Reducing the impact of geriatric conditions by physical activity

Due to the increase in the number of people aged 65 and older and the fact that diseases that were formerly fatal can now be better treated and managed, the number of older adults with chronic disease is rising. As well as diagnosed diseases, the so-called geriatric conditions are common. These can be described as a collection of symptoms and signs common in older and vulnerable adults and which are not necessarily related to a specific disease. These include cognitive impairment, incontinence and immobility. One important consequence of multiple chronic disease or conditions in older adults is the increased risk of becoming disabled - as described by the disablement process model of Verbrugge & Jette in 1994. This model describes the pathway that runs from aging and pathology via impairments and functional limitations towards disability which threatens the quality of life and participation of older adults in society. Physical activity has been identified as one of the factors that can speed up or slow down this process and which affects its direction.

Theoretically physical activity can influence all stages along this pathway, but there is discussion about what is the most effective physical activity or exercise intervention to prevent or slow down this process, particularly in those older adults who are already impaired. Paradoxically, those groups that would benefit most from an active lifestyle are also those known to be the least active, i.e. older persons and those with disabilities or chronic conditions. There is a need for better understanding of how to surmount these barriers and increase adherence and maintenance to physical activity in this growing group. The aim of this thesis is to study the role of physical activity in preventing or reducing the level of functional limitations and disability in older adults with geriatric conditions.

Three separate research questions have been developed to address this issue:
I. What is the association between habitual physical activity and disability in older persons both with and without geriatric conditions?
II. Can the impact of geriatric conditions on functional limitations and disability be reduced by specifically designed exercise programs?
III. What are determinants of initiation, adherence to and maintenance of exercise programs in older persons with geriatric conditions?

In order to answer the first question, two studies using observational data were carried out. The first was a meta-analysis of the association between physical activity and the incidence and progression of basic ADL disability (Chapter 2). By means of an electronic literature search and cross-referencing, thirteen prospective longitudinal studies on physical activity and basic ADL disability in community-dwelling older adults (50+) with baseline and follow-up measurements were selected. Results of the meta-analysis show that compared with a low physical activity level, a medium/high physical activity level reduced the risk of
incident basic ADL disability by 0.51 (95% CI: 0.38, 0.68; p<.001). This is based on nine longitudinal studies involving 17,000 participants followed up for 3 to 10 years. The result was independent of age, length of follow-up, study quality, differences in demographics, health status, functional limitations, and lifestyle. The risk of progression of basic ADL disability in older adults with a medium/high level of physical activity compared with those with a low physical activity level was 0.55 (95%CI: 0.42, 0.71; p<.001), based on four studies involving 8,500 participants.

The second study (Chapter 3) studied the same association but this time in community-dwelling older adults with generalized radiological osteoarthritis (GROA in hand, knee and/or hip) and disability. A good outcome at follow-up was defined as improved or mild disability, and a poor outcome as worsened or severe disability. Factors potentially associated with outcome were demographics, joint complaints, chronic health problems or limitations and level of different types of PA.

The results show that in the 309 community dwelling older adults (75+) with GROA that were identified in the cohort of the Rotterdam Study, the level of disability at baseline was classified as mild to moderate with minor increases in 5 years. At baseline physical activity decreased with increasing disability, particularly in sport and walking. Physical activity was univariately associated with a better outcome at follow-up, but when adjusted for other factors only higher age and having more than two other chronic conditions were associated with negative changes in general and lower limb disability, but not with upper limb disability. This means that the results of the meta-analysis could not be replicated within this group of older adults with GROA, which might be due to the complex relationship between physical activity and symptomatic OA. This leaves the question on function can be improved and disability reduced in older adults who are frail or suffer from multiple geriatric conditions that have great impact on daily life and activities?

To answer this second research question, two randomized controlled trials (RCT) were conducted in which the effect of exercise on reducing functional impairment and disability was studied. The first multicenter RCT (Chapter 4) was carried out among women living in homes for the elderly in whom urinary incontinence (UI) is highly prevalent. Management is usually restricted to dealing with the consequences instead of treating underlying causes such as bladder dysfunction or reduced mobility. The aim of this study was to compare a group-based behavioral exercise program to prevent or reduce UI, with usual care. This study was done by recruiting, matching and randomizing Dutch homes into intervention or control homes. These homes recruited older women, with or without UI, with sufficient cognitive and physical function to participate in the program. This program addressed behavioral aspects of continence and used physical exercises to improve PFM, bladder and physical performance. It consisted of a weekly group training session and homework exercises and ran for 6 months during which time the control group participants received care as usual.
In total a 102 participants were allocated to the program and 90 to care as usual. Intention to treat analysis, based on an imputed data set (n=85 intervention, n=70 control) showed improvement of physical performance as measured with the Physical Performance Test (intervention +8%; control -7%) and no differences on other primary and secondary outcome measures. Per protocol analysis, including all participants who completed the study and intervention (n=51 intervention, n=60 control) showed a reduction in participants with self-reported UI (intervention -40%; control -28%) and in frequency of self-reported episodes (intervention -51%; control -42%) in both groups. The observed improvement of physical performance (intervention + 13%; control -4%) was related to participation in the exercise program. Based on these results it was concluded that improving physical performance by exercise is feasible in institutionalized older women. The reductions in UI were not related to the intervention.

The second trial (Chapter 5) was aimed at evaluating an 8-week exercise program with strength training and lifestyle advice for community-dwelling older adults with osteoarthritis (OA) of the hip. Although there is no cure for OA, disease-related factors, such as impaired muscle function and fitness, are potentially amenable to exercise intervention. However, unlike in OA of the knee there is little evidence to support the efficacy of such programs in OA of the hip, and few studies have evaluated the long-term effects of such programs. The program ‘Hop with the Hip’ consists of eight 1-hour weekly group sessions of strength training using fitness equipment under the supervision of a physical therapist. Participants were also offered a home exercise program, personal ergonomic advice from an occupational therapist and dietary advice from a dietician. A total of 109 participants (55 experimental, 54 controls) were included in the trial. They had to be 55 years or older, have clinical OA diagnosed in accordance with the ACR criteria, and live independently. Fifteen participants dropped out due to lower pain tolerance and younger age. The results show that the program had a positive effect on pain (VAS scales; moderate effect at post-test and small effect at follow-up), hip function (Harris Hip Score; small effect at post-test), self-reported disability (GARS; small effect at follow-up), and the timed Up & Go test (small effect at follow-up). It did not affect QOL, other measures of observed disability or BMI.

Based on this it was concluded that the exercise program had positive effects on pain and hip function, which the disablement process model shows to be important mediators of disability.

These two trials show that it is feasible to improve physical performance in older adults with geriatric conditions by using specifically designed exercise programs, and that reduction in disability takes more time and follows improvement in functional performance. In frail institutionalized older women improvement in disability was not achieved, at least not at post-test, despite small improvements in functional performance. Finally, these results also indicate that compliance can be an important mediator in achieving improved function and reduced disability levels.
The third and final research question looks into the issue of compliance and was studied by two observational studies that looked at determinants of maintenance of physical activity behavior after exercise trials in community-dwelling older adults. The first study (Chapter 6) was conducted after an RCT showing that improvement in some aspects of cognitive function was related to adherence to an exercise program. To address patterns of adherence and determinants of maintenance older adults with mild cognitive impairment were contacted by telephone for an interview six months after the end of their exercise program. Mean adherence during the trial was 53%. About one-third of participants had lapses during the trial but completed it, one-third had no lapses, and one-third dropped out or never started. Practical barriers (time, location) were related to not starting, functional limitations to dropout. After the trial 25% of participants continued with the programs, 14% reported an intention to continue, and 61% quit. Maintenance was determined by fewer health complaints, higher levels of satisfaction with the programs and better adherence during the programs. Although maintenance was low, this study identified motivators and barriers to adherence and maintenance that can be addressed.

The final study (Chapter 7) evaluated whether behavioral aspects of self-efficacy, attitude, social norm and coping predict change in physical activity in older adults with OA in the knee and/or hip. A total of 105 participants of a RCT (self-management intervention) were followed up to 6 months. Results show that forty-eight percent of participants had a self-reported increase of physical activity at 6 weeks and 37% at 6 months which corresponds with PA levels measured with the Voorrips questionnaire. At 6 weeks, univariately as well as multivariately, use of the pain coping style ‘resting’, intention to and participation in the intervention were positively associated with more physical activity behavior whereas being single and less use of the pain coping style ‘distraction’ predicted more self-reported physical activity. More severe pain only predicted less physical activity multivariately. At 6 months, univariate associations were found for age, general coping style ‘seeking support’ and participation in the intervention; multivariately, higher age was associated with less self-reported physical activity. It was concluded that a self-reported change of physical activity at post-test was predicted by the behavioral factors ‘intention’ and several pain coping styles. Together with other predictors of self-reported change (pain severity, higher age, being single), these can be addressed in future interventions to enhance physical activity at the end of an exercise program which is a critical period for maintenance.

The final chapter of this thesis (Chapter 8) discusses the results from these six studies, using a conceptual framework for linking physical activity and disability research based on the disablement process model. According to this enhanced model physical activity can prevent the start of the disablement process by preventing disease, physiological aging and disuse. Secondly, specifically designed exercise may lead to a reduction in symptoms such as pain or fatigue which can cause disablement. This was shown in the second trial (Chapter
5), aimed at older adults with hip osteoarthritis which reduced pain levels. Thirdly, exercise programs such as the hip program or Incondition program (Chapter 4) aim to improve the functional performance, even in frail institutionalized women, as well as physical functioning. These improvements in symptoms, performance and functioning may delay or prevent the end stage of the disablement process, disability in daily life. Nevertheless alternative pathways cannot yet be ruled out. The results from the meta-analysis (Chapter 2) show that being physically active also has an effect on disability when controlled for functional limitations. Other explanations are discussed, such as physical activity being a proxy for a general healthy lifestyle, missing of relevant confounding factors in the disablement pathway, selection effect (those already disabled are limited in their physical activity) and other, non-physiological pathways such as via psychological mechanisms.

Next a possible link between the disablement process and behavioral aspects as studied in Chapters 6 and 7 is discussed. Various behavioral models such as the ASE model and phase-specific models such as the Trans Theoretical Model do not integrate relevant aspects such as symptoms or coping into their models which have been shown to be relevant in older adults with geriatric conditions. Also the different stages of physical activity behavior, initiation, adherence and maintenance and their specific determinants need to be taken into account.

Several methodological issues that are challenging in doing research with older adults with geriatric conditions are discussed: loss of statistical power (due to lack of participation and compliance) and valid outcome measurements (due to lack of suitable objective instruments, choice of stage specific instruments, lack of comparability between PA instruments). Other challenges include the design of exercise interventions (regarding the reduced capacity and heterogeneity of the target group), recruitment, increasing adherence and minimalizing dropout. Most of these issues can be solved but have negative consequences. Finding the right balance is necessary and guidelines addressing these problems are presented and discussed. One important recommendation is that interventions and studies should be better tailored to the heterogenic older population.

Finally implications and recommendations from a scientific, practical and policy point of view are discussed. These include better theoretical combination of the fields of physical activity and disability, designing and using better instruments for tailoring interventions, developing additional physical activity guidelines including optimal type of physical activity and threshold levels, improving physical activity programs on theoretical, practical and quality level. Finally translating the results from this thesis, and aging and physical activity research in general needs to be our next priority. On a European level there are platforms, such as the EUNAAPA network, that can help to disseminate knowledge between scientists, practitioners and policy makers.