet adaptable framework for managing qualitative data. It not only accommodates the early establishment of themes but also allows for their iterative refinement and the emergent identification of new themes throughout the analytical process (Braun & Clarke, 2020, 2021; Ritchie & Spencer, 1994). The five phases of the framework analysis (familiarization, development of the framework, indexing, charting, and interpretation) (Ritchie & Spencer, 1994) provided a structured form of data management that helped us capture patterns across the participants' accounts despite the high amount of data.

The first author conducted this analysis in dialogue with co-authors. First, we familiarized ourselves with the data by thoroughly engaging with the interview recordings and transcripts, documenting initial impressions. Then, we created a codebook consisting of four main code categories, each with corresponding sub-themes. The first section encompassed need frustration, the second need unfulfillment, and the third one need satisfaction. The sub-themes for these three categories included each of the three basic psychological needs – autonomy, competence, and relatedness. The fourth category, restoration adaptations, captured the strategies participants employed to restore their needs after incidences of need frustration and need unfulfillment. By systematically assigning portions of the transcripts to relevant codes from the codebook, we deductively analyzed the data. We charted the coded data into a matrix, with rows representing each participant and columns representing each of the code constructs (refer to the supplementary file for the code matrix). As we found patterns in the participants' experiences, the analysis became more inductive. We engaged in iterative refinement of these to accurately capture the nuanced complexities inherent in the restoration process. The scope of these themes was adjusted, either narrowed or broadened, and some were merged or split to offer more precise conceptual clarity. Themes and their names were iteratively reviewed, refined, and revised throughout the writing of this paper.

Ethical considerations

Ethical approval for conducting this study was granted by an Institutional Review Board prior to participant recruitment. Before participating in the study, participants received study details and gave verbal consent, knowing they could withdraw at any time without any negative consequences. Anonymity was ensured through pseudonyms and confidential data storage on a password-protected computer accessible only to the research team.

Results

We identified four distinct yet interconnected phases in the need restoration process: Discrepancies between Actual and Desired Need States, Experiencing Negative Affect, Initiating Plans for Action, and Action. The following section presents a description of each of the phases, grounded in SDT and supported by participants' quotes.

Discrepancies between Actual and Desired Need States

Discrepancies between actual and desired need states served as the starting point for the restoration process. Participants experienced need frustration and unfulfillment by identifying discrepancies between desired and current levels of their needs for autonomy, competence, or relatedness. For example, Laura (aged 17) experienced relatedness frustration when she was demoted to a reserve position in her Team Gym practice. She described her experience as follows:

If you were not good enough, you would be taken off the team and become a reserve [...] You are jumping for yourself, and the whole team is jumping together and doing rhythm together. The focus was on the ten girls on the team while I stood on the sideline. (Laura)

Laura viewed her membership in the team as dependent on her performance levels, which put her in a vulnerable position of being sidelined as she did not meet the team's expectations. During practices, Laura found herself physically separated from the team, literally standing on the sidelines. This spatial isolation underlined her perception of being disengaged from the team's core activities, including their collective jumping and rhythm exercises. Moreover, Laura perceived that the team's attention was disproportionately allocated to the ten active members, reinforcing her sense that she was not a valued part of the group. These various perceptions contributed to her overall feeling of disconnectedness from the team.

This pattern of perceiving discrepancies between actual and desired need states was also evident among participants who experienced other types of need frustration. For instance, Lisbeth's (aged 69) experience below illustrates how she experienced competence frustration. Lisbeth found school gymnastics challenging, becoming aware of her physical limitations. She described her situation as follows:

We had gymnastics at school [...]. I weighed 5-7 kilos too much and a little more than the others [...] Sometimes, we had to lay under the bar, swing the leg, and get ourselves over, and I could hardly do it. It was really difficult. (Lisbeth)

In Lisbeth's account of her experiences of school gymnastics, three considerations stood out: physical inadequacy, comparative disadvantage, and task difficulty. Lisbeth perceived herself as physically inadequate, underscored by her belief that she weighs 5-7 kilos too much and, therefore, she is not suitable or capable of performing gymnastic activities in physical education. When Lisbeth notes that she weighs "a little more than the others," she makes a social comparison, where she perceives herself as falling short relative to her peers. The task difficulty comes to the forefront in Lisbeth's description of the physical struggle in the specific gymnastic exercise of laying under the bar and swinging her leg to get over it. She perceived the activity as highly challenging, almost impossible for her, further reinforcing her opinion of physical inadequacy. This perception of task difficulty interacts with her earlier perceptions of physical inadequacy and comparative disadvantage, compounding her overall sense of not measuring up either to the task at hand or to her peers.

Lene (aged 66) was also experiencing competence frustration stemming from discrepancies between actual and desired need states. However, while Laura and Lisbeth experienced need frustration due to the action of others, that is, external contingencies, Lene experienced need frustration due to internal factors. She noted, "I have gained a lot of weight. I have gotten a big belly, which I usually do not have. [...] I think it is ugly. I actually think a lot about it [...] I have a rowing machine upstairs that I forget to use... I struggle to maintain good intentions and find it hard to stick to a routine." Lene's situation is characterized by a notable disconnect between her desired physical appearance and her actual condition. She recognizes a problem (weight gain, altered physical appearance) and possesses the means to address it (a rowing machine), yet struggles to take consistent action. This discrepancy between her ability to identify what needs to be done and her actual behavior indicates an experience of competence frustration. She feels ineffective and incapable of managing her physical appearance.

The same pattern of experiencing discrepancies between actual and desired need states was evident amongst those who experienced need unfulfillment. Andreas (aged 16), for example, found himself in a football club environment that was acting indifferent to his psychological needs. He said:

Things were beginning to unravel at my previous club. There were frequent stops for various reasons and a change in the coaching staff [...] The new coach was just an older brother to one of the others. The training sessions were limited to technical skills. He just stood there and acted as a coach, pretending to be wise in giving advice. His approach seemed ineffective to me.
(Andreas)

Andreas' account highlights a discrepancy between the actual coaching he received and the comprehensive empowering approach he desired. His experience of the training being limited to technical skills points to an unmet need for competence, indicating that the sessions did not fulfill his aspirations for broader skill development. Furthermore, his perception of the coach's ineffectiveness suggests a lack of meaningful guidance, as he found the advice to be more of a pretense than genuinely useful. These factors collectively reveal a gap between Andreas' actual state of need unfulfillment and his desired state of need satisfaction.

Experiencing negative affect

We frequently observed that participants discussed their affective states alongside their accounts of discrepancies between their actual and desired need states. Specifically, negative affect served to reinforce their cognitive interpretations of need frustration or unfulfillment. In this way, their negative affect initialized the effort towards restoring psychological needs by avoiding or withdrawing from the need undermining context. For example, Laura, who experienced relatedness frustration as she was demoted to a reserve position in her Team Gym practice, further noted, "You feel excluded [...] You get really irritated or sad. Like, I want to go home now." Laura articulated affective states of irritation and sadness. These states directly resonate with her experience of being sidelined in her team activities. Her experience of negative affect is an indicator of her frustrated need for social inclusion and acceptance by the team. Driven by these affective states, she develops a desire to leave the situation and go home as a way to escape further experiences that could reinforce her sense of not belonging.

This pattern was also evident among participants who experienced other types of need frustration. Lene, who had gained weight and struggled to do something about it, said, "When I see myself in profile in the mirror, I feel so bad." Lene's negative affect, in this context, serves as an indicator of her psychological distress about her appearance. Her emotional response to her physical appearance underscores and amplifies her cognitive recognition of the gap between her desired and actual physical states.

Andreas expressed his negative feelings subtly, stating, "It did not feel right for me." Another common way of articulating negative affect in relation to need unfulfillment among the participants was "It was extremely boring," as expressed by Niels (aged 69), who purchased an exercise bike to enhance his health. These affect responses, less intense and more reflective, contrast with the intense emotions of Laura (irritation and sadness) and Lene (distress about her physical appearance). Andreas' and Niels' diffuse and subdued emotional reaction was characteristic of the state of need unfulfillment,

compared to the more intense affective responses seen in the aforementioned need frustration experiences.

Initiating Plans for Action

In the Initiating Plans for Action phase, participants developed a plan for action to change their psychological need state. An internal drive to address discrepancies in actual and desired psychological need states was evident in all participants' narratives. For example, Lisbeth said, "If one could, then one should participate [...] However, I certainly did not like it, so if I could avoid it, I would gladly do so." Her approach, marked by avoidance, reflects a deliberate choice to withdraw from activities that contribute to her experiences of need frustration as a means to restore her psychological needs.

However, the participants' initiation of plans for action to restore their needs varied. We found that some participants' development of plans to restore their needs was heavily influenced by social dynamics or their available resources. Laura's telling illustrates this influence of social connections on decision-making. She said: "It was very demotivating, and then I just lost the desire in the end. Some of the people I talked to also stopped, and then I was like, I do not want to do it anymore." Her decision to disengage was not made in isolation but was deeply influenced by the actions and decisions of those around her, highlighting the interplay between personal feelings and the social environment. In a parallel manner, Andreas' decision-making was also significantly influenced by social dynamics, albeit in a different context. An opportunity arose through a personal connection, as he explained: "An old friend of my father's, who was coaching another club, invited me over. I decided to try to train with them." This decision was catalyzed by the prospect of a new environment, indicating the role of external opportunities and social connections in his initiative to change clubs. Both Laura and Andreas demonstrate how social dynamics and connections can significantly influence individual decisions during the Initiating Plans for Action phase. While Laura's decision appears more reactive, influenced by a loss of belonging within her team, Andreas' decision was proactive, driven by the opportunity to join a new team through a personal connection. This difference might be due to their different need states, with Laura experiencing need frustration and Andreas experiencing need unfulfillment, both due to external contingencies. The influence of social dynamics parallels the tendency to use available resources for the initiation of plans for action observed in other participants. Hanne's case exemplifies this. Confronted with her own perceived limitations in tennis, she leveraged the skills of the ball boys, who also offered tennis coaching. Hanne reflected, "Well, I never became really good at it [...] But there were those ball boys running around collecting the balls [...] They taught tennis if you paid them a little for it,

and they got me to a certain level where I could serve and return a ball and learn a bit. So I could keep up when people played." This approach of seeking instruction enabled her to enhance her tennis abilities and, consequently, her perceived competence. Her strategy of making incremental adjustments to her environment through utilizing available coaching resources underlines how participants tapped into accessible support systems to develop action plans.

For other participants, the initiation of plans for action was a reflective process marked by internal deliberation. Take, for example, the case of Lene, who shared:

I think a lot about doing something to take care of myself and get started. I want to focus on exercise instead of relying on diet alone. I am well aware that crash diets do not work [...] I need to find something that offers more.
(Lene)

In Lene's narrative, the initiation of plans for action is a deeply reflective exercise, marked by an internal debate and the consideration of multiple variables. This might be the case because her need frustration was due to internal factors. She engages in a thoughtful process that incorporates concrete information. For example, her statement, "I am well aware that crash diets do not work," shows that her initiation of plans for action is informed by specific objective knowledge about the ineffectiveness of certain approaches to weight loss. Additionally, her initiation of plans for action involves a complex interplay of variables—her weight, her health, her appearance, and her past experiences with dieting and exercise. She even acknowledges the tension between her logical, reasoned plans for exercise and some unidentified but powerful barriers that prevent her from acting on those plans. The culmination of her initiating plans for the action phase is a specific intention, articulated as "I want to focus on exercise instead of relying on diet alone." This intention represents her commitment to a particular course of action, but it also highlights the challenges she faces in translating this intention into sustained action.

Action

The action phase of the restoration process involved the specific steps participants took to restore their psychological needs. Broadly, the strategies were classified into two categories. The first strategy involved stopping or avoiding the behavior. The other strategy was characterized by actively working against the challenges, fighting back. Rather than withdrawing, the participants who applied this strategy engaged in actions to directly address and overcome the obstacles to restore their needs. The first strategy was typically applied by participants who experienced need frustration due to the actions of

others, while the second strategy was typically applied by participants who experienced need unfulfillment or need frustration due to internal factors.

Delving deeper into the first strategy, instances of need frustration due to the actions of others often prompted participants to either avoid or stop the behavior altogether. For example, Laura, who had been sidelined at her team gym team, stopped her participation, "Then I stopped." In contrast, Lisbeth's approach within the action phase represents a slightly different strategy for need restoration after incidences of need frustration in physical education. Her strategy represented an avoidance tactic: "I always sought to avoid participation by claiming to be in pain or that something else was wrong." Unlike Laura's direct decision to withdraw, Lisbeth's action involved creating scenarios that justified her non-participation. The key difference between Laura and Lisbeth's responses in the action phase of their psychological need restoration process lies in the nature of their participation in physical activity – voluntary for Laura and obligatory for Lisbeth. Laura, in a voluntary participation context, directly ceased participation, effectively removing herself from the source of need frustration. In contrast, Lisbeth, within an obligatory context, applied indirect avoidance strategies, like feigning illness, to navigate the constraints of obligatory participation and restore her psychological needs. This contrast was a general pattern in the data, highlighting how the voluntary or obligatory nature of participation influences individuals' pathways for need frustration in physical activity.

Further, the participants who experienced need frustration in a voluntary activity context tended to take up other types of physical activity at a later point, whereas participants who had experienced need frustration in an obligatory physical activity context tended to avoid sport and exercise settings for extended periods. Lisbeth, for example, at 69 years old, continued to avoid these activities after her incidences of need frustration in physical education that occurred 54 to 63 years earlier. Similarly, another participant, Niels (aged 68), narrated:

I have never really been the athletic type and was the one who got picked last in physical education classes [...] That has caused some emotional issues over the years [...] It is something that today... I think it has shaped my attitudes towards sports and physical activity ever since [...] I found my sense of achievement elsewhere.

In contrast, Laura decided to participate in fitness classes shortly after she stopped her voluntary team gym practice.

Shifting the focus to the second category of strategies, fighting back, this strategy was evident in participants dealing with need unfulfillment and participants whose experience of need frustration is due to internal factors. A common way of fighting back from experiences of need unfulfillment and need frustration due to internal factors was to make different kinds of adjustments. These ranged from minor adjustments, such as making slight tweaks in routines or enhancing existing skills through additional training or resources within their current environment, to more salient adjustments, such as changing their sport or environment. An example of someone who chose the latter strategy was Andreas, who experienced psychological need unfulfillment in a football club environment. He acted by switching clubs. He said, "I decided to switch clubs [...] I quickly felt like a part of the team. This gave me a renewed sense of purpose and community in the sport." Andreas' proactive decision to switch clubs was a significant adjustment in response to the need unfulfillment he experienced. Upon joining the new team, Andreas experienced a quick integration, feeling like a part of the team. Thus, his needs were successfully restored. Another example of fighting back after incidences of need unfulfillment stems from Mathilde (aged 21), who did not feel a part of the community on her swim team because she chose not to participate in competitions. In response, she switched to a new sport, explaining:

So, I chose that I did not want to swim anymore [...] Then I started strength training with friends. I wanted to look big and strong. Sculpt my body [...] It was something I could control myself. There was no one to tell me what to do.

Similarly, Lene, who experienced need frustration due to internal factors, feeling bad when looking in the mirror because she had gained weight and thus intended to start exercising, said: "Now I have signed up for a gymnastics team." By choosing to exercise more, she is taking control of her situation, actively working towards improving an aspect of herself that she is dissatisfied with, thus trying to move her need state towards satisfaction. However, changing behavior was not the only strategy she needed to apply. Alongside, Lene also shifted her mindset about physical activity. She acknowledged, "It is something that lies in my consciousness as a duty. But it is primarily associated with pleasure because I feel so good afterward." This cognitive adjustment helped her focus on the positive outcomes of her activities, maintaining her engagement and commitment. The combination of behavioral change and cognitive reframing thus enabled Lene to align her actions with her values and achieve a more fulfilling engagement with physical activity.

Discussion

We offer the first qualitative investigation of the psychological need restoration process in the SDT literature. Below, we describe our main findings, how they advance the extant literature and have implications for a more dynamic representation of psychological needs in future SDT models. We also offer several directions for future research.

The initial phase of the restoration process 'discrepancies between actual and desired need states' align with past findings which reported that autonomy need frustration triggered the restoration process (Radel et al., 2011, 2013, 2014; Sheldon & Gunz, 2009; van Prooijen, 2009). Extending past research, we identify specific factors that contribute to the perception of discrepancies between actual and desired need states, such as physical separation (e.g., Laura feeling sidelined at her team gym, despite her desire for a sense of belonging to the team), conditional inclusion (e.g., Laura perceives her inclusion in the team as dependent on her competencies), and comparative disadvantage (e.g., Lisbeth and Niels, who experienced challenges due to their larger body sizes compared to their peers). These factors provide granular insights into the various factors that can initiate the restoration process.

The second phase of the restoration process we identified, 'experiencing negative affect', is not adequately addressed in the existing restoration process literature. Our findings suggest that experiencing negative affect provides an interpretive layer that refines the initial perceptions of discrepancies between actual and desired need states. These results align well with the theoretical framework of cybernetic control processes posited by Carver and Scheier (1990, 2012), underlining the significance of feedback mechanisms in behavioral self-regulation. Carver and Scheier propose that negative affect functions as an integral component of feedback loops, actively guiding modifications in behavior. Rather than being a passive psychological consequence, negative affect serves as a functional signal, indicating a gap between current social engagement levels and desired social interactions. In our study, we further found that the experience of negative affect provides an interpretive layer that goes beyond the initial affect response, directing attention to discrepancies between actual and desired need states. This also resonates with Carver and Scheier's assertion that negative affective feedback instigates adjustments in strategies to reduce discrepancies between present circumstances and targeted goals. For instance, feelings of sadness in response to social exclusion not only signal an affect but also heighten awareness towards potential opportunities for social inclusion, thus guiding individuals towards more focused restorative activities. These arguments also align well with the research of Kramer and Yoon (2007) on approach-avoidance motivation and the use of affect as information. Their series of studies

suggests that affective states, including emotions and mood, provide individuals with critical information about their internal and external environments. For example, someone experiencing negative affect in a situation might, based on their approach or avoidance motivation, interpret this as a cue to either engage in change-oriented behavior or to avoid potential harm. In conclusion, we advocate for the merits of considering affective responses as active components in psychological need restoration and behavior change.

The 'initiating plans for action' phase was significantly influenced by social dynamics, opportunities, and the resources available to the participants. These insights into the initiation of action plans are in alignment with Carver and Scheier's feedback theory of self-regulation (1990). Carver and Scheier emphasize the role of external factors, including social interactions, in shaping behavioral responses. Such influences are reflected in our observations, where decisions made by participants, such as Andreas' decision to change clubs, were notably influenced by social connections. Additionally, the adaptability demonstrated by participants, like Hanne's utilization of available resources for tennis coaching, resonates with Carver and Scheier's perspective on how environmental factors influence behavior. In essence, our study's insights into the role of social and environmental factors in the development of action plans underscore the significance of external stimuli in shaping effective restoration strategies. We further found that the phase of initiating plans for action can manifest in two distinct ways: As a deeply reflective exercise (such as deliberate consideration of future outcomes and weighing of various options) or as a more straightforward, reactionary internal dialogue (like an immediate, instinctive response to a current situation). This observation is in agreement with the dual systems outlined in the Reflective-Impulsive Model (RIM) by Strack and Deutsch (2004). While much of the existing literature, such as the studies by Radel et al. (2011, 2013, 2014), focuses on the role of automatic, impulsive systems in initiating restoration activities, our findings suggest that the process of initiating plans involves not only these automatic impulses but also a conscious reflective layer. The culmination of this phase is a specific intention, setting the stage for action. The 'initiating plans for action' phase complements and extends the existing literature on the restoration process, particularly focusing on the level of awareness and cognitive appraisal that individuals undergo.

The 'action' phase in the restoration process, as identified in our study, intricately involves how participants react to different types of need frustrations (those due to external contingencies or internal factors) or need unfulfillment. By referring to the Approach and Avoidance Behavior framework (Corr, 2013), which categorizes responses into the Behavioral Approach System (BAS), the Fight-Flight-Freeze System (FFFS),

and the Behavioral Inhibition System (BIS), we can gain a deeper insight into these varied coping mechanisms. In situations where need frustration arises from external factors, such as restrictive rules or unsupportive environments, our study observed a predominant 'flight' response. This defensive strategy, characterized by avoidance or withdrawal, aligns with the activation of the FFFS. It signifies an immediate reaction to minimize discomfort or harm by distancing oneself from the source of frustration. This reaction is consistent with findings by Maner et al. (2006), DeWall et al. (2009), Radel et al. (2014), and Fang et al. (2017, 2018, 2021, 2022), who noted that such withdrawal is a common strategy to circumvent further frustration. However, when the perceived threats from these external contingencies are less immediate or severe, the BIS might dominate, leading to more cautious and considered approach behaviors. This shift from an immediate flight to a strategic reassessment of the situation is a critical aspect of the need restoration process that the Approach and Avoidance Behavior framework (Corr, 2013) helps elucidate. In voluntary contexts like sports clubs, this may manifest as participants choosing to leave frustrating activities, thus exercising their autonomy to seek fulfillment in alternative activities.

The action tendencies in response to need unfulfillment (e.g., lack of available opportunities and challenges to become better) or frustration due to internal factors (e.g., increased weight reduces capability for specific tasks) present a different scenario. Rather than withdrawing, individuals are more likely to engage in a 'fight' response, characterized by actively seeking new opportunities (e.g., shifting to a team or activity that better supports their needs) or making adjustments (e.g., cognitive adjustments or investing in lessons to improve skills). This proactive approach is indicative of a BAS activation. This finding resonates with Sheldon and Gunz's (2009) assertion that deficiencies in psychological needs drive individuals to seek experiences that will fulfill such needs. Thus, our study delineates the distinct pathways of coping with need frustration due to external contingencies, need frustration due to internal factors, and need unfulfillment, which previous literature has not differentiated.

Strengths and limitations

This study adds to the growing literature on the process of psychological need restoration in multiple ways. First, we identified four stages in the restoration process—discrepancies between actual and desired need states, experiencing negative affect, initiating plans for action, and action. Previous studies have not examined the dynamic nature of need restoration in such a nuanced way. Second, we looked at the restoration of all three psychological needs proposed by SDT using rich qualitative data; previous studies have been quantitative in nature, and some of them focused on one psychological need only. Third, we distinguished between incidents of need frustration and need

unfulfillment and found differences in how the participants restored their needs depending on whether they had prior experience of need frustration versus need unfulfillment. Fourth, previous studies have primarily investigated early-stage adaptations after incidences of need frustration (DeWall et al., 2009; Fang et al., 2018, 2022; Radel et al., 2011). The present study has also explored repeated or long-term need frustration, which, as indicated by Fang et al. (2018, 2022), has not been studied in past research. Taken together, our findings can be used in the future by SDT researchers to develop theoretical models that are not static but acknowledge both the dynamic nature of psychological needs as well as their multidimensionality (satisfaction, frustration, and unfulfillment).

Our study also offers key insights for PA understanding and promotion. Firstly, it identifies specific factors, like physical separation and conditional inclusion, that trigger the restoration process. This knowledge can improve strategies to address need frustration in PA contexts. The study highlights the role of negative emotions in signaling discrepancies and guiding behavioral changes, in line with Carver and Scheier's cybernetic control process theory. Recognizing the functional role of negative affect can enhance PA interventions by using emotional responses as cues for behavior change. Additionally, the study shows that the initiation of action plans is significantly influenced by social dynamics and available resources, underscoring the importance of supportive environments in facilitating physical activity. Finally, the study's insights into the 'action' phase, using the Approach and Avoidance Behavior framework, reveal distinct responses to different types of need frustrations. This differentiation is crucial for tailoring PA interventions to address specific challenges, enhancing engagement and sustained participation in PA.

However, despite its strengths, the study is not without its limitations. The focus on Danish adults might limit the broader applicability of our findings. Cultural, social, and economic nuances specific to Denmark could potentially influence the experiences of our participants, and these might not seamlessly translate to other demographic or cultural contexts (Flick, 2015). The focus on physical activity as behavior might limit the applicability of our findings to other types of behavior. Physical activity, with its unique determinants (see Baumann et al., 2012), may not represent or mirror the complexities and nuances of other behaviors. Additionally, the retrospective nature of the narratives in our study might introduce elements of recall bias. The accuracy of participants' memories or their present emotional states could inadvertently color their past experiences, thereby influencing the narratives they shared (Schwarz & Sudman, 2012). Further, we employed interview techniques to prompt deeper participant insights into their experiences of need frustration and restorative adaptations. While acknowledging

that interviews influence participants' conceptualization of their experiences (Brinkmann & Kvale, 2018; Loftus & Palmer, 1974), we suggest that the increased richness of data generated might compensate for this limitation.

Future directions

In terms of future research, it could potentially include diverse behaviors (e.g., other health behaviours, learning behaviours), settings (e.g., families, classrooms, health clinics, and workplaces), methodologies (e.g., ecological momentary assessments), and populations to render a more holistic understanding of the restoration process. For example, in terms of diversity in settings, the predominance of laboratory-based studies in this field calls for an expansion into real-life settings. Future research could also extend the focus to diverse population groups, such as adolescents, the elderly, patient groups, or employees. This approach would offer more diverse perspectives of where the restoration process might play out differently, influenced by diverse real-world complexities. In terms of methodologies, intensive longitudinal designs could allow researchers to examine the unfolding of the restoration process repeatedly over days or weeks and investigate successful and unsuccessful restoration attempts. Such research designs would provide just-in-time insights into the affective and cognitive states that act as triggers for the restoration process, thereby minimizing the limitations associated with retrospective accounts. The effects of social agents on the restoration process could also be examined, for instance, the role of need supportive social agents.

Further, future research should examine the restoration processes separately for need frustration due to external contingencies, need frustration due to internal factors, and need unfulfillment. The current literature is heavily focused on the restoration process after incidences of need frustration due to external factors (e.g., Fang et al., 2018, 2021; Radel, 2014), overlooking other restoration pathways. Mapping such diverse pathways, potentially by also incorporating relevant literature on goal self-regulation and cybernetics (Carver & Scheier, 1990; 2012), can offer a more comprehensive understanding of the different facets of psychological need restoration.

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Moving Denmark

Physical Activity Beliefs and Motivation Within and Across Life

Drawing on Theory of Planned Behaviour and Self-Determination Theory, this study *aimed* to understand how individuals' physical activity beliefs and motivation are influenced within and across life. The study used long semi-structured interviews with 42 Danish adults, analysed through thematic analysis to identify key themes related to physical activity beliefs and motivation within and across life domains and life transitions.

The findings suggest that individuals' physical activity beliefs and motivation are influenced within and across life are influenced by past experiences (e.g. experiences of need frustration in physical education), present circumstances (e.g. life transitions and how life domains support psychological needs), and anticipations of the future (e.g. anticipation of improved health and psychological well-being).

The study suggests that future practices should develop adaptable interventions and initiatives that are sensitive to life transitions, focus on supporting psychological needs across domains of physical activity, and focus on enhancing early physical activity experiences to cultivate lasting motivation and positive attitudes towards physical activity.



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