Maintenance of Quality of Life and Independence in Old Age despite Fear of Falling

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Abstract

While falls prevention measures are gaining in importance, against the background of the current demographic development, motivating individuals to participate in falls prevention programs remains a challenge. Therefore, one aim of this dissertation was to examine social-emotional and health-related factors that predict older adults' attendance to falls prevention programs. The main goal of this thesis was to advance research on falls prevention by focusing on fear of falling as a psychological construct, as well as by examining its relationship to quality of life and perceived overprotection by others.

The findings in Chapters 2 and 3 present results of an evaluation study of a falls prevention program, while Chapter 4 relies on data from a randomized controlled trial to increase physical activity in older adults. The results in *Chapter 2* suggest that older adults meet their social needs by participating in group-based falls prevention programs, especially if they live alone. Moreover, the findings in *Chapter 3* revealed that physical functioning and gait speed postulate how fear of falling compromises quality of life in old age. The findings in *Chapter 4* suggest that fear of falling translates into well-intentioned support from others, which is perceived as overprotective over time. The assumption of a downward spiral between fear of falling and overprotection was not confirmed.

These findings bear several implications: 1) strengthening social identification during an intervention and focusing on short-term social, emotional rewards may motivate older adults to engage in falls prevention programs, 2) interventions could support the maintenance of quality of life by targeting fear of falling as a cognitive factor in addition to physical function and gait speed, 3) future research should focus on the social environment to investigate whether overprotection by others may increase loss of independence. Finally, Chapter 5 outlines strategies for future research and practice aimed at maintaining quality of life and independence in old age, despite fear of falling.

Zusammenfassung

Vor dem Hintergrund der demographischen Entwicklung wird die Prävention von Stürzen in den nächsten Jahren an Bedeutung gewinnen, um ein selbstbestimmtes Leben bis ins hohe Alter zu ermöglichen. Die bisherige Forschung konzentriert sich vor allem auf die körperlichen Determinanten von Stürzen sowie auf Interventionen zur Förderung der körperlichen Funktionen. Psychologische Konstrukte wie die Sturzangst wurden bisher vernachlässigt (Wu et al., 2020). Das primäre Ziel dieser Dissertation war es daher, die Forschung zur Sturzprävention voranzubringen, indem Sturzangst als psychologisches Konstrukt in den Fokus gerückt wurde.

Um der altersbedingten Abnahme körperlicher Funktionen entgegenzuwirken, ist es wichtig, ältere Menschen zu ermutigen, körperlich aktiv zu bleiben (Bangsbo et al., 2019). Sturzpräventionsprogramme setzen an diesem Punkt an und können durch gezielte Balance- und Kraftübungen die Sturzrate um bis zu 23% senken (Sherrington et al., 2019). Es stellt jedoch eine große Herausforderung dar, Personen zur Teilnahme an Sturz-präventionsprogrammen zu motivieren (Osho et al., 2018). Ein weiteres Ziel dieser Dissertation war es deshalb, die Motive älterer Menschen für die Teilnahme an Sturz-präventionsprogrammen zu untersuchen.

In *Kapitel 1* der Dissertation wird der theoretische Hintergrund dargestellt und es werden theorie- und evidenzbasierte Hypothesen abgeleitet. *Kapitel 2* und *3* basieren auf den Ergebnissen einer Evaluationsstudie eines Sturzpräventionsprogramms, während sich *Kapitel 4* auf die Daten einer randomisierten kontrollierten Studie zur Steigerung der körperlichen Aktivität bei älteren Erwachsenen stützt. Abschließend werden in *Kapitel 5* Strategien für die zukünftige Forschung und Praxis diskutiert, die darauf abzielen, körperliche Aktivität im Alter zu fördern, um die Lebensqualität und Unabhängigkeit trotz

Sturzangst zu erhalten. Im Folgenden werden die Ergebnisse der empirischen Kapitel 2 – 4 zusammengefasst.

In *Kapitel 2* wurde die *Sozio-emotionale Selektivitätstheorie* (Carstensen, 1993) herangezogen, um die Motive für die Teilnahme an einem ambulanten Sturzpräventions-programm zu untersuchen. Der Theorie zur Folge streben ältere Menschen, stärker als jüngere Menschen, nach emotional bedeutsamen Erlebnissen. In der Studie wurde daher angenommen, dass ältere Teilnehmende eher aus sozial-emotionalen Motiven (z.B. Zugehörigkeitsgefühl zur Gruppe) als aus gesundheitsbezogenen Motiven (z.B. wahrgenommenes Risiko zu stürzen) an Sturzpräventionsprogrammen teilnehmen. Die Ergebnisse der Längsschnittstudie zeigen, dass ein hohes Zugehörigkeitsgefühl zur Trainingsgruppe eine regelmäßige Teilnahme am Programm vorhersagte. Dieser Zusammenhang zeigte sich jedoch nur für Teilnehmende, die allein wohnen. Gesundheitsbezogene Motive standen in dieser Studie nicht im Zusammenhang mit der Teilnahme am Training. Die Ergebnisse deuten darauf hin, dass ältere Erwachsene ihre sozialen Bedürfnisse durch die Teilnahme an gruppenbasierten Sturzpräventions-programmen befriedigen, insbesondere wenn sie allein leben. Demnach sollte die soziale Eingebundenheit bei der Implementierung von Sturzpräventionsprogrammen betont werden, um diese Zielgruppe zu erreichen.

Kapitel 3 widmet sich der Frage, welche Mechanismen hinter dem negativen Zusammenhang zwischen Sturzangst und Lebensqualität stehen. Die Ergebnisse legen nahe, dass dieser negative Zusammenhang durch eine verminderte Wahrnehmung der Beinkraft und Balancefähigkeit vermittelt wird, die wiederum mit einer geringeren Geschwindigkeit beim Gehen zusammenhängt. Ältere Erwachsene, die ein hohes Maß an Sturzangst empfinden, nehmen ihre körperlichen Funktionen demnach als eingeschränkter wahr, was sich auch in niedrigen Bewertungen ihrer Lebensqualität niederschlägt.

Sturzangst kann damit zusammenhängen, dass Personen es vermeiden, körperlich aktiv zu sein, was langfristig eine Beeinträchtigung der Beweglichkeit mit sich bringt, und eine selbständige Lebensführung erschwert. Sturzpräventionsprogramme, die gezielte Balance- und Kraftübungen beinhalten, können dazu beitragen, die subjektive Sicherheit beim Gehen und die Gehgeschwindigkeit zu erhalten und somit zur Lebensqualität im Alter beitragen.

In *Kapitel 4* wurde untersucht, inwieweit die Sturzangst älterer Menschen mit dem Verhalten des sozialen Umfelds zusammenhängt. Angehörige, Freunde und Pflegepersonal können sich als Reaktion auf die Sturzangst von älteren Personen überbehütend verhalten. Dadurch werden die Fähigkeiten älterer Menschen unterschätzt und sie werden bei Tätigkeiten unterstützt, die sie noch selbst ausführen könnten (Niemann-Mirmehdi et al., 2019). Umgekehrt kann eine weitreichende Unterstützung durch das soziale Umfeld im Alltag zu einer eingeschränkten Mobilität älterer Menschen führen (Yeom et al., 2008), die mit der Angst vor Stürzen im Alter einhergeht. Die Ergebnisse in Kapitel 4 deuten darauf hin, dass Sturzangst zu einer Unterstützung durch andere führt, die mit der Zeit als überbehütend empfunden werden kann. Die Hypothese einer Abwärtsspirale zwischen Sturzangst und wahrgenommener Überbehütung konnte nicht bestätigt werden. Aus den Ergebnissen lässt sich ableiten, dass es wichtig ist, sowohl den Unterstützungsbedarf als auch den Wunsch nach Unabhängigkeit älterer Menschen zu berücksichtigen (Gallant et al., 2007). Demnach ist Unterstützung erforderlich, die die Autonomie älterer Menschen nicht einschränkt. Ein Ansatz könnte darin bestehen, überbehütendes Verhalten in Interventionen für Pflegende und das soziale Umfeld zu thematisieren, um wahrgenommenen Einschränkungen der Autonomie älterer Menschen vorzubeugen.

Insgesamt zeigen die Ergebnisse dieser Arbeit, wie wichtig es ist, psychologische Faktoren bei der Entwicklung von Interventionen zur Sturzprävention zu berücksichtigen.

Die Ergebnisse aus *Kapitel 2* legen nahe, dass die Stärkung der sozialen Zugehörigkeit während einer Intervention und die Betonung sozial-emotionaler Vorteile ältere Erwachsene dazu motivieren können, an Sturzpräventionsprogrammen teilzunehmen. Den Ergebnissen aus *Kapitel 3* zu Folge ist Sturzangst neben körperlichen Funktionen ein zentraler Faktor, wenn es darum geht, Lebensqualität im Alter zu erhalten. Dies sollte in zukünftigen multimodalen Sturzpräventionsprogrammen berücksichtigt werden. Die Ergebnisse aus *Kapitel 4* sprechen dafür, dass das soziale Umfeld nicht vernachlässigt werden sollte, wenn ältere Menschen Sturzangst empfinden, da ein höheres Maß an Sturzangst zu überbehütendem Verhalten anderer führen kann. Zukünftige Forschung zur Immobilität im Alter sollte auch das soziale Umfeld einbeziehen, um festzustellen, ob die Überbehütung durch andere mit der Vermeidung von alltäglichen Aktivitäten von älteren Erwachsenen zusammenhängt.

1

Introduction

Introduction

Growing old is closely related to the desire to remain independent in old age and to live a self-determined life, as long as possible. The *World Health Organization* (WHO) describes this construct as *healthy aging*, which is "the process of developing and maintaining the functional ability that enables well-being in older age" (WHO, 2020a, p. 13). Against the background of demographic development in most countries in the Western world, healthy aging will become an increasingly relevant subject in the coming years. In 2020, 14% of the world's population – of an overall 7.8 billion humans – were adults aged 60 years and older. By 2050, this number will increase to 20% (WHO, 2020a). Falling birth rates and an increasing life expectancy are the two driving forces behind this demographic change (WHO, 2015). In Germany, a research focus on the aging population is becoming increasingly relevant. The populous cohorts born between 1955 and 1970 represent the largest age group in the German population that will be retiring in the coming 2 decades (Federal Statistical Office of Germany, 2019). Recently, due to the strong immigration of refugees in 2015, younger generations increased in numbers, and the shrinking population was counteracted. Nevertheless, the aging of the overall population cannot be prevented (Federal Statistical Office of Germany, 2019).

To enable healthy aging, it is essential that higher life expectancy is not inevitably accompanied by poor health. However, aging naturally coexists with a decline in physical functioning, such as loss of muscle strength and decreased balance (Billot et al., 2020). This functional decline implies an increased risk for falls, which is a major health concern in old age (Grossman et al., 2018). Continuous concern about falling could lead to the avoidance of daily activities (Tinetti & Powell, 1993). This contradicts a crucial factor of healthy aging – the maintenance of quality of life and independence (Menassa et al., 2023). Therefore, the overall aim of the present thesis is to investigate factors that maintain quality

of life and independence in old age, despite the fear of falling. In the following Chapter, I present the framework of this thesis to emphasize the need for further research. After describing the structure of this dissertation, I provide the rationale for the research questions.

Falls as major health concern in old age

There is a consensus that a crucial factor in promoting health among older adults is physical activity. Physical activity is associated with reduced pain, a lower risk of falling, and promotes physical functioning (Bangsbo et al., 2019). *Physical activity* is broadly defined as any body movement that was initiated through muscles and required energy expenditure (WHO, 2020b). To achieve substantial health benefits for older adults, aged 65 years and older, the WHO (2020b) recommends at least 150 minutes of aerobic physical activity at moderate intensity (e.g., gymnastics) or at least 75 minutes of vigorous intensity (e.g., jogging) throughout the week. The adherence to these recommendations was especially challenging during the pandemic, whereby physical activity levels among older adults decreased (Yamada et al., 2020). Thus, in order to maintain independence in old age, promoting an active lifestyle has grown in relevance.

Before addressing theories of health behavior change aimed at increasing physical activity, it is important to understand which physical challenges aging implies. Age-related loss of muscle strength and decreased balance ability are associated with an increased risk for falls, which is a major health concern in old age (Grossman et al., 2018). The WHO (2021) describes a *fall* as an incident that results in an individual unintendedly coming to rest on the ground. Children are also at high risk of falling, however, serious injury or death as a consequence of a fall occur particularly often among older adults (WHO, 2021). One-third of adults over the age of 65 fall each year (Sherrington et al., 2019). At the age of 80, this number increases to 40% (Kaveh et al., 2021). Among older adults who fall, 20 to 30%

experience moderate to severe injuries, including hip fractures or traumatic brain injury (Aranda-Gallardo et al., 2018). These non-fatal injuries may reduce mobility or result in the admission to residential care (Jancey et al., 2018). In the year 2020, in Germany, 17,211 individuals died due to a fall (Federal Statistical Office of Germany, 2021). According to estimates, 684,000 fatal falls occur worldwide every year, which constitutes the second leading cause of accidental injury death after traffic accidents (WHO, 2021).

To prevent falls, it is essential to encourage older adults to stay physically active to maintain physical functioning (Bangsbo et al., 2019) and thus support healthy aging. A Cochrane review including 108 randomized controlled trials showed high-certainty evidence of preventing falls by targeting physical functioning ($N = 23,407$ participants; Sherrington et al., 2019). These structured falls prevention programs include strength and balance exercises and reduce the rate of falls by 23% (Sherrington et al., 2019). It is, therefore, important to distinguish between the umbrella term *physical activity* and the subcategory *exercise*. The latter is defined as structured and repetitive physical activity, aimed at improving or maintaining physical performance (WHO, 2020b) and is associated with a reduced fall rate (Billot et al., 2020). A reduced fall rate is also accompanied with a reduction in medical costs at the societal level, as nearly 40% of adults aged 65 years and older who fall require medical treatment related to the fall (Grossman et al., 2018). Thus, falls also place a heavy burden on the healthcare system (Florence et al., 2018). In addition to reducing healthcare costs, falls prevention programs could support older adults in increasing compliance to the physical activity recommendations by the WHO, through promoting health behaviors. As a result of demographic change, the implementation of falls prevention programs will become more important in the coming years (dos Santos et al., 2021).

Regular attendance to falls prevention programs is crucial in reducing risk of falling

Merely implementing falls prevention programs is insufficient, as a reduction in risk of falling requires participation on a regular basis (Osho et al., 2018). However, regular participation represents a major challenge in falls prevention programs (Nyman et al., 2012). Results of a meta-analysis of 20 randomized controlled trials ($N = 5,820$ participants) revealed that, on average, only two-thirds of falls prevention sessions were attended by adults aged 65 years and older (Osho et al., 2018). Consequently, it is important to identify factors that enhance participation in falls prevention programs. Therefore, one focus of this dissertation is to investigate factors that motivate older adults to attend a falls prevention program.

Social-cognitive theories of health behavior change can help in understanding why individuals engage in health-promotion programs. One social-cognitive factor that could be beneficial for participation in falls prevention programs is *risk perception*, that is, the insight of being at risk of falling (Haines et al., 2014). Furthermore, anticipated health benefits when attending an exercise program, termed *outcome expectancies*, might too be relevant. Results of a systematic review indicated that higher *self-efficacy beliefs,* that is, the confidence in one's own abilities, increase the participation in regular exercise among older adults (Martin-Moya et al., 2020). A theory that encompasses these three social-cognitive factors as antecedents of intention formation for health behavior is the *health action process approach* (*HAPA*; Schwarzer, 1992; Schwarzer, 2008). According to the HAPA, risk perception, outcome-expectancies and self-efficacy beliefs are proposed to motivate a person to attend an exercise program. Outcome expectancies and self-efficacy are also proposed as determinants of health behavior in other social cognitive theories of behavior change, such as the *social cognitive theory* (Bandura, 1977) or the *protection*

motivation theory (Rogers, 1983). However, social-cognitive theories of behavior change are generic in terms of age and do not consider developmental changes (Gellert, 2012a).

Considering lifespan theory to predict attendance of falls prevention programs

Although the primary goal of falls prevention programs is a reduction in fall rate, older adults do not name long-term outcome expectancies such as muscle strength, balance, and the prevention of falls as their primary reasons for participation (Franco et al., 2014). In contrast, evidence suggests that older adults report primarily short-term benefits such as social interactions and a sense of community gained from group-based falls prevention programs (e.g., dos Santos et al., 2021; Jenkin et al., 2021; McPhate et al., 2016). A sense of community seems especially relevant to older adults who lack social embeddedness (Sims-Gould et al., 2019). In addition, findings of a systematic review demonstrated that living alone is associated with regular participation in exercise programs among older adults ($k = 9$ studies, $N = 1,370$ participants; Assumpção Picorelli, 2014). These results are in line with the *socioemotional selectivity theory* (*SST*; Carstensen, 1993). This theory postulates that the perception of time left in one's lifetime, termed *future time perspective*, is associated with a motivational shift regarding goals. When time is perceived as limited, individuals prioritize present-oriented goals with emotional meaning rather than goals with a long-term impact in the indefinite future. Regarding outcome expectancies among older adults, Gellert et al. (2012b) revealed that affective outcome expectancies predicted physical exercise 6 months later, while the relationship between health-related outcome expectancies and physical exercise was non-significant. In comparison to younger adults, older adults tend to focus on engaging in social interactions and close social relationships, rather than on the acquisition of knowledge and future personal development (Löckenhoff & Carstensen, 2004). According to the *positivity effect*, older adults might remember positive information better than negative information (Carstensen et al., 1999). For

example, Notthoff et al. (2016) revealed that older adults showed a higher motivation to participate in physical activity programs when receiving positively framed messages compared to negative ones. It is, therefore, postulated that older adults might be more inclined to attend group-based exercise programs due to socio-emotional instant rewards, such as a sense of community, rather than for the prevention of long-term health risks.

However, health promotion programs are often tailored to the needs of children, adolescents, and younger or middle-aged adults, whereas the needs of older adults are less often incorporated (Ziegelmann & Knoll, 2015). As it considers a lifespan perspective, socioemotional selectivity theory could inform the implementation of effective interventions in old age (Gellert et al., 2013). For instance, in a randomized controlled trial, Gellert et al. (2014) compared an age-tailored intervention, emphasizing present-oriented and emotion-focused benefits of physical activity, with an age-neutral intervention. Results revealed that the age-tailored intervention was superior regarding maintenance of physical activity. Expanding knowledge about engagement in health behavior across the lifespan requires combining theories from health psychology and gerontopsychology (Ziegelmann & Knoll, 2015). This perspective is of particular importance regarding falls prevention programs in which older adults are targeted. Therefore, in the present dissertation, I investigated predictors from theories on health behavior change as well as on lifespan psychology. The aim was to examine to which degree older adults anticipate social-emotional short-term rewards, or long-term health benefits, when participating in group-based falls prevention programs.

Fear of falling and the loss of independence

Besides addressing physical factors, such as muscle strength and balance ability, falls prevention programs should also address fear of falling as a psychological risk factor for falls. According to results of a Cochrane review and meta-analysis, fear of falling values

can be reduced within exercise interventions (Kumar et al., 2016). The authors included 36 interventions (N = 2,878 participants), composed of Tai Chi, yoga, balance training, strength, and resistance training, and revealed a small to moderate effect size. Tinetti and Powell (1993) describe *fear of falling* as a continuous concern of falling, which leads to the avoidance of activities, despite the individual still being capable of performing these. Previously, fear of falling was considered fear-related "*post-fall syndrome*." Today, it is not solely seen as a consequence of falls, as fear of falling is also prevalent among older adults without a fall history (Schoene et al., 2019). For instance, Makino et al. (2017) examined a large sample of older adults who experienced fear of falling (N = 1,467 participants) and revealed that 84% of the sample had not experienced a fall. In general, two-thirds of older adults aged 60 years and older are afraid of falling. As a result, nearly 40% of this population group restrict their daily activities to avoid falls (Merchant et al., 2020). Upon first inspection, fear of falling could be seen as a protective factor, as the avoidance of activities reduces situations in which falls could occur (Rivasi et al., 2019; Wu et al., 2020). However, avoiding activities entails a long-term decline in physical functioning, which, in turn, increases the risk of falls (Liu et al., 2020; Pereira et al., 2020; Whipple, 2018). As can be seen from Figure 1, a downward spiral of immobility may begin with the fear of falling (Clemson et al., 2012; Friedman et al., 2002). This implies a future loss of independence, which means a reduced ability to participate in daily activities (Bimou et al., 2021).

Mechanisms behind the association between fear of falling and quality of life

Fear of falling is not only a risk factor for falls, but also affects quality of life in old age. A conceptual framework on quality of life is lacking (Boggatz, 2015); consequently, a range of definitions exist. The WHO describes *quality of life* as an individual's perception of one's own physical health, mental state, level of independence, social relationships, and

personal beliefs with regard to their environment (The WHOQOL Group, 1995). Maintaining quality of life becomes increasingly important as adults age and become physically challenged (Brinkmann, 2014). Results of a systematic review that mainly included studies with cross-sectional research designs, revealed a higher fear of falling is strongly associated with lower quality of life among adults aged 60 years and older ($k = 31$ studies, $N = 29,029$ participants; Schoene et al., 2019). To date, it remains unclear how fear of falling is associated with quality of life. For this reason, the present dissertation examines mechanisms behind the association between fear of falling and quality of life.

Figure 1

The downward spiral of immobility
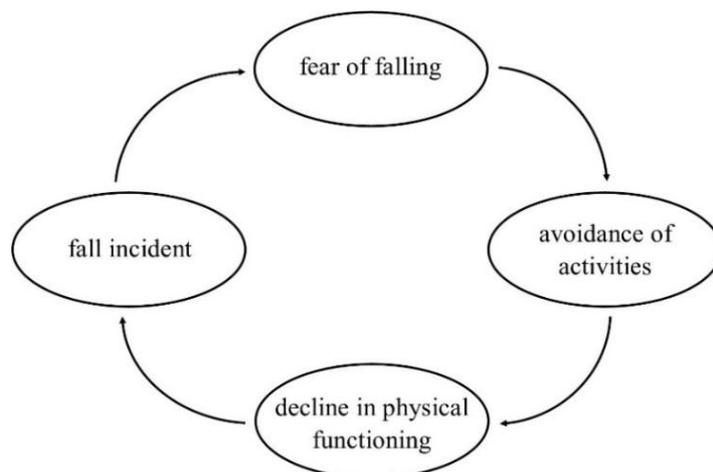
As depicted in Figure 1, fear of falling is closely related to a restriction of activities that might lead to a decline in physical functioning. A systematic review by Denkinger et al. (2015), comprising 20 cross-sectional studies, confirmed the negative relationship between fear of falling and physical functioning. This finding is in line with recent research indicating that individuals who fear falling showed significantly reduced balance as well as a slower gait speed, compared to older adults without a fear of falling (Makino et al., 2017; Sapmaz & Mujdeci, 2021). In terms of reduced quality of life in old age, growing evidence suggests an association with lower levels of physical functioning and a slower gait speed

(e.g., Lin et al., 2015; Sartor-Glittenberg et al., 2014). For instance, Davis et al. (2015) revealed that lower performance-based balance and a slower gait speed predict reduced quality of life among older men at 6- and 12-month follow up. In addition, results of a randomized controlled trial showed that women aged 60 years and older, who participated in a balance exercise training, reported higher levels of quality of life, compared to the control group, after intervention cessation and at 2-month follow up (Kaveh et al., 2021). One approach might be to bring both lines of research together by examining whether physical factors could help to explain *how* fear of falling is associated with quality of life. As quality of life itself cannot directly be increased in health interventions, longitudinal research on mechanisms behind the association between fear of falling and quality of life might help to inform intervention development. To close this research gap, this dissertation examines whether physical functioning and gait speed can support our understanding on how fear of falling is associated with quality of life.

Fear of falling and its association with overprotection of the social environment

As stated above, studies have examined fear of falling primarily in association with physical factors, rather than with psychosocial factors. However, fear of falling also affects the social environment of older adults (Honaker & Kretschmer, 2014). Pereira et al. (2020) showed that fear of falling is associated with physical dependence on others because older adults could no longer master daily activities without support. It might be assumed that, although older adults are still capable to cope with everyday life, their social environment may induce dependence. In response to morbidity, the social environment might begin to exhibit overprotective behavior. For example, caregivers reported well-intentioned support as assistance with daily activities to prevent their patients from future falls (Ang et al., 2019). By behaving overprotectively, family, friends, and caregivers underestimate the abilities of older adults and support them in activities they would still be capable to

accomplish themselves (Niemann-Mirmehdi et al., 2019). Thompson and Sobolew-Shubin (1993) describe *overprotection* in adulthood as an individual's perception of the social environment that induces dependence, averts stress, and does not interact with them as an adult. In contrast to social support, overprotection constitutes an unintended hindrance and could be understood as a problematic form of receiving support (Thompson et al., 2002). Overprotection of the social environment, in the form of extensive assistance with activities of daily living, may lead to reduced mobility (Yeom et al., 2008), which is associated with fear of falling in old age. Conversely, older adults' fear of falling could transfer to overprotective behavior of the social environment. Family, friends, and caregivers may exhibit more overprotective behaviors, with the motivation to support older adults they perceive as fearful.

Until now, the role of the social environment has been neglected in research on fear of falling. Very little is known about overprotection by others in association with, or as a consequence of, fear of falling in old age. However, based on safety concerns, overprotective behavior by others might be particularly prevalent in the context of fear of falling. Longitudinal research is required to examine whether this assumption holds true. This highlights the importance of examining the potential reciprocal longitudinal association in the present thesis.

Aim of the dissertation and research questions

The previous paragraphs describe the structure of the present thesis as well as highlight the need for further research on this subject. While studies on physical determinants of falls, as well as interventions to promote physical abilities, prevail in research on falls prevention, psychological mechanisms are studied to a lesser degree. The present thesis aims to contribute to this field of research by focusing on fear of falling as a psychological construct and by examining its relationship to quality of life and perceived

overprotection by others. Furthermore, predictors that enhance the attendance of group-based falls prevention programs are investigated to promote health benefits. The structure of this dissertation is displayed in Figure 2.

Figure 2

Structure of the present thesis
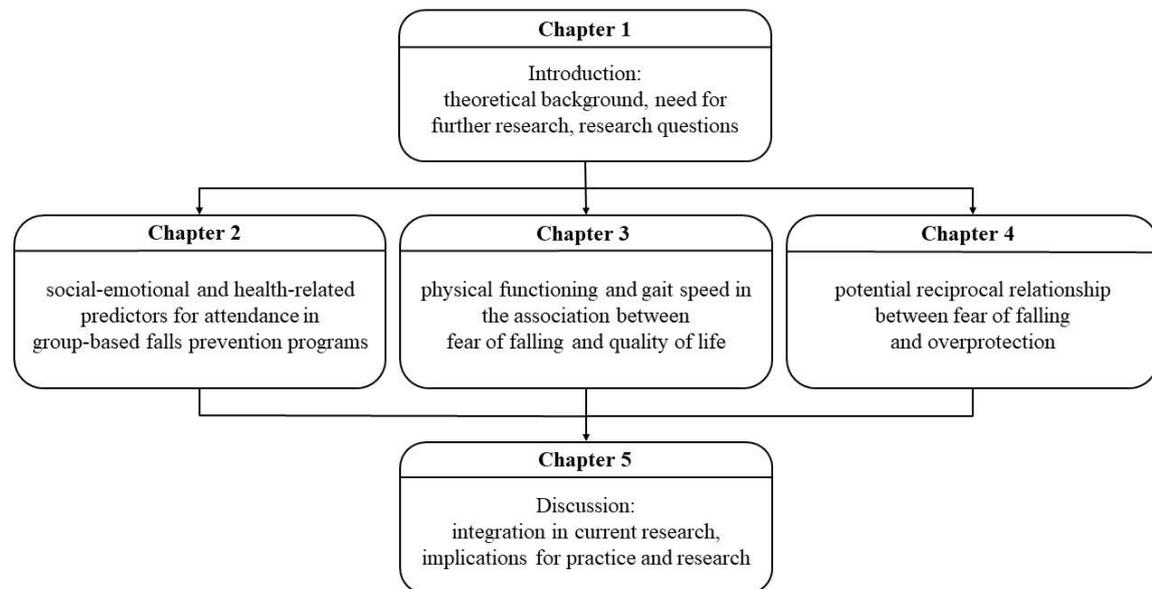
Predictors from theories on health behavior change and lifespan psychology are addressed in *Chapter 2*. This chapter elaborates on the question to which degree older adults anticipate social-emotional short-term rewards or long-term health benefits when participating in group-based falls prevention programs. *Chapter 3* examines the mechanisms behind the association between fear of falling and quality of life. The second research question is whether physical functioning and gait speed can support our understanding on how fear of falling is associated with quality of life. Finally, *Chapter 4* considers the social environment. The last research question examines whether fear of falling predicts higher overprotection or whether an overprotective social environment might imply a higher level of fear of falling. An overall discussion of the empirical chapters

is provided in *Chapter 5*. This chapter includes implications for future research as well as practical considerations for promoting group-based exercise programs. Furthermore, the relevance of fear of falling for quality of life and the social environment is discussed.

Studies and samples for the present thesis
Sample 1

With the exception of Chapter 4, the empirical chapters (Chapters 2 and 3) of the present dissertation are based on the falls prevention program "*Be active, but safe.*" A German health insurance company, the *AOK Nordost,* developed and funded the group-based falls prevention program. After completing training provided by the health insurance company, volunteer trainers facilitated the falls prevention groups. The trainers were staff members at the community meeting places or health care homes, where the program took place. To attend the ongoing falls prevention program, participants did not have to pay participation fees.

Figure 3

Measurement points of the longitudinal study of the falls prevention program
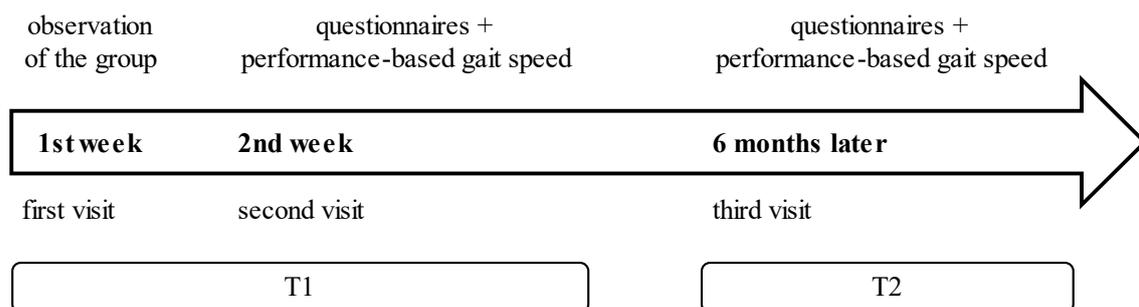
As depicted in Figure 3, the longitudinal design was composed of two measurement points in time that were 6 months apart. At both measurement points, research assistants visited the meeting places and care homes in Berlin and Brandenburg where the group training took place. Data collection started in October 2017. A one-group prospective

design was used to follow participants who were already enrolled in the falls prevention program. In addition to participant perspectives, self-reports of trainers and the observation by research assistants were considered, whereby the present thesis focusses on the perspective of participants. Data analyses included self-reports collected via paper-pencil questionnaires and objectively measured gait speed. Older adults with moderate to severe dementia diagnoses were excluded from the study. The Department of Education and Psychology of the *Freie Universität Berlin* (number 165/2017) provided ethical approval, a requirement for participation.

Sample 2

Chapter 4 is based on longitudinal data from the *PREFER II* trial (Warner et al., 2016). Participants were recruited via newspaper articles, flyers, and advertisement letters. Inclusion criteria were participants 1) with a minimum age of 64 years and 2) who exercised less than twice a week for half an hour. Older adults were excluded when they had 1) an acute physical impairment, 2) were disabled, or 3) cognitively impaired. Individuals gave their informed consent and completed the baseline paper-and-pencil questionnaire in spring 2012. The *German Psychological Society* approved ethical consent (DGPs-SW02-2012).

Figure 4

*Measurement points of the PREFER II trial*
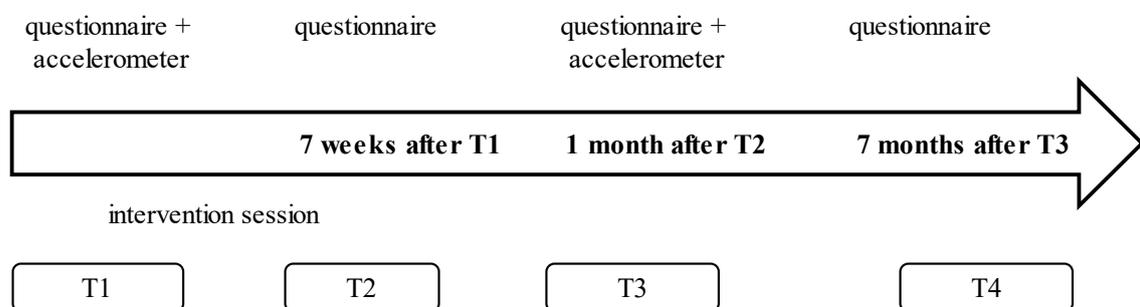
Figure 4 shows the measurement points of the randomized controlled trial (RCT) that comprised two intervention groups, one active control group, and one passive control group. The face-to-face behavior change intervention lasted 3 hours and took place 5 weeks after Time 1 (T1). The intervention session comprised behavior change techniques to increase physical activity. Data collection contained self-reports and accelerometer-assessed physical activity, whereby Chapter 4 relied on questionnaires.

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2

Preventing Falls Together: Social Identification Matters for Engaging Older Adults in a Group-based Exercise Program

Steckhan, G. M., Warner, L. M., & Fleig, L. (2022). Preventing falls together: Social identification matters for engaging older adults in a group-based exercise program. *Activities, Adaptation & Aging, 46(1)*, 31-45. https://doi.org/10.1080/01924788.2020.1871540

Abstract

According to socioemotional selectivity theory, older adults may attend a falls prevention program due to social-emotional rather than health-related factors. Within a prospective design, $N = 174$ participants completed a questionnaire (T1) assessing social identification with the training group, risk perception, outcome expectancies, self-efficacy beliefs, intention, health status and form of housing. At follow-up six month later (T2), $n = 125$ participants provided information on training attendance. A multiple regression analysis with form of housing as moderator revealed that social identification predicted attendance, but only for those participants living alone ($\beta = .87$, $p < .001$). Health-related predictors were not associated with attendance.

Keywords

Falls prevention, health behavior change theory, older adults, socioemotional selectivity theory, social identification, training attendance

Introduction

The second leading cause of accidental injury death worldwide is falling fatally, a risk that increases dramatically with age (World Health Organization, 2018). Falls often cause serious and painful injuries, which might, in turn, lead to long-term limitations of physical functioning as well as to institutionalization (Burns et al., 2016). Moreover, the experience of falling reduces individuals' confidence in their ability to move around independently and can start a vicious cycle of decline in physical activity and loss of independence (Clemson et al., 2012).

Structured falls prevention programs usually incorporate balance, strength, and coordination exercises. Thus, such prevention programs can achieve a significant reduction in older adults' fall rate (e.g., Bangsbo et al., 2019; Clemson et al., 2012). Given the growing costs of health care due to fall-related injuries among older adults, there is a need for effective falls prevention programs. Regular attendance is key to the success of such programs (e.g., Lin et al., 2010; Nyman, 2011). Therefore, the aim of this study was to investigate predictors from theories on health behavior change and lifespan psychology in order to gain a better understanding of why older adults take part in group-based falls prevention programs.

Using theory of behavior change in falls prevention research: social-cognitive predictors for program attendance

Social-cognitive theories of health behavior change can help in understanding why individuals engage in a health behavior, such as taking part in a group-based falls prevention program. The *health action process approach* (*HAPA*; Schwarzer, 1992, 2008) proposes three individual, social-cognitive factors, which motivate a person to attend an exercise program. First, individuals are more likely to regularly attend a falls prevention program if they recognize that they are at risk of falling (*risk perception*) and understand

that falls could result in serious limitations with overall health and wellbeing. Second, individuals are more motivated to attend a program, if they anticipate beneficial results (e.g., feeling better because of doing the exercises), namely, positive *outcome expectancies*. Third, *self-efficacy beliefs* – the confidence in one's own abilities to engage in a health behavior – are crucial for explaining training attendance for older adults (Cohen-Mansfield & Sommerstein, 2019). However, psychological theories of behavior change such as the HAPA do not account for developmental changes, which may be just as important to consider.

Using lifespan theory in falls prevention research: social-emotional predictors for program attendance

In order to better understand older adults' motivation to engage in behavioral changes during later years of life, health behavior theories may be complemented by a lifespan perspective (e.g. Gellert et al., 2012; Leventhal, 2002). One of these lifespan approaches is the *socioemotional selectivity theory* (*SST*; Carstensen, 1993). This theory indicates that older adults are, in comparison to younger adults, not as concerned with the acquisition of knowledge but rather with the pursuit of goals related to emotional satisfaction (Carstensen, 1993). Older adults tend to prioritize goals, which are emotionally meaningful, such as engaging in social interactions and focus on close social relationships. According to SST, this motivational shift is due to changes in perceived time left in one's lifetime, called *future time perspective*. When time is perceived as limited, individuals tend to concentrate on the present rather than the future and tend to engage in activities that promise instant rewards rather than long-term benefits (Carstensen et al., 2003). Li (2017) showed for instance that as individuals age, their intentions to engage in physical activity decrease. This negative association between age and physical activity intentions was mediated by future time perspective: Intentions to be physically active decreased when

individuals viewed their time as limited (Li, 2019). This line of reasoning also has implications in engaging older adults in group-based exercise programs. According to SST, it can be assumed that older adults participate in a falls prevention program because they anticipate social-emotional rewards (short-term) rather than health benefits (long-term).

Preventing falls together: group exercise as an emotionally meaningful exercise context?

It may, therefore, be important to consider the social interactions within a group-based exercise setting, when motivating older adults to regularly attend a falls prevention program. According to SST, older adults may derive emotional meaning from group-based exercise, as they feel connected to and identify themselves with their training group. In other words, perceived group membership may function, in this context, as a social-emotional reward. Individuals' social identification as a member of the group might be positively associated with their regular attendance (Stevens et al., 2019). According to Tajfel and Turner (2004), individuals strive for social identification and can fulfill this need through group affiliation. Identifying oneself with a group can have both positive and negative effects on health and health behavior. Social identification can be health compromising when individuals affiliate themselves with high health-risk groups, such as smokers or drug users (Haslam et al., 2009), which might strengthen intentions to adhere to their own risk behaviors. Contrarily, social identification can also result in positive effects on health, for example, by increasing well-being and physical health through its link to positive group affiliation (Steffens et al., 2016). There is also accumulated evidence that older adults, who identify with their group, are more likely to regularly attend group-based training sessions (e.g. Farrance et al., 2016; Stevens et al., 2018).

In the falls prevention context, Fleig et al. (2016) showed that older adults identified the group format as one of the highlights of the program. Along this line, Kramer and

Labudek et al. (2020) developed a standardized version of a group-based falls prevention program, which demonstrated feasibility in a pilot study. In line with theoretical reasoning of SST, previous research has shown that group-based programs are superior to one-on-one programs (Kanamori et al., 2015), mainly due to the fact that group-based settings promote positive social identification (e.g. Haslam et al., 2010) and seem to provide an emotionally meaningful exercise context. Older adults, who are less socially integrated might particularly value the feeling of belonging to a group. A lack of social embeddedness due to retirement or the loss of significant others is often reflected in feelings of loneliness (Lindsay Smith et al., 2018). In their review, Cohen-Mansfield et al. (2016) highlighted that loneliness is primarily associated with being single and living alone. The absence of a partner further explains an essential proportion of variance in loneliness among older adults over 80 (Luhmann & Hawkley, 2016). The participation in group-based health-promotion programs offers health benefits on one side, but also an opportunity for social embeddedness and reduced loneliness (Lindsay Smith et al., 2018).

According to SST, older adults face an age-associated reduction in social contacts as they deliberately focus on emotionally meaningful relationships, limiting their time for further contacts (Carstensen et al., 2003). Older adults who live in company might better fulfill their social needs at home and might therefore be in less need for other groups to create a feeling of belonging. Thus, social identification through participation in a health promotion program with stable groups could be particularly relevant for older adults who live alone and lack emotionally meaningful interactions.

Although a growing number of studies emphasize the importance of group membership in the context of health promotion (e.g. Cameron et al., 2018; Cohen et al., 2001; Helliwell & Putnam, 2004), social factors are often neglected – both in theory and practice (Haslam et al., 2018). Based on the social identity theory and health behavior

theories, the present study, therefore, accounts for social-emotional and individual factors to predict training attendance among older adults. In line with SST, we assume that social identification with the training group is positively associated with training attendance in addition to individual, social-cognitive factors as suggested by the HAPA. Social embeddedness, that is, whether individuals live on their own or in company, may moderate this relationship. Older adults, predominantly those who are less socially integrated, may be more inclined to fulfill their social needs by joining a falls prevention group.

Hypotheses

Social identification with the training group is positively associated with attendance of the group-based training sessions beyond individual social-cognitive variables (i.e. risk perception, outcome expectancies, self-efficacy and intention). Form of housing moderates the relationship between social identification with the training group and attendance. The positive relationship between social identification and training attendance is stronger for participants who report to live on their own compared to those living in company.

Materials and methodology

This study presents analyses of an evaluation project of the group-based falls prevention program *"Be active, but safe – an outpatient falls prevention program"*. The falls prevention program is funded and facilitated by the *AOK Nordost*, a German health insurance company. To evaluate the program, we employed a one-group prospective design in which we followed participants who were already enrolled in the group-based program, for six months. Data collection for the first (T1) and second measurement point (T2) took place between October/2017 and January/2018 (T1) and July/2018 and July/2019 (T2), respectively. Data analyses of the present study focused on self-reports collected via paper-

pencil questionnaires answered by participants of the falls prevention groups. Detailed information and pre-registration data of further measured assessments (e.g., group observation, gait speed, trainer survey) can be found through the German Clinical Trials Register (www.drks.de; ID = DRKS00012321). Before answering the questionnaires, participants completed an informed consent, approved by the ethics committee of the Department of Education and Psychology of the *Freie Universität Berlin* (number 165/2017).

Procedure

At T1, research assistants visited the training groups throughout Berlin and Brandenburg, informed participants about the study and invited them to complete a self-report questionnaire including social identification with the training group, risk perception, outcome expectancies, self-efficacy beliefs, intention, form of housing, and subjective health status. Six months later, at T2, three members of the research team revisited the training groups to collect data on training attendance.

Sample

Participants consisted of individuals who were already enrolled in the ongoing falls prevention program. Overall, we excluded six care homes from further data analyses and T2 assessments, as trainers reported that the participating older adults were diagnosed with moderate to severe dementia. Twenty-six institutions were included in the study. Of those, 20 were meeting places for older adults and six were care homes. Within these 26 institutions, 34 training groups agreed to participate at T1. Overall, $N = 174$ participants completed the baseline questionnaire. Of those, $n = 125$ participants completed the follow-up questionnaire (72% of T1; main reasons for drop-out: not present at T2 training session due to health issues or holidays). Individuals, who were not present at T2, received a follow-up questionnaire by post. The mean age of participants of the longitudinal sample was 76

years ($M = 75.99$, $SD = 7.11$, min = 51 max = 93). Nearly two-thirds lived on their own (60%) and were single or widowed (62%). Participants were predominantly women (86%) and they rated their perceived health status as good ($M = 70.50$, $SD = 18.81$).

Measurements

We assessed *social identification* with a single-item social identification measure at T1 (Postmes et al., 2013). Participants rated their agreement with the statement "I identify with this group" on a 7-point scale ranging from *fully disagree* (1) to *fully agree* (7). Good convergent and divergent validity as well as good test-retest reliability of this single-item measure were shown in three studies (Postmes et al., 2013).

The following social-cognitive variables were assessed at T1. We measured *risk perception* with two items with regard to fear of falling (based on Friedman et al., 2002): "Have you been afraid that you might fall?" and "Did you limit your activities at home or outside because you were afraid of falling?". Participants rated their answers on a 6-point scale ranging from *(almost) never* (1) to *(almost) always* (5). According to Jung (2008) the directness of this measure can be seen as a strength because it provides a simple response. Moreover, it detects variability in the degree of fear compared to a yes/no answering format (Legters, 2002). The internal consistency of the two items was $r = .82$ in our sample. We assessed *outcome expectancies* based on eleven items of the *Physical Activity Enjoyment Scale* (*PACES*, Kendzierski & DeCarlo, 1991). The items were measured with a 7-point scale with two contrasts, e.g., "I feel physically good while doing the exercise" and "I feel physically bad while doing the exercise." The German version of the PACES showed sufficient test–retest reliability, internal consistency and criterion-related validity (Jekauc et al., 2012). Jekauc et al. (2012) identified the mixture of positively and negatively worded items as one limitation of this scale. To avoid wrong evaluations due to potential response tendencies, it is recommended to use only the negatively worded items and exclude the

reversed items (e.g. Dishman et al., 2005; Paxton et al., 2008). In our study, this procedure led to a Cronbach's α of .87. *Self-efficacy beliefs* were measured using three items based on Scholz et al. (2005) who reported good internal consistencies. Participants rated their self-efficacy beliefs on a 6-point scale with an answering format ranging from *fully disagree* (1) to *fully agree* (6), e.g., "I am sure, that I will perform the exercise regularly, even though it sometimes requires effort." The three items showed an internal consistency of $\alpha = .79$ in this study. The *intention* to participate regularly in the group-based training was assessed with a 6-point scale of two items based on Schwarzer et al. (2003): "I have the intention to participate regularly in the training" and "Taking part in the training motivates me to incorporate more exercise into my daily routine." The intercorrelation of the two items was r = .40.

We measured *subjective health status* at T1 using the visual analogue scale from the *EQ-5D* (Rabin & de Charro, 2001). Participants marked their health status on a vertical line between the best imaginable at 100 and the worst imaginable health status at 0. For older adults, the EQ-5D showed good reliability and validity (Haywood et al., 2005).

In order to measure *social embeddedness*, we assessed form of housing through five categories at T1: alone, together with the partner/a family member/a friend or in a residential community. In addition, participants had the opportunity to add other cohabitants. We recoded answers into a dichotomous variable: alone (0) and in company (1).

Training attendance was measured at T2. Participants answered the question "How often did you participate in the group-based training on average in the last six months?" with a 7-point answering format ranging from *never* (1) to *always* (7) (adapted from Schwarzer et al., 2008).

Results

Statistical procedures and analysis

IBM SPSS Statistics 25 was used to analyze data. To test the moderation hypothesis, we used the PROCESS macro for SPSS (Hayes, 2018). Missing values were imputed with the *EM algorithm*. The *ExpectationMaximization (EM)* algorithm is an iterative procedure using auxiliary variables to find maximum likelihood estimates for model parameters. After verifying whether the imputed value (Expectation) is the value most likely (Maximization), a more likely value is imputed or the algorithm converges on a fixed point (Enders, 2010). We inspected *Tolerance* and *variance inflation factors* (*VIF*) across all predictors to test for multicollinearity. Across our sample, no score was salient (*VIF* < 2, *Tolerance* > 0.7), hence no multicollinearity was assumed. Drop-out analyses revealed no systematic differences between older adults completing T2 and those, who discontinued their participation. The intraclass correlation coefficient was .34 indicating that 34% of the variance in attendance is explained through differences between the groups. However, a major restriction to conducting multilevel analyses refers to the higher-level sample size. Results of simulation studies suggest that small sample sizes at level 2, as is the case in our study, leads to biased estimates (Maas & Hox, 2005). Due to the small size and an extremely unbalanced allocation of units across training groups (min = 1, max = 24), we refrained from conducting multilevel analyses.

Descriptive results

Table 1 shows the descriptive statistics and bivariate correlations between all variables. Correlation coefficients revealed small to moderate associations.

Hypothesized model predicting training attendance of older adults

To test the association between social identification with training group and attendance (Hypothesis 1), we conducted a hierarchical regression analysis. Subjective

health status, age and gender were entered into the model as a first step ($R^2 = .04$). The second step introduced risk perception, outcome expectancies, self-efficacy beliefs and intention ($R^2 = .07$, $\Delta R^2 = .04$, $p = .306$). Social identification was included in the final step ($R^2 = .17$, $\Delta R^2 = .09$, $p < .001$). Social identification with the training group at T1 predicted training attendance at T2 ($\beta = .32$, $p < .001$, $n = 125$). Risk perception, outcome expectancies, self-efficacy beliefs, intention, subjective health status, age, and gender were not associated with attendance.

Hypothesized model predicting training attendance: for whom does social identification matter most?

In the second model, form of housing was tested as a moderator of the association between social identification and training attendance, controlling for individual social-cognitive variables and sociodemographics. Table 2 presents the results of the hierarchical regression analysis. As expected, social identification with the training group predicted training attendance but only for participants living alone ($\beta = .87$, $p < .001$) controlled for risk perception, outcome expectancies, self-efficacy beliefs, intention, subjective health status, age and gender. When participants reported to live in company, there was a non-significant positive relationship between social identification and attendance ($\beta = .14$, $p > .05$). R^2 increased by 5% ($R^2 = 24\%$, $n = 119$) after introducing the interaction term (form of housing * social identification). The results with imputed values did not differ substantially from those, which included the smaller sample size. Figure 5 illustrates the interaction effect.

Table 1

Descriptive Statistics and Bivariate Correlations in Longitudinal Sample

Variable	*M*	*SD*	*skewness*	*kurtosis*	1	2	3	4	5	6	7
1. Social Identification (T1)	5.52	0.78	-1.59	1.78	1.00						
2. Risk Perception (T1)	1.95	0.88	0.61	-0.44	-.13	1.00					
3. Outcome Expectancies (T1)	5.83	1.34	-2.16	4.74	.25**	-.14	1.00				
4. Self-efficacy (T1)	4.43	1.46	-0.79	-0.25	.15	.08	.01	1.00			
5. Intention (T1)	5.29	1.03	-1.88	3.45	.22*	-.24**	19*	.44***	1.00		
6. Health Status (T1)	70.49	18.81	-0.72	0.31	.10	.50***	.15	-.02	.27**	1.00	
7. Attendance (last 6 months, T2)	5.97	1.21	-1.72	3.86	.34***	-.03	.14	.13	.03	.14	1.00

*Note. n = 125, *p < .05 **p < .01 ***p < .001*

Table 2

Results of the moderated regression analysis with attendance

	β	*SE*	*t*	*p*
1. step				
Health Status	.01	.01	1.94	.055
Age	.01	.01	0.52	.605
Gender	.22	.32	0.71	.480
2. step				
Risk Perception	.02	.14	0.12	.908
Outcome Expectancies	.09	.08	1.15	.253
Self-Efficacy Beliefs	.14	.08	1.67	.098
Intention	-.23	.13	-1.74	.085
3. step				
Social Identification	.58	.14	4.07	.001***
Form of Housing	-.09	.21	-0.44	.658
4. step				
Social Identification * Form of Housing	-.73	.28	-2.63	.01*
	Conditional effects at Form of Housing			
Alone	.87	.19	4.64	.001***
In company	.14	.21	0.68	.497

Note. $n = 119$, $R^2 = .24$, *p* < .05. ***p* <.001

Figure 5

Relationship between social identification with the training group and attendance

for individuals living alone and individuals living in company
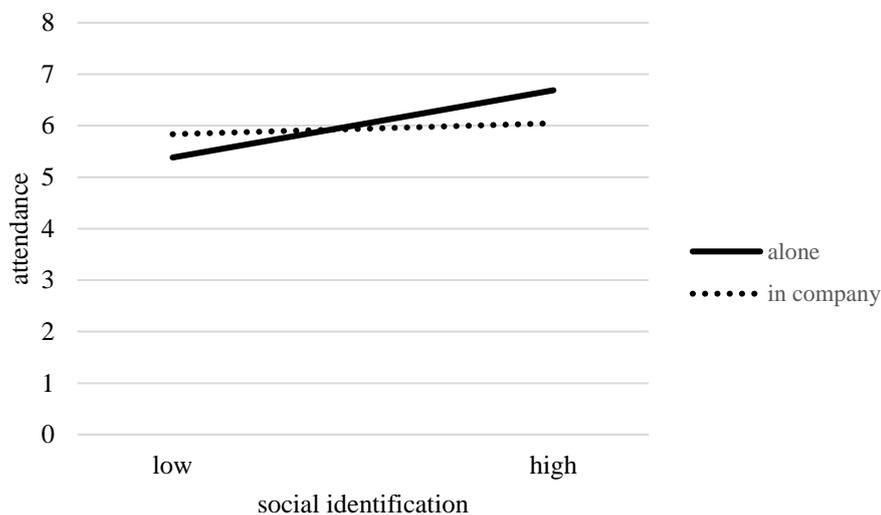
Discussion

In this study, we examined social-emotional and individual, health-related predictors of older adults' attendance of a falls prevention program over a period of six months. As hypothesized, social identification with the training group predicted attendance of the group-based sessions for participants who lived alone. The positive relationship between social identification and attendance of participants living in company was non-significant. The individual health-related predictors risk perception, outcome expectancies, self-efficacy beliefs, and intention were not related to training attendance in the present sample. Thus, social identification with the training group was positively associated with attendance beyond individual, health-related factors. Overall, our results suggest that older adults who are less socially integrated may fulfill their social needs by engaging in a falls prevention group.

Previous research has focused on general program features that have an impact on the attendance of group-based exercise programs among older adults (e.g. De Lacy-Vawdon et al., 2018; Farrance et al., 2016). For instance, instructor characteristics, class duration and frequency were identified as facilitators for the attendance of group-based physical activity among older adults (De Lacy-Vawdon et al., 2018). Our study adds that social perceptions of the group (identity with a training group) may be just as important to consider when motivating individuals to regularly attend a program.

Regarding the usual age range of participants of falls prevention programs, it is important to consider theories from lifespan psychology when examining engagement in physical activity (Gellert et al., 2012) and falls prevention programs, in particular. In line with SST our findings have the following practical implications: when developing theory- and evidence-based exercise programs for older adults it may not be sufficient to focus only on individual, health-related factors. Social-emotional factors such as the social identification with an exercise group should be considered as well. Highlighting the opportunity to fulfill social needs by engaging in a program might better speak to the target group than highlighting health benefits.

Limitations

Although this is a longitudinal field study, the largest limitations are its lack of a control group and the fact that assessments were taken at any point within an ongoing falls prevention program. The question of causality arises, as attending the falls prevention program might also have initially led to higher levels of social identification. Future research should investigate the relationship between social identification and attendance of a falls prevention program by using longitudinal study designs with multiple assessment points.

Furthermore, average levels of reported social identification were above the scale mean. This may have several reasons. First, participants had already been enrolled in the group-based falls prevention program before we started our data collection. Thus, we could not investigate developments of social identification with the training group over time. Second, older adults who perceived low levels of social identification might have already discontinued their participation in the group-based sessions before our data collection started. This assumption might explain the skewed distribution of social identification across the sample. In addition, the distribution of outcome expectancies, intention, and training attendance were also positively skewed possibly due to the inclusion criterion (i.e., being a participant of the ongoing falls prevention program). Nonparticipants could not be included in the study, which may have resulted in range restrictions.

All data were self-reported, which is prone to bias and social desirability. Especially objective measures of attendance in the group-based sessions would be preferable in future studies. Risk perception is usually conceptualized as being composed of two components: perceived severity of falls and individuals' perceived vulnerability toward falling (Weinstein et al., 2007). We considered fear of falling, which can refer to the perceived vulnerability of individuals. Future studies should also include measurements of individuals' perceived severity of falls. In addition, participants' overall perceived health-status was good. Older adults with worse health status might not be as motivated to engage in falls prevention programs and studies in general (Beyer et al., 2015). Consequently, generalizations of our findings to people with worse health status are difficult to draw.

Implications for research

Our results integrate well with previous research (e.g. Gellert et al., 2011; Gellert et al., 2012; Mikels et al., 2010), which underlines the importance of social-emotional factors for physical activity in older adults. Drawing on SST, Gellert et al. (2011) found for

example that older adults were more inclined to participate in physical activity, if their partner was assigned to the same program. Furthermore, social relations within an exercise program are positively associated with subjective wellbeing in older adults (Lindsay Smith et al., 2018) and seem to encourage training attendance (Chiang et al., 2008).

Our study is located at the crossing point of health psychology and gerontopsychology. So far, no comprehensive theory allows specific predictions for physical activity behavior change across the lifespan. Therefore, we investigated SST-predictions within a HAPA-framework. Future studies on physical activity in old age may profit from a systematic theory building process in their planning phase, for example, by taking individual's satisfaction of social needs into account (e.g., Social Determination Theory; Deci & Ryan, 1985).

Practical implications

Our results provide preliminary support for the idea that it may be more effective to emphasize social-emotional rather than individual, health-related advantages of a group-based falls prevention program. Furthermore, positive message framing was found to promote physical activity among older adults (Notthoff & Carstensen, 2014; Whaley & Ebbeck, 2002). Thus, emphasizing the advantages of physical activity is more effective than providing information about possible risks of physical inactivity (Notthoff et al., 2016). In the falls prevention context, one could try to motivate individuals by using messages such as "promoting a physically active lifestyle together" instead of "being physically active to prevent falls."

Conclusion

When implementing health promotion programs among older adults, patterns of social embeddedness of participants should be considered. Providing group-based sessions

and emphasizing social benefits of being active together are constructive strategies to maintain training engagement.

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3

Perceived Physical Functioning and Gait Speed as Mediators in the Association between Fear of Falling and Quality of Life in Old Age

Steckhan, G. M., Fleig, L., Schwarzer, R., & Warner, L. M. (2022). Perceived physical functioning and gait speed as mediators in the association between Fear of Falling and Quality of Life in Old Age. *Journal of Applied Gerontology, 4(2)*, 421-429. https://doi.org/10.1177/0733464820979188

Abstract

Preserving quality of life in old age gains in importance, but fear of falling considerably limits quality of life. The aim of our study was to understand how physical mediators may translate fear of falling to quality of life. At Time 1, fear of falling, subjective leg strength, balance, quality of life, and objective gait speed were assessed. Quality of life was reassessed after 6 months, at Time 2 ($n = 125$). A sequential mediation analysis examined whether the relationship between fear of falling and quality of life could be mediated by leg strength, balance, and gait speed. Fear of falling was directly associated with quality of life ($\beta = -.27$; 95% CI [-0.007, -0.001]) as well as indirectly via leg strength, balance, and gait speed (specific sequential indirect effect: $\beta = -.03$; 95% CI [-0.06, -0.001]; $R^2 = .40$ in quality of life; controlled for age, quality of life at Time 1). An intervention approach could be to address fear of falling and foster physical functioning and gait speed to maintain quality of life.

Keywords

quality of life, fear of falling, physical functioning, gait speed, older adults

Introduction

Maintaining quality of life is one of the main goals in the process of active aging (World Health Organization [WHO], 2002). According to the *WHO*, quality of life is an individual's perception of one's own physical health, mental state, level of independence, social relationships, and personal beliefs with regard to their environment (The WHOQOL Group, 1995). As quality of life has become a key performance indicator in health care, maintaining quality of life is the goal of many intervention programs (Oppikofer & Mayorova, 2016). Against the background of the demographic development in most countries in the Western world, there is an urgent need to investigate factors that could affect quality of life in old age (Çinarli & Koç, 2017). Age has been suggested as one correlate of quality of life, but research has revealed no consistent relationship between quality of life and age (Hansen & Slagsvold, 2012; Netuveli et al., 2006). In contrast, accumulated evidence suggests a positive association of quality of life with health status, social integration, and socioeconomic status (e.g., Campos et al., 2014; Layte et al., 2013). Age and socioeconomic status, in particular, are variables that are fixed, an alternative approach is to identify *modifiable* factors that are associated with age, for example, fear of falling (Hoang et al., 2017).

Fear of falling in association with quality of life

Fear of falling is one subcategory of falls-related psychological concerns (Hughes et al., 2015) and can be understood as a psychological risk factor for falling that goes beyond other concepts, that only consider falls-related *physical* abilities (Vaapio et al., 2008). Fear of falling is even more common among older adults than actual fall incidents (Chang et al., 2016). Older adults may report or develop concerns of falling irrespective of whether or not they have previously experienced a fall (Scheffer et al., 2008). Tinetti and Powell (1993) describe fear of falling as an individual's continuous concern about falling,

which in turn leads to the avoidance of activities—even if the capability to perform these activities remains intact. Results of a current systematic review revealed a negative relationship between fear of falling and quality of life in adults aged 60 years and older (Schoene et al., 2019), indicating that higher fear of falling is related to lower quality of life within this population. Across different operationalizations of fear of falling in the original articles, Schoene et al. (2019) revealed a consistent association between fear of falling and quality of life. Throughout the 31 peer-reviewed articles included in the review, fear of falling was measured by either assessing the concern about falling itself or by using the *Falls Efficacy Scale* (FES-I, Yardley et al., 2005). In contrast to merely asking individuals about their concern about falling, the FES-I assesses individuals' confidence in performing daily activities without falling (Yardley et al., 2005). In that review, the self-report measures of quality of life were diverse, too. Among others, a quality of life assessment developed by the WHO (*WHOQOL-BREF*), the *Short Form 36* (*SF-36*), and the *EQ-5D* were used.

Besides the psychological construct of fear of falling, a higher number of actual falls is also related to lower quality of life in older populations (Boyé et al., 2015; Pérez-Ros et al., 2019). However, Schoene et al. (2019) reported a lower impact of actually experienced falls on quality of life in comparison to fear of falling. In line with this finding, a large-scale study on women's health showed that differences in quality of life between fallers and non-fallers emerged as early as 12 years *before* the first reported incident of a fall (Peeters et al., 2015). This discrepancy in quality of life between fallers and non-fallers might be based on risk factors other than the actual falls themselves (Iglesias et al., 2009; Peeters et al., 2015).

Fear of falling and its association with leg strength, balance, and gait speed

In addition to fear of falling, serious risk factors for falls are leg strength, balance, and gait speed (Ambrose et al., 2013; Rubenstein, 2006). The systematic review by Denkinger et al. (2015) suggests that there is a reciprocal relationship between fear of falling and the before mentioned risk factors for falls. Fear of falling can develop due to deteriorating abilities, but fear of falling itself may initiate a process of feeling less capable to move around (Wijlhuizen et al., 2007), leading to impaired functioning (Denkinger et al., 2015) - in the sense of "use it or lose it." Restrictions of physical activity due to fear of falling might lead to decreasing muscle strength and, ultimately, to reduced gait speed (Denkinger et al., 2015; Donoghue et al., 2013). Findings by Delbaere et al. (2009) suggest that both psychological and physiological risk factors are negatively related to gait speed. To measure psychological risk of falling, the authors used the FES-I (Yardley et al., 2005), whereas the *Physiological Profile Assessment* (Lord et al., 2003) objectively measured physiological risk of falling by muscle strength and standing balance, among others (Delbaere et al., 2009). Thus, lower muscle strength and balance might be important predictors for decline in gait speed in old age (Kline Mangione et al., 2008) and consequently relevant indicators for assessing physical functioning.

Physical functioning and gait speed in association with quality of life

Increasing evidence shows that leg strength, balance, and gait speed are related to quality of life in old age (Lin et al., 2015; Sartor-Glittenberg et al., 2014; Vagetti et al., 2015). Results of a longitudinal study confirmed this finding and additionally highlight that performance-based balance and walking, can be used to predict decreased quality of life in older adults (Davis et al., 2015). Therefore, Davis et al. (2015) recommended to promote and particularly target older adults' physical functioning in interventions, to maintain quality of life. Conversely, quality of life should be regarded as an outcome measure to

assess the effects of intervention programs in health care, as suggested by Vaapio et al. (2008). The results of their systematic review on quality of life in the context of falls prevention indicate that improvements in quality of life are accompanied by improvements in physical functioning (Vaapio et al., 2008). Given the fact that falls prevention programs could address fear of falling and incorporate balance and strength exercises, such programs might be particularly suitable for promoting quality of life in old age. Against this background, we address the question of the role of physical functioning and gait speed in the association between fear of falling and quality of life in our study.

Physical functioning and gait speed in the association between fear of falling and quality of life

Most studies focused on direct relationships between fear of falling, physical functioning, gait speed, and quality of life and do not consider physical functioning and gait speed as working mechanism behind the relationship between fear of falling and quality of life (Schoene et al., 2019). A cross-sectional study investigated the associations between leg strength, gait speed, and quality of life with fear of falling in women aged 70 to 80 years (Patil et al., 2014). The results revealed that women who were highly concerned about falling reported lower quality of life, as well as showed limited physical functioning and a slow gait speed. However, the relationships between leg strength, gait speed, and quality of life were not described. In addition, Lin et al. (2015) examined older adults with an increased risk of falling and found that performance-based lower gait speed and impaired balance were related to declines in quality of life. Due to their cross-sectional research designs, developments over time could not be investigated in these studies.

Aims and Hypothesis

To gain a better understanding of the role of physical functioning and gait speed in relation to fear of falling and quality of life, we bring both lines of research together: fear

of falling and its negative relation to physical functioning as well as a slow gait speed as a predictor of decreased quality of life. Therefore, the aim of our longitudinal study is to investigate physical functioning and gait speed as putative mediators in the negative association between fear of falling and quality of life in a sample of older adults. As depicted in Figure 6, self-reported leg strength, balance, and objectively measured gait speed might account for the relationship between fear of falling and quality of life. We hypothesized that higher fear of falling predicts poorer quality of life through a sequential pathway from lower leg strength and balance to slower gait speed. This study presents post hoc analyses of an existing data set based on a larger prospective study (www.drks.de; ID = DRKS00012321).

Figure 6

The conceptual multiple-step mediation model
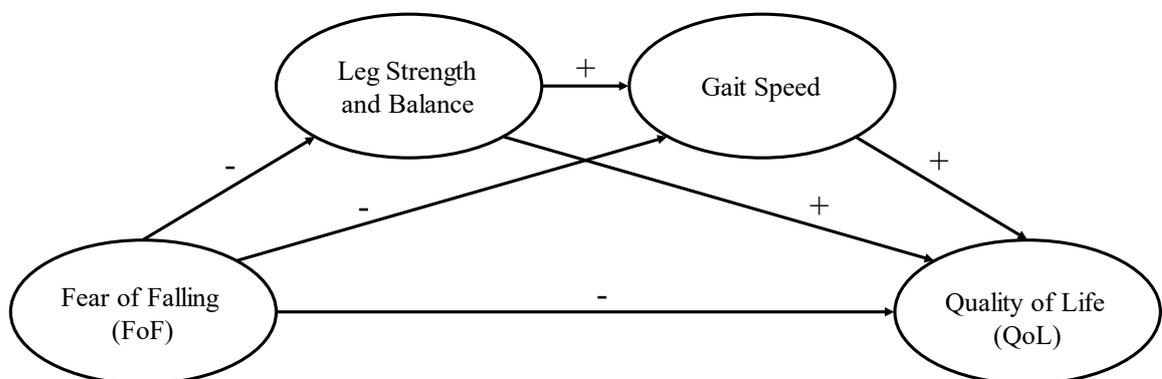
Note: - = hypothesized negative relationship, + = hypothesized positive.

Method

Design and Procedure

This study presents analyses of a study evaluating the acceptance and efficacy of the group-based falls prevention program "*Be active, but safe*", developed by the *AOK Nordost*, a German health insurance company. The falls prevention groups were provided

by qualified volunteers, trained by the health insurance company. The trainers were co-workers in meeting places or employees of the health care homes where the program took place. In addition, training materials were funded by the health insurance company. Participation in the ongoing falls prevention program was free of charge. Detailed information and pre-registration data can be found through the *German Clinical Trials Register* (www.drks.de; ID = DRKS00012321). For recruitment, contact details of meeting places and care homes were relayed by the health insurance company. Participation required signing an informed consent form, which was approved by the ethics committee of the *Freie Universität Berlin*. Individuals who were already enrolled in the falls prevention program were included as participants in the study. On average, participation in the falls prevention program lasted for 2 years and 3 months (*SD* = 1 year and 11 months) before data collection started. Six of 12 care homes from T2 assessments were excluded, as their residents had been diagnosed with moderate to severe dementia. While a publication (Steckhan et al., 2021) focused on self-reported, individual, and social predictors of group attendance in the falls prevention program, the present study focused on the interplay between self-reports and objectively measured gait speed.

At Time 1 (T1), research assistants visited the training groups located in meeting places and care homes throughout Berlin and Brandenburg. After receiving information about the study and signing an informed consent form, participants were asked to fill in a questionnaire, which included items assessing self-reported fear of falling, leg strength, balance, and quality of life among others. In addition, data on performance-based gait speed were collected. Six months later, at Time 2 (T2), members of the research team visited the training groups again to reassess data on quality of life.

Measures

Fear of falling was measured at T1 with the German version of the *Falls Efficacy Scale* (Dias et al., 2006), consisting of 16 items to assess different activities of daily life (e.g., cleaning the house, walking outside). Participants were asked to rate these activities, with regard to their concerns about falling during performance, on a 4-point scale, ranging from *not at all concerned* (1) to *very concerned* (4) (total score: range: 16–64). Excellent internal and test–retest reliability of the English Version of the *FES-I* was presented in a large-scale study (Yardley et al., 2005). The internal consistency could be confirmed in this study (Cronbach's α = .92).

Leg strength and balance were measured at T1 using two self-developed questions "How would you estimate your leg strength/balance?" with a 6-point scale, ranging from *very weak* (0) to *very strong* (6). In our sample, the correlation of the two items assessing physical functioning was r = .80.

We measured gait speed as part of a *Walking While Talking Test* (*WWT*; Verghese et al., 2002) at T1. In the first condition, participants were timed walking 3 m in their daily gait speed. In the dual-task condition, participants counted backwards by threes from a given number while walking the same distance (adapted from Schwenk et al., 2010). In the last condition, participants counted backwards by threes from a given number without walking. For the purpose of this study, only the first condition is relevant. To prevent a lower gait speed when starting and ending the walk, the overall distance comprised of 5 m, but only the 3 m in the middle were timed. We calculated gait speed as meters per second (m/s) so that higher levels of gait speed imply a shorter time to walk the standardized distance. An interrater reliability of the *WWT* of r = .60 was shown by Verghese et al. (2002).

Quality of life was assessed based on the single index value of the *EQ-5D* (Rabin & Charro, 2001) at T1 and T2. The descriptive system considers the following five dimensions: *mobility, self-care, usual activities, pain/discomfort*, and *anxiety/ depression*. Each dimension is divided into five levels ranging from *no problems* (1) to *extreme problems* (5). After forming the index score, the total value comprised of values ranging from 0 to 1. The higher the index score, the higher the reported quality of life. A review of self-assessed health instruments for older adults revealed good reliability and validity of the EQ-5D (Haywood et al., 2005).

Statistical Analyses

Drop-out analyses revealed that there were no differences in perceived fear of falling, leg strength and balance, quality of life, performance-based gait speed and age (p > .05) between participants who completed the assessments at both time points and those who did not. A multiple step mediation analysis was run in *IBM SPSS Statistics 25* using the *PROCESS* macro (Hayes, 2018). Little's Missing Completely At Random (MCAR) test revealed that data were MCAR ($\chi 2 = 34.41$, p > .05). Missing values were imputed with the *EM algorithm* in the longitudinal sample. The dependent variable quality of life was regressed on the independent variable, fear of falling, via the chain of leg strength, balance, and gait speed as two sequential mediators. We analyzed the direct effect of fear of falling on quality of life, the indirect effects of leg strength, balance, and gait speed mediating between fear of falling and quality of life and the total effect, as well as two single mediation paths, each skipping one of the mediators. As depicted in Figure 6, six path coefficients, three specific indirect effects and the total indirect effect were estimated. The indirect effects were estimated via a bootstrapping procedure with 5,000 resamples and 95% confidence intervals.

Results

Sample

Twenty-six institutions were included in the study. Of those institutions, 20 were meeting places for older adults and six were care homes. Within these 26 institutions, 34 training groups agreed to participate at T1. Overall, $N = 174$ participants completed both the baseline questionnaire and gait speed test. Individuals who were not present at T2 received a follow-up questionnaire via postal mail. A subsample of $n = 125$ participants answered the follow-up questionnaire (72% of T1). The sample was heterogeneous in terms of age, ranging from 51 to 93 years in the longitudinal sample, with a mean age of 76 years ($SD = 7.11$). As depicted in Table 3, our sample consisted predominantly of women (87%). Concerning falls, 25% of participants reported to have fallen within the six months prior to the baseline assessment (T1); 18% of participants indicated that they require the use of a walking aid in daily life. During the gait-speed test, only one person used a walking aid.

Descriptive Statistics

Table 4 presents means, standard deviations, and bivariate correlations of all variables included in the model. Fear of falling showed moderate negative correlations with leg strength, balance, and quality of life at both measurement points in time. Leg strength and balance were positively associated with gait speed and quality of life. Gait speed, in turn, was also positively correlated to quality of life at T1 and T2.

Multiple Step Mediation Analysis

Figure 7 presents the results of the multiple step mediation analysis. Fear of falling at T1 was significantly negatively associated with self-reported leg strength and balance at T1, which in turn were positively associated with objectively measured gait speed at T1. Finally, gait speed at T1 predicted quality of life at T2. The total effect of the independent variable fear of falling at T1 on the dependent variable quality of life at T2 was significant

($\beta = -.44$; 95% CI [-0.009, -0.004]). The path remained significant when the mediator variables were included in the model ($\beta = -.27$; 95% CI [-0.007, -0.001]).

Table 3

Frequencies and Percentages in the Longitudinal Sample (n = 125)

Variable		frequency	percent
1. program setting			
	meeting place	97	77.6
	care home	28	22.4
Total		125	100
2. gender			
	female	109	87.2
	male	16	12.8
Total		125	100
3. walking aid			
	no	92	73.6
	yes	23	18.4
Missing		10	8
Total		125	100
4. fall/s six months prior to T1			
	0	81	64.8
	≥ 1	31	24.8
Missing		13	10.4
Total		125	100

Note. T1 = Time 1

Table 4

Descriptive Statistics and Bivariate Correlations in the Longitudinal Sample (n = 125)

Variable	M	SD	1	2	3	4	5	6
1. Fear of Falling (T1)	22.21	6.08	1.00					
2. Leg Strength and Balance (T1)	3.63	1.23	-.58**	1.00				
3. Gait Speed (T1)	2.71	0.89	-.49**	.48**	1.00			
4. Age (T1)	76.00	7.11	.20*	-.17*	-.37**	1.00		
5. Quality of Life (T1)	0.84	0.17	-.52**	.30**	.30**	-.07	1.00	
6. Quality of Life (T2)	0.87	0.09	-.56**	.47**	.43**	-.11	.45**	1.00

Note. *p < .05, **p < .01. T1 = Time 1, T2 = Time 2

Figure 7

The multiple step mediation model in n = 125 participants, R^2 = .40
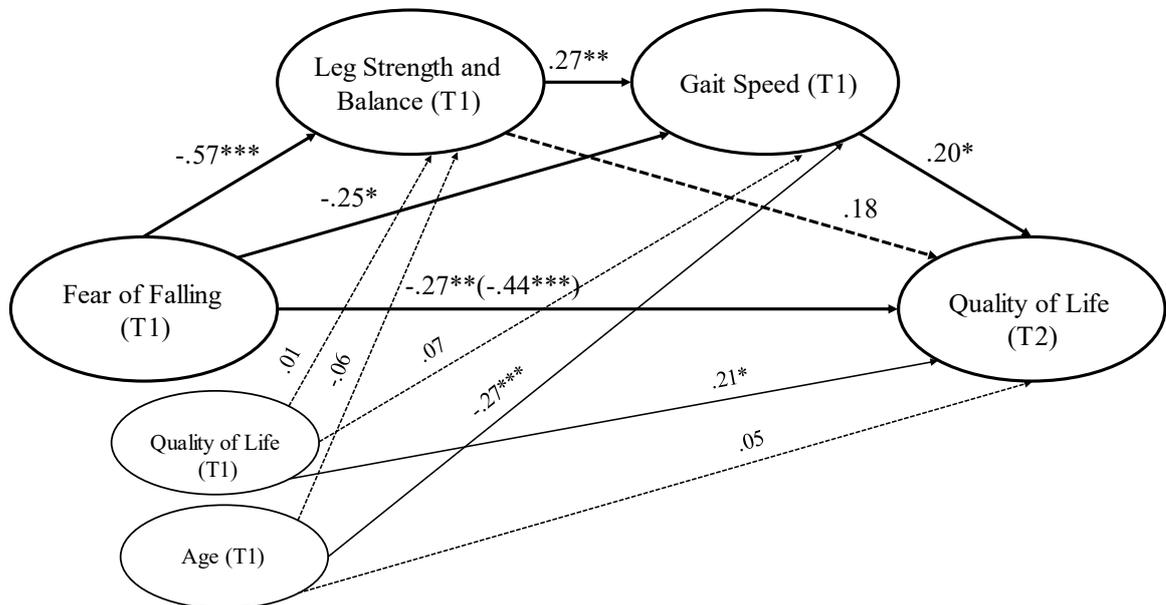
Note. The model is controlled for quality of life at T1 and age; reported coefficients are standardized.
*p < .05, **p < .01, ***p < .001, T1 = Time 1, T2 = Time 2.

In this serial mediation path model, three possible indirect effects were tested. The overall indirect path from fear of falling to quality of life through physical functioning and gait speed was significant (β = −.03; 95% CI [−0.06, −0.001]). The indirect path through leg strength and balance alone was also significant (β = −.10; 95% CI [−0.21, −0.007]), as well as the specific indirect effect through gait speed (β = −.04; 95% CI [−0.08, −0.002]). This indicates that physical functioning and gait speed can serve as independent mediators of the effect of fear of falling on quality of life. All effects emerged over and above the covariates age and quality of life at T1. Age at T1 was negatively associated with gait speed at T1, while quality of life at T1 predicted quality of life at T2 (see Figure 7). Overall, 40% of the variances in quality of life at T2 was accounted for.

Discussion

The current study examined self-reported leg strength, balance, and objectively measured gait speed as sequential mediators in the negative association between fear of falling and quality of life in a sample of older adults. As hypothesized, higher fear of falling predicted poorer quality of life six months later through a sequential pathway from lower leg strength and balance to slower gait speed. In addition to the multiple-step mediation effect, physical functioning and gait speed also served as single mediators between fear of falling and quality of life. Overall, our findings help to explain *how* fear of falling compromises quality of life: higher fear of falling is related to the perception of poorer physical functioning, which is associated with a slower gait speed, subsequently predicting lower levels of quality of life.

The main effect findings integrate well with previous research, which indicates that higher fear of falling is related to lower levels of quality of life (Schoene et al., 2019). The finding that physical functioning alone mediates the relationship between fear of falling and quality of life is in line with current evidence (Davis et al., 2015; Lin et al., 2015; Sartor-Glittenberg et al., 2014), although the previously mentioned studies measured performance-based muscle strength and balance objectively.

Strengths and Limitations

Using a longitudinal design and collecting performance-based data on gait speed contribute to this area of research. Our sample also comprised of older adults who live in care homes, thus offering a broader picture of the older population. In addition, the interplay of leg strength, balance, and gait speed provides further evidence as to how fear of falling translates into quality of life.

Nevertheless, several limitations of our study need to be considered. When conducting a multiple step analysis, it is recommended to measure each variable at different

measurement points in time. In the present analyses, there was only a time lag of six months between the dependent variable and the independent variables. However, we argue that fear of falling and subjective estimates of leg strength and balance would directly limit older adults' gait speed, and that deteriorations in relatively stable ratings of quality of life could be observed with a time lag. Our measurement of self-reported leg strength and balance indicated good internal reliability and predictive validity in the present sample. So far, objective measures of leg strength and balance (e.g., Four Square Step Test, Timed Up and Go test) prevail in research (e.g., Jeon et al., 2017; Lin et al., 2015; Stanghelle et al., 2020) and self-reports are less common. Nevertheless, findings of Latham et al. (2008) revealed that self-reports are comparable to performance-based measures regarding validity. Future studies should combine self-reports with objective measures of balance and leg strength to replicate our findings. In addition, physical functioning and gait speed could have changed during the six months of data collection. Because this study is no randomized controlled trial but an ongoing falls prevention program, and average participation before T1 started was 2 years and 3 months, there might not be a major change on the mediating variables. Finally, our sample was predominantly female. Previous research revealed gender differences regarding fear of falling and quality of life, indicating that women were more likely than men to report higher fear of falling (Chang et al., 2016; Hoang et al., 2017). Evidence also suggests that women aged 60 years and older tend to report lower quality of life than men (Lee et al., 2015; Pérez-Ros et al., 2019; Setiati et al., 2011). Future studies with more balanced samples should therefore address gender differences in terms of fear of falling and quality of life.

Implications

Our results imply that reducing fear of falling as well as strengthening physical functioning and gait speed are essential for the maintenance of quality of life in old age.

This is in line with the definition of the WHOQOL Group (1995), which emphasizes the perception of one's own level of independence as an important indicator for quality of life. Confidence in one's own physical abilities might be an important variable in fostering gait speed and consequently enabling an independent lifestyle. Previous findings suggest that activities and participation could also facilitate a decreased fall risk (de Clercq et al., 2021). Studies often examine quality of life among older adults without explicitly defining this construct. A review revealed for instance that only 43% of 47 included studies defined quality of life (Halvorsrud & Kalfoss, 2007). Consequently, there is a lack of a conceptual framework of quality of life in old age (Boggatz, 2015). A consistent definition of quality of life is required to advance the progress in this field of research.

According to the results, it is important to target fear of falling and other modifiable risk factors in intervention programs for older adults (Davis et al., 2015; Schoene et al., 2019). Particularly multi-component-interventions that promote both physical functioning and cognitions, such as fear of falling could be suitable. Regarding leg strength and balance, interventions may also target self-efficacy to improve the perception of physical functioning. Because the same physical barriers lead to differences in experienced restrictions, depending on self-efficacy beliefs (Warner & French, 2018). Evidence of a review suggests that promoting self-efficacy by using behavior change techniques in interventions is associated with increased physical activity (Williams & French, 2011). Hence, an increase in self-efficacy beliefs could initiate a process of feeling more capable to move around. Current and future falls prevention programs could be improved by including behavior change techniques (e.g., *focus on past success*) to enhance self-efficacy beliefs among participants (Fleig et al., 2016; Kramer et al., 2020). For instance, *setting graded task* and focusing on positive changes through *self-monitoring* could be implemented to foster *mastery experience* (Warner & French, 2018), that is the most

effective source of self-efficacy (Bandura, 1997). Through enhancing self-efficacy beliefs, addressing fear of falling and incorporating balance and strength exercises, falls prevention programs might be a cost-effective approach in fostering the maintenance of quality of life in old age (Iglesias et al., 2009). Such exercise programs should also address older adults who are at low risk of falls to maintain their low risk (Delbaere et al., 2010) and their independence.

Interventions should not only incorporate such intervention modules, but also be evaluated in terms of such modifiable predictors of quality of life (Pérez-Ros et al., 2019). In line with our results, this could consist of fear of falling, physical functioning and gait speed. Previous research suggests significant improvements in fear of falling, muscle strength, and balance in women aged 65 years and older after participating in a group-based exercise program (Stanghelle et al., 2020). These results are in line with a Cochrane review that revealed a reduction of fear of falling immediately after interventions (Kendrick et al., 2014). Nevertheless, evidence regarding the long-term maintenance was insufficient (Kendrick et al., 2014). More longitudinal studies in this field of research are needed to better understand modifiable factors of quality of life, which could be addressed in exercise programs for older adults.

Conclusion

Our study suggests that reducing fear of falling, promoting physical functioning and gait speed may be essential to enhance, or at least maintain, quality of life among older adults. Addressing fear of falling, leg strength, balance, and gait speed in falls prevention programs are promising strategies to prevent restrictions of physical functioning and maintain independence in old age.

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4

Fear of Falling Carries Over into Overprotection in Old Age: A Cross-Lagged Panel Analysis

Steckhan, G. M., Fleig, L., Wurm, S., Wolff, J. K., Schwarzer, R., & Warner, L. M. (2023). Fear of falling carries over into overprotection in old age: a cross-lagged panel analysis. *International Journal of Aging & Human Development. 1-16.* https://www.doi.org/10.1177/00914150231196819

Abstract

Fear of falling might result in overprotection by one's social environment. In turn, feeling dependent could increase fear of falling. However, the association between fear of falling and perceived overprotection and its temporal order is unknown. This longitudinal study explores this potential mutual longitudinal association. This study presents secondary analyses from a larger trial. We tested the association between fear of falling and perceived overprotection in a cross-lagged path model controlled for falls, health-related quality of life, age, gender, and group membership. $N = 310$ participants ($M = 70$ years, range: 64-92) completed self-reports at Time 1, 7 (Time 2) and 11 weeks (Time 3) after baseline assessment. We found a positive association from fear of falling to perceived overprotection ($\beta = .12$, 95% CI [0.02, 0.21], $p = .02$; $\beta = .10$; CI [0.01, 0.18], $p = .03$). The reversed cross-lagged paths were not significant. Findings suggest higher fear of falling translates into perceived overprotection, which may in turn increase loss of independence in old age.

Keywords: fear of falling, overprotection, social support, loss of independence, older adults

Introduction

Fear of falling is a serious concern in old age. It is described as a continuous concern that one might experience a fall (Tinetti & Powell, 1993). This fear may lead to the avoidance of activities, although these are still within the capabilities of an individual (Tinetti & Powell, 1993). Two in three older adults aged 60 years and older are afraid of falling and nearly 40% of them avoid activities as a consequence (Auais, 2017; Merchant et al., 2020). The restriction of activities due to fear of falling can indeed reduce falls (Rivasi et al., 2019). However, avoiding activities results in deterioration in physical functioning which in turn increases the risk for falls (Liu et al., 2020; Whipple et al., 2018). This process can lead to a downward spiral of immobility (Clemson et al., 2012) and may result in a loss of independence in the long term. Hence activity programs for older adults should incorporate strategies to overcome fear of falling besides the promotion of physical abilities to counter the loss of independence (Steckhan et al., 2022). However, fear of falling in old age does not evolve independently of social environment of older adults (Honaker & Kretschmer, 2014) and should be investigated taking this into account.

Fear of falling carries over into social exchange processes in old age: overprotection

While individuals, who experience high fear of falling tend to overprotect themselves from perceived risky activities, these primarily individual concerns could carry over to well-intentioned support from the social environment, or origin from overprotection from the support network. Family, friends, and caregivers might tend to overprotect because they want to help older adults in coping with everyday life, possibly even more so, if they perceive their protégés to experience fear. Thompson and Sobolew-Shubin (1993) defined *overprotection* in adulthood as "a perception on part of the ill adult that he/she is overhelped, induced to be dependent, shielded from stress, and generally not treated as an adult" (p. 87). In other words, overprotection implies the underestimation of older adults'

abilities and consequently the needless support for activities and challenges older adults would still be capable to overcome themselves (Niemann-Mirmehdi et al., 2019). Overprotection can thereby arise in different contexts, such as through family, friends, or significant others at home, but also at care facilities. While social support is considered as positive, overprotection displays an unintended hindrance and could be understood as a maladaptive and problematic manner of receiving support (Thompson et al., 2002). In a qualitative study by Gallant et al. (2007) older adults reported discouragement of physical activity as one example of overprotection. Quantitative research extended this finding and revealed that overprotection is related to lower levels of activation and predicts a decline in physical functioning in the long term (Bertoni et al., 2020; Joekes et al., 2007).

Fear of falling in association with overprotection in old age

Studies examining overprotection among older adults primarily investigated individuals with chronic illnesses such as cardiac or renal diseases (e.g., Bertoni et al., 2022; Jansen et al., 2014). In individuals with chronic diseases higher levels of functional disability may be related to increased levels of perceived overprotection as shown in a study by Cimarolli et al. (2006) investigating older adults with visual impairment. Very little is known about overprotection in association with or as a consequence of fear of falling in old age. However, overprotection might particularly occur in the context of fear of falling due to safety concerns of the social environment. For instance, caregivers reported to alter their routine after a fall with the primary objective to monitor care recipients (Dow et al., 2013). In another study caregivers overprotected their patients with the intention to prevent future falls (Ang et al., 2019). Overprotection of the social environment as extensive assistance with activities of daily living might lead to limited mobility (Yeom et al., 2008), which in turn could increase fear of falling among older adults. In addition, older adults are not just passive recipients of well-intentioned support (Gallant et al., 2007) and might internalize

an overprotective social environment that could manifest itself in fear of falling or the will to comply with the intentions of significant others (in a sense of subjective norms as specified in the *reasoned action approach*; Fishbein & Ajzen, 2009). Having summarized preliminary findings on how fear of falling might elicit overprotection from the social environment but also how overprotection might increase fear of falling, the empirical question arises which association is stronger: the prediction of higher overprotective behavior by fear of falling or the prediction of higher fear of falling by an overprotective social environment. Therefore, we aim to investigate the reciprocity of the relationship between both concepts. This is of particular importance to gain insights into the possible origins and consequences of well-intentioned support from family, friends, and caregivers that might be perceived as overprotective by older adults. If individuals in the social environment of older adults tend to reinforce fear-related beliefs by reacting overprotective, raising awareness among family, friends, and caregivers is required. The social environment could be sensitized to the fact that extensive assistance might result in a loss of independence in old age.

Figure 8

The conceptual cross-lagged path model
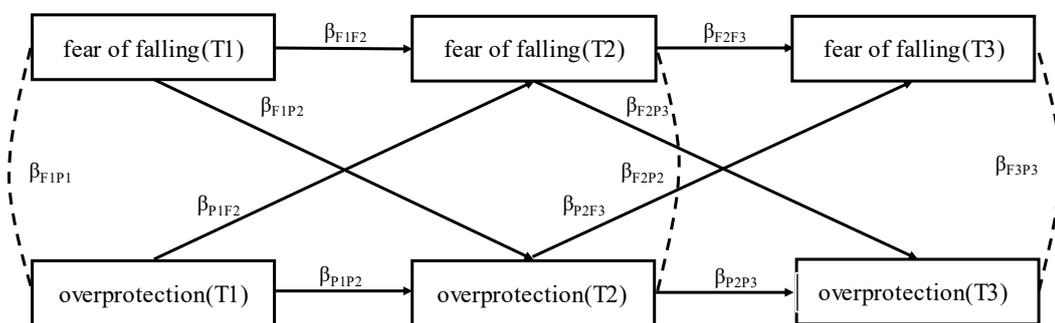
Note. The cross-lagged path model covers four auto-correlations (β_{F1F2}, β_{F2F3}, β_{P1P2}, β_{P2P3}), three cross-sectional correlations (β_{F1P1}, β_{F2P2} and β_{F3P3}) and four cross-lagged correlations (β_{F1P2}, β_{F2P3}, β_{P1F2} and β_{P2F3}).

Aim of the study

As depicted in Figure 1, our study examines the relationship between fear of falling and perceived overprotection in a cross-lagged path model. The longitudinal study with three measurement points spanning three months allows to investigate the reciprocity of the relationship continuously over time to detect a consistent effect. Based on the studies mentioned above we assumed a downward spiral between fear of falling and perceived overprotection. We hypothesized that higher fear of falling is associated with higher levels of perceived overprotection across all assessment points. Conversely, we hypothesized that the perception of higher overprotection of the social environment is related to higher fear of falling for all measurement points.

Methods

Participants and procedure

This paper presents secondary analyses of data from the *PREFER II* trial. The trial was registered at www.clinicaltrials.gov (NCT01577134). The *German Psychological Society* granted ethical consent (DGPs-SW02-2012). Using newspaper articles, flyers, as well as advertisement letters sent to German health insurance companies, a sample of community-dwelling adults aged 64 years and above was recruited in Berlin, Germany. As an expense compensation each participant received 25€. Within the randomized controlled trial (RCT) older adults were randomized into four groups: two intervention groups, an active control group, and a passive control group. The intervention groups comprised a three-hour face-to-face behavior change intervention with motivational and volitional behavior change techniques (BCTs) to increase physical activity in a group setting. The intervention session took place five weeks after Time 1 (T1). See Warner et al., (2014;

2016) as well as Wolff et al. (2014) for further details on study groups of the RCT and a flow chart of study participation.

Inclusion criteria were a minimum age of 64 years and exercising less than twice a week for 30 minutes. We excluded older adults who had an acute physical impairment, were disabled or cognitively impaired. $N = 310$ participants gave their informed consent and filled out the baseline paper-and-pencil questionnaire in Spring 2012. Participants received follow-up questionnaires via mail with prepaid return envelopes seven weeks ($M = 6.95$, $SD = 1.57$, Time 2 (T2)) after T1 and four weeks ($M = 4.27$, $SD = 1.55$, Time 3 (T3)) after T2. Due to inaccuracies in the autoregressive and cross-lagged estimates that are caused by unequal time intervals in cross-lagged path model (Newsom, 2015), we do not consider the fourth measurement point seven months ($M = 27.99$ weeks, $SD = 2.31$) after T3. 253 participants completed T2 (82% of T1) and 244 remained at T3 (79% of T1). Participants' average age was 70 years ($SD = 4.89$, range = 64-92 years) at T1, and women were predominant (75%) in the sample. 53% of older adults were high-school graduates and 46% lived with a partner. Seven percent rated their health status as bad or very bad and a quarter (26%) experienced at least one fall in the past 12 months.

Measures

At T1, *fear of falling* was assessed with two items validated by Friedman et al. (2002) – "In the past 12 months, have you been afraid that you might fall?" and "Did you limit your activities at home or outside because you were afraid of falling?". Both items were reassessed at T2 and T3, while adapting the time interval of the first item – "Since the last survey, have you been afraid that you might fall?". Answers were given on a 5-point scale from *(almost) never* (1) to *(almost) always* (5). In our sample the correlation of the two items was $r_{T1} = .75$, $r_{T2} = .72$ and $r_{T3} = .57$.

Participants rated perceived *overprotection* at each measurement point on a 4-point scale with answering options ranging from *fully disagree* (1) to *fully agree* (4). The following three items from Thompson and Sobolew-Shubin (1993) were used – "People from my family and circle of acquaintances…" "… no longer let me do things that I could do myself.", "…want me to be dependent on them.", "… keep me from doing things that might frustrate me". Good internal consistency was shown in an earlier study by the authors of the scale comprising eight items (α = .88, see Thompson & Sobolew-Shubin, 1993). In our study Cronbach's α was α_{T1} = .52, α_{T2} = .63 and α_{T3} = .71.

Covariates were *falls, health-related quality of life, age, gender,* and *group membership* measured at T1. The question – "How often did you fall in the last twelve months?" was used to assess the number of falls. Health related quality of life was measured with the item – "In general, how would you describe your health in the last 4 weeks?" (TNS Infratest Sozialforschung, 2011). Participants rated their answers on a 6-point scale ranging from *very bad* (1) to *excellent* (6).

Statistical Analysis

Data analyses were performed using the *lavaan* package in *R* (version 4.1.1). With 79% of older adults who participated at T1 completing T3, withdrawal across time was acceptable. X^2-tests and t-tests were calculated to compare participants who dropped out with those who remained in the study on all measures included in these analyses. Results revealed no significant differences. Hospital admissions, major health problems and time constraints were self-reported reasons for withdrawal. As approach to handle missing values, we used the *full information maximum likelihood estimation* (*FIML*) in the longitudinal sample. To allow comparability of the paths in the cross-lagged path model, all metric variables were T-transformed (M = 50, SD = 10).

We tested the longitudinal associations between fear of falling and perceived overprotection using a cross-lagged path model with a two-variable three-wave design. As depicted in Figure 1, the cross-lagged path model covers four auto-correlations (β_{F1F2}, β_{F2F3}, β_{P1P2} and β_{P2P3}), three cross-sectional correlations (β_{F1P1}, β_{F2P2}, β_{F3P3}) and four cross-lagged correlations (β_{F1P2}, β_{F2P3}, β_{P1F2} and β_{P2F3}). The following fit indices were used to assess the model fit: Comparative Fit Index (CFI), the Tucker-Lewis-Index (TLI), the root-mean-square error of approximation (RMSEA), and the standardized root-mean squared residual (SRMR). The model was considered to have a good fit if *CFI* > 0.90, *TLI* > 0.95, *RMSEA* < 0.06, and *SRMR* < 0.09 (Hu & Bentler, 1999; Steiger, 2007). We statistically controlled the model for group intervention at T2 and T3 respectively. Falls, health-related quality of life, age, and gender were taken into account when there was a significant bivariate correlation with fear of falling or perceived overprotection at T1, T2 or T3. The significant bivariate correlations are displayed in Table 1.

Results

Descriptive results

Table 1 displays means, standard deviations and bivariate correlations. Mean values indicate that perceived overprotection remained rather stable across measurement points.

Cross-Lagged Path Analysis

The model fit was good, *CFI* = 0.99, *TLI* = 0.98, *RMSEA* = 0.03, *SRMR* = 0.02. At T3, 56% of the variance in fear of falling was explained, as well as 36% in perceived overprotection. At T2, 51% of the variance in fear of falling was explained, and 17% in perceived overprotection. Figure 2 depicts the results of the cross-lagged path model. Focusing on the cross-lagged paths, the paths from fear of falling to perceived overpro-

Table 5

Descriptive Statistics and Bivariate Correlations in the Longitudinal Sample (n = 310)

| Variable	*M*	*SD*	1	2	3	4	5	6	7	8	9
1. fear of falling (T1)	1.54	0.77	1.00								
2. fear of falling (T2)	1.39	0.63	.68***	1.00							
3. fear of falling (T3)	1.34	0.56	.59***	.70***	1.00						
4. overprotection (T1)	1.29	0.43	.10*	.10*	.05	1.00					
5. overprotection (T2)	1.30	0.45	.15**	.15**	.13*	.39***	1.00				
6. overprotection (T3)	1.32	0.46	.18***	.19***	.22***	.38***	.58***	1.00			
7. falls (T1)	0.43	0.90	.38***	.27***	.26***	.07	.01	-.03	1.00		
8. quality of life (T1)	3.91	0.94	-.25***	-.27***	-.22***	.01	-.06	-0.5	-.05	1.00	
9. age (T1)	70.34	4.89	.10*	.06	.12*	.11*	.05	.17**	.04	-.04	1.00

Note. T1 = Time 1, T2 = Time, T3 = Time 3. *$p < .05$, **$p < .01$, ***$p < .001$

tection were significant across all assessment points (fear of falling$_{T1}$ → overprotection$_{T2}$ β = .12; 95% CI [0.02, 0.21], p = .02; fear of falling$_{T2}$ → overprotection$_{T3}$ β = .10; 95% CI [0.01, 0.18], p = 0.03) and revealed a positive association. The cross-lagged paths from perceived overprotection to fear of falling were not significant (overprotection$_{T1}$ → fear of falling$_{T2}$ β = .02; 95% CI [-0.06, 0.08], p > .05; overprotection$_{T2}$

→ fear of falling$_{T3}$ β = .01; 95% CI [-0.06, 0.07], p > .05). Regarding covariates, falls at T1 were positively associated with fear of falling at T1 (β = .36, p = .001) and T3 (β = .10, p = .015). Health-related quality of life at T1 was negatively related to fear of falling at T1 (β = -.22, p = .001) and T2 (β = -.10, p = .01). Furthermore, age at T1 showed a positive association with perceived overprotection at T1 (β = .10, p = .036) and T3 (β = .12, p = .007).

Figure 9

The cross-lagged panel model
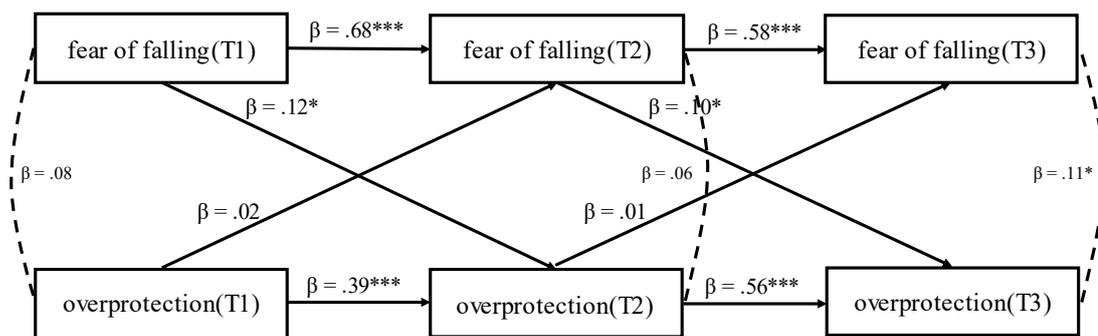
Note. The cross-lagged panel model in n = 310 participants, fear of falling: R^2 = .51 at Time 2, R^2 = .56 at Time 3, perceived overprotection: R^2 = .17 at Time 2, R^2 = .36 at Time 3. Reported coefficients are standardized, controlled for falls, health-related quality of life, age, gender, and group membership, T1 = Time 1, T2 = Time 2, T3 = Time 3. *p < .05, ***p < .001.

Discussion

The present study examined the association between fear of falling and perceived overprotection and their temporal order in a cross-lagged path model over three measurement points in time. Higher fear of falling predicted higher levels of perceived overprotection across all assessment points. The hypothesis that the perception of higher

overprotection from the social environment carries over into higher fear of falling could not be confirmed for any of the measurement points. Overall, these results do not support the assumption of reciprocity or a downward spiral between fear of falling and overprotection, but rather suggest that the individual's fear of falling is transferred to the perception of their social environment, which is perceived as overprotective over time.

These findings are in line with previous research that investigated fear of falling in association with perceptions of autonomy. For instance, a recent study indicates that individuals with higher fear of falling perceive lower levels of autonomy compared to participants with lower fear of falling (Singh et al., 2021). Another longitudinal study among adults with an average age of 65 years supports these findings by showing that fear of falling predicted lower levels of perceived autonomy three years later (Hajek & König, 2020). Our results revealed a positive association between fear of falling and overprotection. Individuals who feel overprotected might feel so because they perceive their autonomy to be restricted by their social environment.

Strengths and Limitations

Our study is among the first to document that older adults' fear of falling carries over into perceived overprotection by the social environment over time. These findings add new insights to research on fear of falling, as we considered perceived overprotection as psychosocial factor rather than examining fear of falling in association with physical factors. A further strength of the current study is the survey period that comprised three points of measurement over three months.

However, several limitations must be addressed. On the one hand, we had a predominantly female sample. Previous studies showed that women are more likely to experience fear of falling in comparison to men (Hoang et al., 2017; Robert Koch-Institut, 2020). Future research should replicate our results with samples that are better balanced for

genders. In contrast to the original scale by Thompson and Sobolew-Shubin (1993), the internal consistency of the overprotection construct was rather low in our study. We measured overprotection with three items of the original scale comprising eight items. In addition, perceived overprotection was assessed regardless of its source and quality. Gallant et al. (2007) showed that unwanted support particularly from family members is perceived as overprotecting as compared to support received from friends. The authors argue that friends might be more discrete, and their overprotective behavior could be refused more easily whereas social interactions with family members are less voluntary and often cannot be avoided. Future studies should also consider the perspective of older adults' social environment as well as the perspective of close friends or the partner (e.g., type and quality of provided support, vicarious fear of falling).

Future Research

Based on our results, we cannot answer the question of whether overprotection is maladaptive in the context of fear of falling and increases loss of independence in old age. Cross-sectional studies suggest that overprotection of the social environment is significantly related to lower levels of activation (Bertoni et al., 2020; Sánchez-Garcia et al., 2019). In line with these cross-sectional results a longitudinal dyadic study on patients surveyed after myocardial infarction revealed that perceiving a partner as overprotective predicted a decline in physical functioning nine months later (Joekes et al., 2007). In contrast, Wolff et al. (2013) investigated the balance of needed and received support and revealed that more support than needed is associated with a lower negative affect among older adults aged 68 and above. Thus, even though overprotection is associated with lower levels of activation and physical functioning it may not result in fear of falling. In addition, perceiving social support as overprotective depends on how older adults perceive their personal capabilities to still perform a task unassisted: If self-efficacy beliefs are high,

receiving unsolicited support may threaten perceptions of autonomy (Warner et al., 2011). Future research should investigate under which conditions older adults perceive social support as overprotective and when it accelerates dependence.

In a study by Spitze and Gallant (2004) older adults reported to have an ambivalent attitude towards receiving assistance. The desire to remain independent competed with the need for support in areas of life that could no longer be handled autonomously. Therefore, it is important to identify forms of support that older adults receive by closer examining the conditions that determine whether it is perceived as positive or negative (Gallant et al., 2007). According to Crombie et al. (2004), a positive way of supporting older adults is to encourage them rather than to overprotect them. The authors demonstrated that encouragement by caregivers helped older adults to overcome fear of falling and to engage in physical activity (Crombie et al., 2004). Thus, supporting older adults' autonomy can be understood as a positive way of support. Another study examining adherence to physical activity revealed that autonomy support is particularly relevant to older adults (Levy et al., 2008). *Autonomy support* implies acknowledging older adults' views, meeting their requests, providing choices, and minimizing control (Williams et al., 2006). Whereas overprotection is described as an individuals' perception of a social environment that induces dependence, averts stress, and does not interact with them as adults (Thompson & Shobolew-Shubin, 1993). Further elaborating on the fine line between support that not only helps solving the recipients' problems but also protects their perceived autonomy and self-integrity will enable deducing advice on how to increase the adequacy of assistance from their social environment. Research with interventional designs might help to reduce overprotective behavior and promote an adequate fit of assistance to recipients' needs.

Implications

Our findings emphasize the importance of investigating fall related beliefs, as these are associated with perceptions of unwanted support from the social environment. To identify the needs of older adults it is important to focus on their resources instead of their disabilities (Sánchez-Izquierdo et al., 2019) and to acknowledge the ambivalence of dependency on support as well as the need for independence (Gallant et al., 2007). Interventions for caregivers and other members of the social network might raise their awareness for overprotective behaviors and to prevent often unintended restrictions of autonomy. A behavioral intervention comprising a weekly one-hour session over three weeks designed for caregivers showed initial success (Sanchez-Izquierdo et al., 2019). After completing the intervention, caregivers reported significant improvements in promoting autonomy behaviors among older adults. Another important component of these interventions might be the focus on views on aging because when age is perceived as a period of cognitive and physical decline, older adults' opportunities for further development could be restricted (Kornadt et al., 2019; Wurm et al., 2022).

Conclusion

Our study is among the first to document that individuals' fear of falling carries over into perceived overprotection over time. However, our results do not support the assumption of reciprocity or a downward spiral between fear of falling and overprotection. This shows that social support perceived as overprotection does not always result in lower capability believes. It might also be counteracted in terms of a strong will to stay active and independent. Moreover, studies on fear-related beliefs and its potential carry-over effects on social interactions are required, possibly also including recipients' and providers' perspective. New findings might help to find a balance between offering adequate support

where needed but at the same time promoting activities that help maintain independence and counteract fears.

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5

General Discussion

General Discussion

Summary of dissertation aims

The overall aim of this dissertation was to advance research on falls prevention by investigating fear of falling as a psychological construct. To date, falls prevention research has been dominated by studies of physical determinants of falls and interventions to improve physical functioning. The goal of the present thesis was to address this research gap by examining fear of falling. Limited research on this psychological construct exists, particularly in longitudinal studies (Hughes et al., 2015; Wu et al., 2020). Another goal of the dissertation was to investigate social-emotional and health-related predictors that could increase attendance of falls prevention programs, as solely focusing on their implementation is insufficient in reducing fall rates (Osho et al., 2018). Table 6 provides a summary of the dissertation aims, findings, and conclusions. In the following discussion, I integrate the empirical chapters (Chapters 2 - 4) into current research and develop them further to include specific implications for practice. I discuss the strengths and limitations of the studies as well as an outlook on suggestions for future research.

Findings and implications

Social identification matters for engaging older adults in exercise programs

Chapter 2 examines to what extent older adults anticipate social-emotional, short-term rewards and long-term health benefits when participating in group-based falls prevention programs. Results revealed that social identification with the training group predicted attendance 6 months later for participants living alone. Individual health-related predictors were not associated with attendance. In accordance with our results, Robins et al. (2016) revealed social interactions within falls prevention programs were more valued by participants who lived alone. Older adults who live in company may have less of a need

Table 6

Summary of dissertation aims, findings, and conclusions

Aims	Findings	Conclusions
Chapter 2 examines whether older adults anticipate social-emotional, short-term rewards or long-term health benefits when participating in group-based falls prevention programs. It was hypothesized that social identification with the training group is positively associated with attendance of the group-based training sessions beyond individual health-related variables.	Social identification with the training group predicted attendance 6 months later for participants living alone whereas there was a non-significant positive relationship for participants who lived in company. Individual health-related predictors were not associated with attendance.	Participation in falls prevention groups may help older adults meet their social needs. Considering the reinforcement of social identification during intervention development and emphasizing short-term advantages may be promising strategies to promote participation in exercise interventions among older adults.
Chapter 3 investigates mechanisms behind the association between fear of falling and quality of life in old age. Leg strength, balance, and gait speed were tested as mediators in the negative association between fear of falling and quality of life in old age.	Physical functioning and gait speed served as single and sequential mediators in the negative association between fear of falling and quality of life. After adjustment for the mediators, the association remained significant, suggesting partial mediation.	The results of Chapter 3 provide valuable insights on intervention development. Targeting leg strength, balance, and gait speed as well as fear of falling as cognitive factor in falls prevention programs could be a promising strategy to maintain quality of life in old age.
Chapter 4 analyses the relationship between fear of falling and perceived overprotection by others over time to detect a consistent effect. A positive reciprocal relationship between fear of falling and perceived overprotection of the social environment was hypothesized.	The results do not support the assumption of a downward spiral between fear of falling and overprotection. The findings rather suggest that the individual's fear of falling is transferred to the perception of their social environment, which is perceived as overprotective over time.	Fear of falling increases the likelihood of well-intentioned support by others, which older adults perceive as overprotective. One approach to promote autonomy behavior is to sensitize the social environment to the fact that extensive assistance might be perceived as overprotective and may restrict independence.

to create a sense of belonging. Social identification through participation in a falls prevention program may be particularly important for older adults who live alone and who lack emotionally meaningful interactions.

Regarding the promotion of group-based falls prevention programs, it may be more effective to emphasize social-emotional gains instead of focusing on the prevention of falls. This might be particularly relevant when older adults lack social embeddedness. Our results are in line with the positivity effect, implying that older adults tend to focus more on positive, rather than on negative information (Carstensen et al., 1999). Falls are a distressing event, which may constitute a barrier to promoting exercise programs for older adults. Instead, community-based exercise may be a positive aspect that should be emphasized to increase motivation to participate in falls prevention programs. It may be more effective to motivate older adults with the message "promote a physically active lifestyle together" rather than the statement "be physically active to prevent falls." Furthermore, Freund et al. (2010) showed that older adults favor goals with a process focus (e.g., social embeddedness) rather than with an outcome focus (e.g., improving muscle strength). Emphasizing short-term advantages instead of focusing on long-term health benefits may be a promising strategy for motivating older adults to take part in exercise interventions (Gellert, 2012; McPhate et al., 2016).

Beyond motives of attendance, the question arises as to how social identification can be enhanced in group-based exercise programs. Theoretically, *social identification* refers to "that part of an individual's self-concept which derives from knowledge of membership in a social group" (Tajfel, 1978, p. 63). Accordingly, the self-concept is composed not only of individual attributes, but also of attributes that are shared with others (Haslam et al., 2019). In other words, the groups that individuals choose to belong to provide social identity (Scheppers & Ellemers, 2019). Individuals form their social identity

through social categorization and social comparison. These cognitive processes, aimed at deriving a sense of belonging, contribute to positive self-esteem (Scheppers & Ellemers, 2019). As social identification increases, the perception of the group changes from "the other group members" to "we as a group" (Steffens et al., 2019). Identifying as a member of a group can lead individuals to align themselves with the norms, values, and ideals of the group in order to achieve a common goal (Haslam et al., 2004). In terms of falls prevention programs, this means that participants with higher levels of social identification may be more motivated to pursue the goal of exercising together than older adults with lower levels of social identification. Following the discussion of theory, the empirical findings are presented below.

Results from a study by Stevens et al. (2022) support our results that social identification predicts regular participation in falls prevention programs. The authors showed that participation in an exercise group was higher when individuals reported stronger social identification. However, living status was not considered in the study. The findings in Chapter 2 of this dissertation contribute to the fact that social embeddedness is an important factor with regard to social identification. Stevens et al. (2022) also conducted a multilevel mediation model in their longitudinal study. Social identification was shown to mediate the positive relationship between participant similarity and attendance. Group members who were similar in age, physical functioning, and expectations reported higher levels of social identification, which, in turn, increased their likelihood for participation (Stevens et al., 2022). Consistent with these findings, adults aged 70 years and older reported that disliking group members was a barrier to regular attendance to falls prevention programs (Robins et al., 2016). In terms of strategies to facilitate social identification, one implication may be to form groups with relatively homogeneous individuals, e.g.,

participants similar in demographic variables and physical functional status (Stevens et al., 2022).

Another approach to increasing social identification among group members refers to the concept of identity leadership (e.g., Steffens et al., 2014; van Dick et al., 2018). *Identity leadership* encompasses the role of leadership in creating a shared sense of identity among group members. This can be achieved by acting as a role model and shaping a sense of unity in terms of group values and norms (Häusser et al., 2020). In addition, using collective language, such as referring to "we" instead of "I" (Steffens & Haslam, 2013), and the development of common goals are possible strategies to foster social identification (Høigaard et al., 2013). Results of longitudinal studies demonstrate that perceived identity leadership predicts participation in exercise programs through social identification (Steffens et al., 2019; Stevens et al., 2020). Participants who perceived higher levels of team leaders' engagement in identity leadership reported higher levels of social identification, which in turn was reflected in higher attendance rates. These findings highlight the importance of identity leadership in the development of social identification and long-term participation in health promotion programs. However, the samples consisted of university students (Stevens et al., 2020) and individuals who were, on average, 39 years old (Steffens et al., 2019). Future research should aim at replicating these findings with samples of older adults. Applied to group-based falls prevention programs, this may suggest that trainers should be responsive to participants in order to promote social identification and long-term attendance. Therefore, trainers who see themselves as both facilitators for teaching exercises as well as leaders who support and guide group-level processes should be recruited. Chapters 2 and 3 of this dissertation are based on a falls prevention program, in which a German health insurance company provided training for volunteer trainers prior to the start of each falls prevention group. The results of Chapter 2

suggest that these trainings should consider the formation and reinforcement of social identity among group members, rather than focusing solely on the exercises. This may be a useful approach to promote social identification among group members, which, in turn, might increase attendance rates.

Addressing fear of falling and physical restrictions is crucial to maintain quality of life

Chapter 3 assessed mechanisms behind the association between fear of falling and quality of life in old age. According to our results, physical functioning and gait speed served as single and sequential mediators in the negative relationship between fear of falling and quality of life. These results help to explain how quality of life is impaired by fear of falling. Similarly, Gottschalk et al. (2020) revealed that physical functioning and disability served as single mediators in the negative association between fear of falling and quality of life. Higher fear of falling was associated with poorer quality of life, through lower physical functioning or a higher degree of disability. The authors used the *Late Life Function and Disability Instrument* (*LLFDI*; Haley et al., 2002; Jette et al., 2002) to assess subjective physical functioning. In contrast to our self-developed scale, the LLFDI is an established instrument for measuring subjective physical functioning in old age. However, Gottschalk et al. (2020) conducted a cross-sectional study. In our longitudinal study, we considered gait speed as an additional mediator, as fear of falling is related to a slower gait speed to support stability during walking (Makino et al., 2017). Furthermore, gait speed predicts quality of life in old age (Davis et al., 2015) and is the main indicator of mobility impairment (Billot et al., 2020). Accordingly, the results of our longitudinal study and the measurement of gait speed as an objective measure extend the cross-sectional findings of Gottschalk et al. (2020). Thus, this dissertation further explains the mechanisms behind the association between fear of falling and quality of life in old age, as well as provides valuable insights for intervention development, which will be discussed below.

Fear of falling could be an early warning sign of declining quality of life in old age. Identifying older adults who experience fear of falling is crucial for counteracting the decline in physical functioning (Makino et al., 2017) which, in turn, affects quality of life (Davis et al., 2015). Focusing primarily on physical activity in exercise programs may evoke negative self-concepts among older adults who have negative associations with physical activity (Ziegelmann & Knoll, 2015). Addressing both fear of falling and physical functioning at an early stage is essential to improve, or at least maintain, quality of life in old age. It is widely recognized that exercise programs among older adults improve muscle strength, balance ability, and gait speed (e.g., Liu et al., 2017; Sherrington et al., 2019). A Cochrane review revealed a small to moderate effect of 36 exercise interventions on reducing fear of falling directly after intervention cessation ($N = 2,878$ participants; Kumar et al., 2016). The authors note that the results should be interpreted with caution, due to low-quality evidence. The findings of our field study with Sample 1 are consistent with these results. Older adults reported a significant reduction in fear of falling after 6 months, regardless of whether fear of falling was measured through two items by Friedman et al. (2002) or through the German *Falls Efficacy Scale* (Dias et al., 2006). However, the older adults in Sample 1 of this thesis had participated in the ongoing falls prevention program for an average of 2 years and 3 months prior to data collection, suggesting stability in fear of falling. The question arises to what extent fear of falling can be reduced in falls prevention programs. One approach may be to consider cognitive-behavioral strategies in addition to physical exercise. Adding discussion modules to falls prevention programs to uncover fear-related cognitions, to reduce catastrophic thinking, and to acknowledge the resulting avoidance of activities might reduce ongoing concerns about falling. For example, Zijlstra et al. (2009) developed a cognitive-behavioral intervention consisting of eight weekly 2-hour sessions and a booster session 6 months later. The group intervention

included establishing realistic views of falls through cognitive restructuring, challenging false beliefs to increase behavioral control of fall risk, and setting goals for increasing physical activity that were adapted to older adults' abilities. In discussing cognitions related to fear of falling and its impact on physical activity, participants, aged 70 years and older, found individual solutions for performing activities in situations where fear of falling was experienced. Older adults additionally reflected on the benefits of physical activity as well as the harms of being inactive, as part of the cognitive-behavioral intervention (Zijlstra et al., 2009). Participants showed reduced fear of falling and increased perceived behavioral control over falling compared to the control group at 12-month follow-up. In addition, older adults reported a reduced avoidance of activities due to fear of falling, compared with the control group at 8-month follow-up (Zijlstra et al., 2009). The results of a scoping review suggest that combining balance and strength training with cognitive-behavioral modules can successfully reduce fear of falling in older adults (Whipple et al., 2018). Thus, cognitive-behavioral interventions should not coexist separately with falls prevention programs, but rather be integrated as modules into falls prevention programs. In this way, fear of falling can be addressed in addition to physical functioning. Furthermore, providing exercises in falls prevention programs that are tailored to the physical abilities of the participants allows for competence experiences. The goal should be to convey participants in falls prevention programs that they are capable of engaging in activities of daily living, despite the fear of falling. Accordingly, *resource communication* should be considered, which includes the imparting of outcome expectancies and the promotion of self-efficacy beliefs (Schwarzer, 2004). It is therefore important to focus on the resources of older adults rather than on their disabilities. In addition, practicing getting up after a fall (Kumar et al., 2016), modifying the home environment to reduce the risk of falling, and wearing a fall detector in daily life that activates an alarm when a fall occurs could provide a sense of

safety (Wu et al., 2020). The so-called *balance self-efficacy* describes the perceived ability to master everyday life without losing one's balance and is positively associated with physical activity (Schmid et al., 2012). Accordingly, fear of falling is not exclusively maladaptive and may also involve appropriate adaptation of the home environment (Ellmers et al., 2023). Taken together, there is a need for multifaceted falls prevention interventions that include exercises targeting both physical functioning as well as cognitive-behavioral components, in order to reduce fear of falling and the resulting avoidance of activities (Merchant et al., 2020).

There is a consensus that exercises in falls prevention programs should be tailored to the functional abilities of participants, to be challenging and safe at the same time (e.g., Montero-Odasso et al., 2022; WHO, 2021). However, tailored training is hampered by target groups consisting of heterogenous individuals. Perceiving oneself as less able to exercise compared to others could be detrimental for group-based exercise training (de Groot & Fagerstrom, 2011) and might imply a feeling of not belonging (Franco et al., 2015). Thus, an exercise group with diverse needs regarding physical functioning and expectations might hinder the development of social identification (Stevens et al., 2022). Falls prevention groups that consider group composition could serve two purposes: promoting social identification and providing exercises that are tailored to functional abilities. Regarding mobility in daily life, older adults with slow gait speed might be avoiding physical activity through using means of transportation rather than by walking. Falls prevention programs could begin by addressing self-efficacy expectations to increase confidence in reaching destinations by foot. A possible strategy could include positive reinforcement when successes are reported. In addition, *focusing on past success* that displays a behavior change technique could increases self-efficacy. A *behavior change technique* (*BCT*) describes "an observable, replicable and irreducible component of an

intervention designed to alter or redirect causal processes that regulate behavior" (Michie et al., 2013, p. 4). The implementation of BCTs in falls prevention programs may have positive effects on physical activity beyond the course.

The results of a Cochrane review including 81 trials (N = 19,684 participants) implies that balance and functional exercises improve quality of life to a small extent (Sherrington et al., 2019). The results of Chapter 3 provide valuable insights into how to address quality of life in exercise interventions for older adults. Targeting physical functioning, gait speed, and fear of falling as a cognitive factor in falls prevention programs could be promising strategies for maintaining quality of life in old age.

Fear of falling carries over into perceived overprotection in old age

An individual's fear of falling also affects their social environment (Honaker & Kretschmer 2014). Therefore, *Chapter 4* investigated the relationship between fear of falling and overprotection of family, friends, and caregivers. Our results indicate that higher levels of fear of falling predict higher levels of perceived overprotection across all three assessment points, rather than the reverse. The hypothesis of a downward spiral between fear of falling and perceived overprotection was not confirmed. According to our findings, overprotection by others might not always result in lower capability beliefs. Our results are among the first to suggest that fear of falling in old age carries over to perceived overprotection by others. Since very little is known about fear of falling and its association with the social environment, the findings of the current thesis provide valuable starting points for practice, which will be discussed below.

When it comes to overprotection, it is crucial to recognize both the ambivalence of the need for support as well as the request for independence (Gallant et al., 2007). For example, Bimou et al. (2021) showed that a lack of assistance from family and neighbours in daily life (e.g., help in transportation) implies a steady loss of independence for adults,

aged 75 years and older, who rely on environmental support to engage in daily activities. Similarly, Park et al. (2019) showed that offering autonomy support increases the engagement in physical activity among older adults. *Autonomy support* includes acknowledging the older adults' perspective, responding to their requests, providing choices, and reducing control (Williams et al., 2006). Hence, support is required that assists older adults but also accounts for the protection of their autonomy. Caregivers and the social environment should be sensitized to increase the adequacy of their assistance. One approach might be to address overprotective behaviours in interventions for caregivers and the social environment to prevent restrictions of autonomy. For example, Sánchez-Izquierdo et al. (2019) found that caregivers showed a significant improvement of promoting older adults' autonomy behaviours after completing a behavioural intervention. The 1-hour session took place once a week over a period of 3 weeks. Within the intervention, caregivers identified overprotective behaviour and discussed alternative strategies to reinforce autonomy among their care recipients. According to their results, a less overprotective care implies a higher level of independence among older adults (Sánchez-Izquierdo et al. 2019).

Behavioural interventions might also provide a good opportunity to target views on aging. *Views on aging* describe both older adults' concept of aging and how the social environment perceive older adults (Wurm et al., 2017). Age stereotypes of the social environment are related to the assistance that older adults receive. Equating age with a period of cognitive and physical decline could restrict older adults' opportunities for further development (Kessler & Warner, 2022; Konradt et al., 2019). For instance, Smith et al. (2018) showed that negative views on aging are associated with higher levels of overprotection by caregivers. The authors suggest that discussing views on aging is crucial to increasing awareness of stereotypes and how they guide behavior. In line with these

results, randomized controlled trials revealed that self-perceptions of aging improved after completing interventions that addressed false beliefs and provided positive aspects of aging (e.g., Beyer et al., 2019; Wolff et al., 2014). Integrating views on aging into interventions for caregivers and the social environment could improve the adequacy of their assistance and counteract the underestimation of older adults' abilities by focusing on their resources. Discussing overprotective behavior, underlying stereotypes, and strategies to support autonomy among care recipients is necessary to sensitize the social environment, as well-intentioned support might be perceived as overprotective.

Strengths and Limitations

With respect to the *study design*, the collection of longitudinal data displays a strength of the presented findings. Furthermore, conducting a field study coincides with high external validity. Nevertheless, several limitations of the study design need to be addressed. Regarding Sample 1, the main limitation is the lack of a control group and randomization, which increases the likelihood of potential bias in the results. Furthermore, data were collected at any time during an ongoing falls prevention program. For example, in Chapter 3, physical functioning and gait speed may have changed during participation in the falls prevention program, affecting the relationship between fear of falling and quality of life. However, the average length of participation before data collection began was 2 years and 3 months, suggesting that there may not be a major change in the mediating variables. Looking at the results of Chapter 2, it can be argued that individuals show different manifestations in health-related factors when starting to participate in a falls prevention program compared to ongoing participation. For example, perceptions of being at risk of falling might decrease after engaging in regular exercise, which, in turn, could affect attendance. In general, participants who already attended a falls prevention program might have had different motives for participation, compared to older adults who had not

before attended a falls prevention program (McPhate et al., 2016). Furthermore, it might be questionable whether social identification predicted regular attendance, as attending the falls prevention program could also have led to higher levels of social identification. This argument could be invalidated in our sample, as social identification was not associated with duration of participation. Nevertheless, future studies should replicate our findings by considering a baseline assessment prior to the start of the intervention. In addition, investigating the barriers that prevent older adults from participating in falls prevention programs may provide valuable insights (McPhate et al., 2016).

Sample 1 constituted the basis for the empirical Chapters 2 and 3 and included care residents as well as older adults who lived on their own. Hence, a broader picture of the older population was provided that expands the generalizability of our results. However, both samples were predominantly female (Sample 1: 86% women, Sample 2: 75% women). Previous studies revealed that women reported higher levels of fear of falling (Chang et al., 2016; Hoang et al., 2017) and lower quality of life compared to men (Lee et al., 2015; Pérez-Ros et al., 2019; Setiati et al., 2011). According to the Welch-Test, the difference in mean scores of fear of falling between women and men was not significant in Sample 1, regardless of the assessment instruments. There were also no significant gender differences in quality of life in this sample. However, women reported higher levels of fear of falling in Sample 2 across all assessment points. Therefore, future studies should replicate the results of Chapter 4 with more gender-balanced samples. In general, gender should be considered when designing health promotion programs by including men in the intervention development (Gale et al., 2016). Additionally, targeting men in recruitment strategies could increase their participation in falls prevention programs (Sims-Gould, 2019) and, consequently, might raise their representation in field research.

Considering the *methods,* social identification was assessed at an individual level in Chapter 2. However, Häusser et al. (2019) emphasized the importance of investigating social identification at the group-level because the *Social Identification Approach* (Tajfel & Turner, 2004) relies on *shared* social identification. Nevertheless, assessing the individual group member's perspective of social identification is common in current research (Häusser et al., 2019). In this thesis, Sample 1 was characterized by an unbalanced allocation and a small size across falls prevention groups. Because small sample sizes at Level 2 imply biased estimates (Maas & Hox, 2005), we did not conduct multilevel analyses. Future research should calculate multilevel analyses to consider social identification at the group-level. This allows accounting for incongruent perceptions of social identification within a group as well as for differences between groups. Regarding Chapter 4, the potential reciprocal relationship between fear of falling and overprotection by others should be replicated with equal time intervals between measurement points to prevent inaccuracies in the autoregressive and cross-lagged estimates within the cross-lagged panel design (Newsom, 2015). Nevertheless, fear of falling and perceived overprotection showed a similar degree of stability across the measurement points (see Table 5) in Sample 2, which enhances comparability of the cross-lagged correlations (Rogosa, 1980).

The *measures* were based on self-reports, which are prone to bias and social desirability. This is with the exception of performance-based gait speed, which is a strength of the presented results in Chapter 3. With respect to fear of falling, no consensus about the definition in current research exists, which hampers interpretation of empirical findings (Adamczewska & Nyman, 2018). In the present thesis, fear of falling was measured in two ways. In Chapter 2 and 4, fear of falling was assessed with the two items "Have you been afraid that you might fall?" and "Did you limit your activities at home or outside because

you were afraid of falling?" (based on Friedman et al., 2002), whereas in Chapter 3, fear of falling was measured with the German version of the *Falls Efficacy Scale* (Dias et al., 2006). Here, individuals rated 16 activities of daily living, regarding their concerns about falling during performance (e.g., cleaning the house, walking outside). Generally, these two constructs are used synonymously in current research (e.g., Kumar et al., 2016; Wu et al., 2020). Observing the data from Sample 1, the two measuring instruments showed high associations at both measurement points. Within the *PREFER II* trial, fear of falling was solely assessed with the two items based on Friedman et al. (2002). However, some authors argue to differentiate *fear of falling* from *falls efficacy* (Adamczewska & Nyman, 2018; Hadjistavropoulos et al., 2011) as they are perceived to assess different constructs. The latter can be understood as the perceived capability to engage in activities of daily living without falling (Adamczewska & Nyman, 2018) whereas fear of falling comprises the concern about falling. From a health psychology perspective, the term "falls efficacy" is problematic because it cannot be equated with self-efficacy. In the context of falls prevention, *self-efficacy* describes the subjective belief of being able to engage in activities of daily living, despite challenges (e.g., increased risk of falling). It is important to emphasize that self-efficacy does not refer to objective capabilities, because individuals can perceive the same objective barriers (e.g., fear of falling, rheumatism) as different degrees of challenging (Warner & French, 2018). In terms of content, the German version of the Falls Efficacy Scale (Dias et al., 2006) measures risk perception by asking, "How concerned are you about the possibility of falling when performing one of the following activities?" The if-then contingency is again reminiscent of outcome expectancies. Observed as a whole, constructs of health psychology are not distinctly assessed in the scope of falls prevention. An avenue for future research would be to create measurements that are more precise and distinct. In addition, Yardley et al. (2005) suggested using the

term *concern about falling* instead of fear of falling. According to them, this term has less emotional connotations and may be more acceptable to older adults. However, this term has not yet gained acceptance in the peer-reviewed literature. Regarding quality of life, Karimi and Brazier (2016) point out the importance of a commonly used definition, as the terms *health-related quality of life* and *quality of life* are used interchangeably in the literature. The EQ-5D (Rabin & Charro, 2001) was applied as assessment instrument in Chapter 3. As it measures quality of life with five dimensions of health (*mobility, self-care, usual activities, pain/discomfort*, and *anxiety/ depression*), the term health-related quality of life would have been more suitable in the context of this thesis.

Suggestions for future research

Consideration of external facilitators and barriers of engagement in exercise programs

In Chapter 2, we examined individual health-related and social-emotional predictors of regular attendance to falls prevention programs. According to Bauman et al. (2012), these factors refer to intrapersonal (e.g., risk perception) and interpersonal (e.g., social identification) facilitators and barriers for engaging in exercise. Within their ecological model of the determinants of physical activity, the authors further account for external factors concerning the environment and national policy. For example, a systematic review of qualitative literature identified poor access to transportation and high costs of participation as external barriers (Franco et al., 2015). In terms of participation, it is crucial to improve the accessibility of exercise programs (Franco et al., 2014). In the case of fear of falling, weather conditions play a particularly important role (e.g., black ice). Therefore, the consideration of travel distances as well as public transport options should not be neglected. In order to facilitate access to health services for older adults with physical limitations, barrier-free buildings, easily accessible information about public transport, and other environmental resources are of particular relevance (Mümken et al., 2023). Fleig et

al. (2016) showed that the perceived built environment such as street connectivity, translates into behavioral control, which, in turn, promotes physical activity in older adults. Perceived *behavioral control,* in this case, describes older adults' belief that they have control over their engagement in physical activity. The *Theory of Planned Behavior* (Ajzen, 1991) postulates behavioral control as an important predictor, along with attitude toward the behavior and subjective norm, in predicting intention to engage in behavior. Perceived behavioral control is thought to predict intention and, unlike the other two predictors, may also have a direct effect on behavior (Ajzen,1991). This means that individuals do not perform their behavior because of low perceived control over the behavior, even though they have the intention to perform the behavior (Schwarzer, 2004). For example, older adults may have the intention to participate in a falls prevention program, but due to poorly developed infrastructure, behavioral control is perceived as low and the execution of the behavior is prevented. Therefore, it is important to consider environmental circumstances in future research, in order to better understand the challenges associated with engagement in falls prevention programs. Future studies should examine external facilitators and barriers in relation to intra- and interpersonal factors. Focusing solely on intervention development is insufficient, as successful implementation also requires the consideration of the external environment to inform health care providers, community organizations, and policy makers.

Overprotection as possible obstacle to physical activity

Not only the physical environment, but also support from the social environment is important for participation in exercise programs. In this context, social support from family, friends, and peers could come in the form of encouragement or help with transportation. Evidence suggests that social support increases older adults' engagement in exercises (e.g., de Lacy-Vawdon et al., 2018; Smith et al., 2017; Warner et al., 2011). Consistent with these

findings, Chapter 2 suggests that a sense of belonging may facilitate long-term engagement in group-based exercise. Although the social environment is a facilitator of exercise, it can also constitute a barrier if the social environment is perceived as normative and inhibits self-determined motivation (Stehr et. al., 2022). For example, family, friends, and caregivers can provide personal assistance and facilitate physical activity outside the home. In contrast, these populations might also articulate concerns and induce fears that may limit older adults' mobility (Mümken et al., 2023). A systematic review revealed that adults aged 60 years and older experience the uptake of physical activity as challenging, due to overprotective behavior by others through unwarranted safety concerns (Franco et al., 2015). The results of Chapter 4 do not suggest a downward spiral between fear of falling and perceived overprotection. Therefore, overprotection of the social environment might not always imply lower capability beliefs. An avenue for future research is to investigate whether overprotection by others is related to older adults' avoidance of activities, which could result in a decline in physical functioning (Whipple et al., 2018) and might accelerate the downward spiral of immobility (see Figure 1). This is particularly important for expanding research on immobility in old age from the individual to the social level. Furthermore, interventions targeting overprotection of the social environment should be further evaluated to counteract restrictions of autonomy as well as interpersonal barriers for participation in exercise programs.

When overprotection of the social environment limits participation in falls prevention programs, long-term maintenance of health-related quality of life is hampered. Initial research has shown that overprotection by significant others is negatively related to quality of life among older adults diagnosed with dementia (Niemann-Mirmehdi et al., 2019). The cross-sectional results suggest that restrictions of autonomy, due to overprotection, are associated with a reduced quality of life. Our findings in Chapters 3 and

4 revealed that fear of falling predicts health-related quality of life and perceived overprotection. Future longitudinal research is needed to examine the interaction of overprotection by others with older adults' fear of falling and health-related quality of life. Perceptions of overprotection also depend on who is providing it: Gallant et al. (2007) showed that older adults perceived unwanted support from family members as overprotective, compared to that received from friends. The authors suggest that social interactions with family members may be more difficult to avoid, while overprotective behaviour from friends may be more easily rejected. Comparing support from professional caregivers with support from the closer social environment, it could be assumed that the latter is more likely to be perceived as overprotective because it does not occur in a professional context. Future research should consider the support providers from whom overprotective behaviour originates to broaden the understanding of the opportunities and risks of overprotection by others and its association with independence in old age.

Overcoming fear of falling to ensure the uptake and maintenance of physical activity

Theories in health psychology, such as the HAPA (Schwarzer, 1992; Schwarzer, 2008), postulate that higher levels of *risk perception* increase the intention to engage in health behavior. For example, the perception that obesity presents a risk factor for type 2 diabetes might increase the intentions to engage in physical activity. Various studies demonstrate that a higher perceived risk enhances the likelihood of engaging in health behavior (e.g., de Bruin & Bennett, 2020; Ferrer & Klein, 2015; Wise et al., 2020). However, the perception of being at risk of falling represents a special case. Older adults who perceive a higher risk of falling might restrict their daily activities to prevent falls. The short-term benefits of avoiding physical activity outweigh the long-term benefits, but this accelerates the downward spiral of immobility (see Figure 1). Therefore, in the case of risk of falling, the opposite is achieved, and health behavior is avoided due to a higher level of

risk perception. Besides the perceived severity of falls, risk of falling comprises the perceived vulnerability towards falling (Weinstein et al., 2007) which refers to fear of falling. As stated in the introduction, 40% of older adults who fear falling consequently avoid activities (Merchant et al., 2020). Therefore, in the context of falls prevention, an increased risk perception might not facilitate the uptake and maintenance of exercise - instead, it could constitute a hindrance.

Similarly, a systematic review found that a higher perceived risk of falling was related to lower participation in exercise programs among older adults ($k = 9$ studies, $N = 1,370$ participants; Assumpção Picorelli, 2014). In another study, fear of falling was reported as a major barrier to participation in falls prevention programs, along with pain (do Santos et al., 2021). As the perceived risk of falling may reduce older adults' willingness to engage in physical activity, it is important to develop strategies to motivate older adults to exercise. Therefore, future research should build on the findings of Chapter 2 and further explore older adults' motivation to participate in falls prevention programs. Risk perception is central when it comes to adopting health behaviors, whereas it becomes less important later in the process (Schwarzer, 2004), in this case, after the intention to participate in falls prevention programs has been formed. However, perceptions of fall risk may also prevent the uptake of physical activity in daily life. This suggests that addressing fear of falling through cognitive restructuring and uncovering false beliefs is central to falls prevention programs.

Warner et al. (2019) showed that self-efficacy is a possible mechanism in the negative relationship between fear of falling and physical activity among adults aged 64 years and older. According to their longitudinal findings, higher fear of falling translated into lower physical activity through lower self-efficacy beliefs. However, the relationship between self-efficacy and physical activity did not remain significant after controlling for

covariates and baseline scores in their model (Warner et al., 2019). As older adults are confronted with more barriers (e.g., overcoming fear of falling) compared to younger adults, self-efficacy is relevant in the maintenance of exercise in old age (Warner & French, 2018). To meet the needs of older adults, one approach constitutes the implementation of BCTs (e.g., *graded task*, *focus on past success*) in falls prevention programs to increase self-efficacy beliefs (Fleig et al., 2016). Providing *information about health consequences* of activity restrictions within falls prevention programs could be a BCT that directly addresses fear of falling and supports regular attendance of participants. Enhancing self-efficacy beliefs through BCTs might be a promising strategy to overcome fear of falling and the resulting avoidance of activities. Consequently, further research should elaborate on BCTs for long-term falls prevention.

After regular participation in a falls prevention program, the question arises whether the reduced fear of falling remains stable over time. One strategy to foster physical activity beyond the intervention period and to overcome fear of falling in daily life could be the promotion of habit formation. *Habits* represent a key mechanism for behavior maintenance (Kwasnicka et al., 2016) and describe a process in which actions are (almost) automatically evoked by contextual cues (Gardner & Rebar, 2019). Nevertheless, conscious processes, such as intention and action planning, are required at the beginning of the habit formation process (Gardner & Lally, 2018). *Action plans* are defined by when, where, and how to be physically active (Sniehotta et al., 2005). Fleig et al. (2013) revealed that action planning and frequent exercise facilitated the translation of intentions into habits in middle-aged to older adults following cardiac and orthopedic rehabilitation. Falls prevention programs might provide a good opportunity to formulate individualized action plans for daily living and monitor their translation into behavior. One falls prevention program that begins at this point is the *Lifestyle-integrated Functional Exercise intervention* (*LiFE*; Clemson et al.,

2012). By teaching older adults how to incorporate functional balance and strength exercises into their daily routines, LiFE aims to build habits for specific exercise behaviors. Initial research has shown that *habit strength* of exercises, which describes the perceived automaticity of the behavior (Gardner et al., 2012), decreases after the cessation of the LiFE intervention but reaches a plateau over time (Labudek et al., 2022). In the context of maintaining physical activity in old age, future studies should investigate whether habit formation might be a strategy to overcome fear of falling in the long term and prevent avoidance of activities in daily life. Once a habit is formed, the behavior becomes less intentional and more automatic (Di Maio et al., 2020), and barriers such as fear of falling may become less relevant.

Conclusion

In conclusion, the present thesis highlights the importance of considering psychological factors in the development of falls prevention interventions, whether it is shaping social identification among participants of falls prevention programs to increase attendance, or through targeting fear of falling and physical limitations to maintain health-related quality of life. The results presented in *Chapter 2* indicate that trainers should emphasize the formation and reinforcement of social identity within falls prevention programs to enhance participants' attendance. In addition, the findings of *Chapter 3* reveal that, through addressing fear of falling and offering exercises that are adapted to the functional abilities of participants, falls prevention programs provide an opportunity to promote maintenance of health-related quality of life. Future studies should pursue the development of strategies to overcome fear of falling in order to gain insights into this research field. The results of *Chapter 4* suggest that the social environment should not be neglected when it comes to fear of falling, as higher levels of fear of falling might translate into perceived overprotection by others. It remains unclear whether perceived

overprotection increases the loss of independence in old age. Future research on immobility in old age should encompass the social environment to assess whether overprotection by others is associated with older adults' avoidance of daily activities. This thesis provides valuable insights into the challenges of healthy aging. As the prevention of falls becomes more relevant due to an aging population, further research is needed to expand our understanding of living a self-determined life in old age.

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Curriculum Vitae

For reasons of data protection, the curriculum vitae is not included in this version.

List of Publications

ARTICLES IN PEER-REVIEWED JOURNALS

2023

Steckhan, G. M., Fleig, L., Wurm, S., Wolff, J. K., Schwarzer, R., & Warner, L. M. (2023). Fear of falling carries over into overprotection in old age: a cross-lagged panel analysis. *International Journal of Aging & Human Development. 1-16.* https://www.doi.org/10. 1177/00914150231196819

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Steckhan, G. M., Fleig, L., Schwarzer, R., & Warner, L. M. (2022). Perceived physical functioning and gait speed as mediators between fear of falling and quality of life in old age. *Journal of Applied Gerontology, 4(2),* 421-429. https://doi.org/10.1177/0733464820 979188

Steckhan, G. M., Warner, L. M., & Fleig, L. (2022). Preventing falls together – social identification matters for engaging older adults in a group-based exercise program. *Activities, Adaptation & Aging, 46(1),* 31-45. https://doi.org/10.1080/01924788.2020. 1871540

Niebuhr, F., **Steckhan, G. M.**, & Voelter-Mahlknecht, S. (2022). New work poses new challenges – The importance of work design competencies revealed in cluster analysis. *International Journal of Environmental Research and Public Health, 19(21)*, 1-12. https://doi.org/10.3390/ijerph192114107

Under Review in Peer Reviewed Journals

Steckhan, G. M., Niebuhr, F., Severin dos Santos, L., & Voelter-Mahlknecht, S. (under review). Mastering change: Organizational agility facilitates maintaining work-life balance despite work intensification during the Covid-19 pandemic. *German Journal of Human Resource Management.*

Ritter, Y., Pfister, D., **Steckhan, G. M.**, Voelter-Mahlknecht, S., Weber, B., Ellegast, R., Koch, C., Bausch, F., Gruber, M., & Schwenk, M. (under review). The work Lifestyle-integrated Functional Exercise (wLiFE) program for preventing functional decline in employees over 55 years: Development and initial evaluation. *European Review of Aging and Physical Activity.* https://doi.org/10.31219/osf.io/hrgwb

BOOK CHAPTER

Häseler-Bestmann, S., Traxl, B., Fritzsche, E., Liebenow, A., & **Steckhan, G. M.** (2019). PATEN-Patenschaften als Akteure gesellschaftlicher Teilhabe und Entwicklung: Perspektiven zweier gesellschaftlicher Phänomene in Wissenschaft und Praxis. In T. Hilse-Carstensen, S. Meusel, & G. Zimmermann (Hrsg.), *Freiwilliges Engagement und soziale Inklusion* (S. 169-181). Springer.

CONFERENCE PRESENTATIONS (first authorships only)

2023

Steckhan, G. M., Fleig, L., Wurm, S., Wolff, J. K., Schwarzer, R., & Warner, L. M. (2023). *How does the social environment respond to fear of falling? – A cross-lagged panel analysis of fear of falling and overprotection in old age*. Presentation at the 37th conference of the European Health Psychology Society, 4.-8th September 2023 in Bremen, Germany.

2021

Steckhan, G. M., Fleig, L., Schwarzer, R., & Warner, L. M. (2021). *Mechanisms behind the association between fear of falling and quality of life in old age*. Presentation at the 35th virtual conference of the European Health Psychology Society, 23.-27th August 2021.

2019

Steckhan, G. M., Fleig, L., Warner, L. M., & Schubert, B. (2019). *Können ältere Erwachsene durch soziale Anreize motiviert werden regelmäßig an einem Sturzpräventionsprogramm teilzunehmen?* Vortrag auf der gemeinsamen Jahrestagung der Sektion III und IV der Deutschen Gesellschaft für Gerontologie und Geriatrie, 19.-20. September 2019 in Berlin.

Steckhan, G. M., Fleig, L., Warner, L. M., & Schubert, B. (2019). *Motiviert die Identifikation mit der Trainingsgruppe ältere Erwachsene an einem Sturzpräventionsprogramm teilzunehmen?* Vortrag auf dem 14. Kongress der Fachgruppe Gesundheitspsychologie, 25.-27. September 2019 in Greifswald.

Steckhan, G. M., Fleig, L., & Warner, L. M., (2019). *What motivates older adults to attend a falls prevention program: Anticipated health or social benefits?* Presentation at the 33rd conference of the European Health Psychology Society, 3.-7th September 2019 in Dubrovnik, Croatia.

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2018

Steckhan, G. M., Fleig, L., Warner, L. M., & Schubert, B. (2018). *What motivates older adults to participate in a falls prevention program?* Poster presented at the 32. conference of the European Health Psychology Society, 21.-25th August 2018 in Galway, Ireland.

Erklärung

Hiermit versichere ich, dass ich die vorgelegte Arbeit selbstständig verfasst habe. Andere
als die angegebenen Hilfsmittel habe ich nicht verwendet. Die Arbeit ist in keinem früheren
Promotionsverfahren angenommen oder abgelehnt worden.

Erklärung