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### VRIJE UNIVERSITEIT

## More Exercise for Seniors: Opportunities and Challenges

### ACADEMISCH PROEFSCHRIFT

ter verkrijging van de graad Doctor aan de Vrije Universiteit Amsterdam, op gezag van de rector magnificus prof.dr. L.M. Bouter, in het openbaar te verdedigen ten overstaan van de promotiecommissie van de faculteit der Geneeskunde op donderdag 25 september 2008 om 13.45 uur in de aula van de universiteit De Boelelaan 1105

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In 2000 there were more than 2,1 million people over 65 years of age in the Netherlands. In 2005 this had already increased to over 2,3 million older people, which is approximately 14% of the total population. It is expected that by 2050 about 22% of the population will be over 65 years of age. Especially the number of people older than 80 years of age is increasing rapidly. In 2005 25% of the adults older than 65 years were over 80 years of age. Of all people over 65 years of age in 2005 more than 0,9 million were men and 1,3 million women. Among the 80-plus adults, over 70% were female. In 2050 about 35% of the people aged 65-plus will be 80 years and older (Beer & Verweij, 2005). Similar demographic ageing trends are occuring worldwide (DiPietro, 2006; Pescatello & DiPietro, 1993; USDHHS, 1996).

With increasing age several physiological changes take place in the human body, such as a decrease of endurance, basal metabolic rate, strength, flexibility of muscles and joints, co-ordination, speed and bone density. Functional independence also diminishes with increasing age. These declines are a result of both physical inactivity and the aging processes (ACSM, 1998a; Bouchard et al., 1997; DiPietro, 2006; Pate et al., 1995; USDHHS, 1996).

Regular physical activity is often seen as an important way to counteract the age-related decline of body functions. Several physical functions, such as strength (ACSM, 1998a; Bouchard et al., 1997; Buchner et al., 1992; DiPietro, 2006; Fiatarone et al., 1990; Fiatarone et al., 1994; Frontera et al., 1988; King, 1991), and endurance (Blumenthal et al., 1989; DiPietro, 2006; Fiatarone et al., 1990; Hagberg et al., 1989; Seals et al., 1984) can be improved by an increased amount of physical activity. There are indications that an increase in physical activity may lead to an increase in walking-speed and an improved balance in elderly people (Buchner et al., 1992). Physical inactivity is an independent risk factor which may ameliorate several chronic diseases which occur often in the elderly, like coronary heart disease, diabetes mellitus type II, osteoporosis, and cancer. It also has a positive effect on the treatment of these chronic diseases, as well as on rheumatoid arthritis, and osteoarthritis (ACSM, 1998a; Berlin & Coldits, 1990; Bijnen, 1990; Bouchard et al., 1997; Caspersen et al., 1985; DiPietro, 2006; Pate et al., 1995; Powell et al., 1997; USDHHS, 1996). Physical activity also has positive health effects on several risk factors for (chronic) diseases, i.e. hypertension, cholesterol, and overweight (ACSM, 1998a; Bauman et al., 2006; DiPietro, 2006; Pate et al., 1995; USDHHS, 1996; WHO, 1995).

Importantly, reductions in risk factors associated with chronic conditions (heart disease, diabetes, etc.) may improve health status and also contribute to an increase in life expectancy.

Evidence from randomised trials is rapidly accumulating that endurance, strength, and balance training promote mobility and reduce fall risk, though effects of physical activity differ according to the type of activity, the frequency, intensity and duration of the activity, and the length of a program and the target group of older adults. Thus, the benefits

associated with regular physical activity contribute to a more healthy, independent lifestyle, greatly improving the functional capacity and quality of life in the population of older adults (ACSM, 1998a).

## Public Health guidelines of health enhancing physical activity (HEPA)

The Public Health guidelines for health enhancing physical activity state that "all adults should participate in 30 minutes of moderate intensive physical activity during preferably all - but at least five - days of the week" (ACSM, 1998b; Bauman et al., 2006; Kemper et al., 2000; Pate et al., 1995). These guidelines are also applicable to older adults.

Previously, it was believed that only high intensity physical activity would have a beneficial effect on health status. Moderate intensity activities, like brisk walking and cycling are, however, also intensive enough to enhance health. After the age of 65 years there seems to be a significant decrease in the compliance to the HEPA guidelines, and this gets worse at older age (Ooijendijk et al., 2007). It is important to counteract this decrease in physical activity in older adults, and to establish maintenance in participation in physical activity, as the health effects diminish quite soon after a person drops-out of a physical activity program (ACSM, 1998a).

### **More Exercise for Seniors**

It is estimated that approximately 45% of the older adult population in the Netherlands participate in relatively low to moderate intensity organized physical activities on a more or less regular base (Kroes & De Greef, 2000). Among the preferred activities are walking, cycling, swimming, bowling, and, to a lesser extent, gymnastics, tennis, and badminton. More Exercise for Seniors (MBvO in Dutch) is the name of an umbrella organisation that delivers these types of low and moderate organised physical activity programs. MBvO was developed in the Netherlands already more than 40 years ago. Programs are organised for people of 55 years and older, but attract specifically people of 65 years and older. MBvO was established on an experimental base in 1966 and widely implemented since.

The aim of MBvO is promoting optimal functioning, not only physically, but also mentally and socially. MBvO attempts to provide physical activity opportunities that are as attractive as possible, in an attempt to reduce negative perceptions about physical activity among the older adult population. In planning MBvO programs, serious attention is devoted to the preferences, needs, and capabilities of older adults. MBvO programs are structured in such a way as to emphasise social interaction, co-operation, and teamwork. A deliberate effort is made to focus on enjoyment and social interaction.

More than 300,000 people participate in MBvO programs on a weekly base. More than 3,000 MBvO instructors are involved in offering MBvO programs for older people in over 15,000 MBvO groups (Kroes & De Greef, 2000; see Figure 1). Although MBvO consists of a widespread network of instructors and groups, and so many older people participate

in the activities, there is still lack of scientific evidence on the efficacy, and effectiveness of MBvO as a physical activity program of "good practice" for older people. MBvO-gymnastics (MBvO-gym) is a group-based physical activity program consisting of several types of strength-, flexibility-, and balance training activities. These are mainly ground activities (on the mat), sometimes aided by using a chair, seldom applying apparatus. MBvO – gym is the activity which is most popular of all MBvO activities, and therefore has far the largest group of participants. For this reason we have chosen for research into this program.



FIGURE 1: Trends in the participation of More Exercise for Seniors (overall activities including gymnastics) in the period 1980 – 2000 in the Netherlands (in absolute numbers and groups; Kroes & De Greef, 2000)

To build a body of knowledge we have carried out several studies, and then used the Transtheoretical model for behavioral change by Prochaska & DiClimente (1983) as a framework for linkage of the results. This model was originally used in health areas like smoking cessation, and weight control, and nowadays is being increasingly used in the study of physical activity behaviour (King et al., 1992; Marcus & Simkin, 1994).

The 'stage of change' is the central organising construct of the transtheoretical model, therefore we will mention it as the 'Stage of Change model' in this thesis. Prochaska & DiClimente suggest that individuals engaging in a new behaviour move in an orderly progression through the stages of precontemplation (not intending to make changes), contemplation (considering a change), preparation (making small changes), action

ges), contemplation (considering a change), preparation (making small changes), action (actively engaging in new behaviour), and maintenance (sustaining the change over time). In the 1990s, Marcus & Owen (1992) and Marcus & Simkin (1994) modified the behavioural change with respect to physical activity (see Figure 2).



FIGURE 2: The modified Stage of Change model by Marcus & Owen (1992), and Marcus & Simkin (1994)

With the modified behavioural change model in mind we defined the following aims for this thesis:

- To identify entry correlates, and motivations of older adults (50-plus), participating in physical activity programs (including MBvO-gym);
- To review the literature on effectiveness of physical activity programs on functional status and Health Related Quality of Life of older adults aged 65-plus;
- To study the effectiveness of MBvO-gym on Health-Related Physical Fitness, functional status, and Health-Related Quality of Life of older adults aged 65 – 80;
- To study the drop-out incidence, and determinants of drop-out in MBvO-gym, and to compare with several other types of physical activity programs for older adults;
- To develop a social psychological model related to maintenance of physical activity participation in older adults;
- To recommend improvements on the efficacy, the effectiveness and the quality of MBvO-gym in terms of health enhancing physical activity promotion, and implementation.

### **OUTLINE OF THE THESIS**

Part 1 of the thesis follows (potential) study participants from the Preparation Stage to the Action Stage. In Chapter 2 the entry correlates, and motivations of older adults participating in physical activity programs are presented related to ten different organised physical activity programs in the Netherlands, including MBvO-gym.

Part 2: As soon as people have joined a physical activity program they are expected to be in the Action Stage. Chapters 3 through 7 deal with this stage. In Chapter 3 a systematic review of the literature is presented on the effects of physical activity programs on the functional status and health related quality of life of older adults. In Chapter 4 and 5 the health effects are presented of MBvO-gym for independently living people 65 – 80 years

of age, in terms of functional status, health related quality of life (Chapter 4) and healthrelated physical fitness (Chapter 5). In Chapter 6 attention is paid to the drop-out phenomenon within the first six months after the start of a program. The drop-out incidence in MBvO-gym is compared to drop-out in other physical activity programs for older adults. There is a focus on the determinants of dropping out in physical activity programs for older adults.

Part 3: The Stage of Change model emphasizes that people should be in the Action Stage for at least six months before they reach the Maintenance Stage. In Chapter 7 a social psychological model is used to identify determinants of maintenance of older adults in ten physical activity programs.

The outline of the thesis is presented in Figure 3.

Chapter 8 offers a general discussion on the methodological aspects of the thesis, and recommendations. The opportunities and challenges of MBvO-gym are discussed in terms of physical activity promotion. In chapter 9 a summary is given. All sub-studies in this thesis are more or less linked to the Stages of Change model.

In the appendices a historic overview (Appendix A), and a list of publications (Appendix B) is added, as well as the acknowlegdements (Dankwoord; appendix C), and information about the author (Appendix D),

The thesis is built-up by separate papers already published or at least submitted to several journals; these journals use different language. Therefore there is discrepancy in language between British English, and US English in the thesis.



FIGURE 3: The outline of the thesis using the modified Stage of Change model as a framework

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# 2

Entry correlates and motivations of older adults participating in organized exercise programs

Stiggelbout M, Hopman-Rock M, Van Mechelen W van. Entry correlates and motivations of older adults participating in organized exercise programs. Journal of Aging and Physical Activity 2008,16:342-354.

### ABSTRACT

This study reports entry correlates and motivations of older adults participating in organized exercise programs in the Netherlands, as determined in a descriptive explorative study (N=2,350, response rate 86%). Participants were community-living older adults (50+) who enrolled and started in 10 different exercise programs. Entry features were analysed for differences in age, gender, marital status, education, living situation, BMI, lifestyle, and health status. Motivations for entry in an exercise program were determined using homogeneity analyses.

More Exercise for Seniors (MBvO) attracted relatively older seniors, whereas organized sports mainly attracted the younger seniors. Walking, MBvO, and gymnastics attracted more women, whereas skating, and table tennis were reported to attract more male participants. Badminton and cycling attracted relatively higher educated participants, whereas MBvO attracted relatively lower educated participants. Three distinct motivational constructs were found: 'Relax and Enjoy', 'Care & Cure' and 'Competition'. Participants of MBvO may be categorized as Relax & Enjoy exercisers, participants of Fysiosport, and HIB fit into the category Care & Cure; the participants of the six organized sports fit into the category Competition, and participants in walking finally fit in all three categories.

Regular participation in exercise has been associated with a variety of health benefits in those aged 50 and older, such as improved cardiovascular, respiratory, and muscular function, and the reduction of risk factors associated with disease states (American College of Sports Medicine (ACSM), 1998; U.S. Department of Health and Human Services, 1996). Given the numerous benefits of exercise, the ACSM has proclaimed that "a targeted exercise prescription offers a benefit that cannot be achieved with any other therapeutic modality" (ACSM, 1998). The guidelines for health enhancing physical activity state that "all adults should participate in 30 minutes of moderate intense physical activity during preferably all - but at least five - days of the week" (ACSM 1998). These guidelines also are applied to older adults. Despite the potential benefits of exercise, however, many older Dutch people are still physically not active sufficiently (Hildebrandt, Ooijendijk, Stiggelbout, et al., 2004). Therefore, it is important to promote physical activity and exercise in older adults.

Determinant and correlation studies found that several factors are of major importance for the 50+ population to start participating in an exercise program (Brawley et al., 2005; Clark, 1999; King et al., 1998; Resnick & Nigg, 2003; Resnick, Magaziner, Orwig, et al., 2002; Resnick & Spelbring, 2000; Sallis, 2003; Sallis, Bauman & Pratt, 1998; Trost, Owen, Bauman, et al., 2001, Stiggelbout, Hopman-Rock, Crone, et al., 2005, and Stiggelbout, Hopman-Rock, Tak, et al., 2006):

- Personal factors: age, gender, socio-economic class, working or not, (past) exercise beha-viour;
- Social and cultural factors: Influence of a treating physician, social support of friends and family;
- Environmental factors: type of-, location of-, and quality of physical activities, travel time, physical environment with sufficient possibilities to be physically active (e.g. parks, walking trails, bicycling lanes, physical activity clubs for older adults), and low costs.

To study people's transition from a (partly) sedentary lifestyle to a physically active lifestyle the Transtheoretical model is often applied (Prochaska & Di Clemente, 1983). The stages of change construct constitutes the central organizing construct of the Transtheoretical model. Prochaska & DiClemente (1983) suggest that individuals engaging in a new behaviour move in an orderly progression through the stages of precontemplation (not intending to make changes), contemplation (considering a change), preparation (making small changes), action (actively engaging in the new behaviour), and maintenance (sustaining the change over time). In the 1990's, Marcus & Owen (1992) modified the original stages of change construct and processes of change to describe behavioural change with respect to physical activity behaviour. To our best knowledge, no research has been done concerning the correlates associated with voluntary entry of older adults in specific exercise programs, and their motivations for these choices. Knowledge of these correlates and motivations could be of importance to advise other older adults who consider entering an exercise program. The underlying study is aimed to explore these correlates, and motivations.

Consequently, the research questions of this study were:

- What correlates are associated with voluntary entry (enrollment and actual participation) in ten different exercise programs for older adults?
- How can motivations associated with entrance in these ten exercise programs, be categorized, reduced, compared and described?

### METHODS

A descriptive explorative study was carried out on voluntary entry of participants of 10 different exercise programs.

These ten different types of exercise programs are representative for exercise programs for the 50+ population in the Netherlands: More Exercise for Seniors Gymnastics (MBvO in Dutch); organized sports in sports clubs (more specific, athletics, badminton, cycling, gymnastics, skating, and table tennis); Fysiosport (i.e. a fitness program delivered by physical therapists/sports physical therapists); Exercise for Heart Patients (HIB in Dutch); and Walking for sports (further referred to as Walking).

All the physical activity programs are specifically aimed at the target group. For instance gymnastics, and MBvO-gymnastics (MBvO-gym) are group-based physical activity programs consisting of several types of strength-, flexibility-, and balance training activities. These are mainly ground activities (on the mat), sometimes aided by using a chair, seldom applying equipment. In athletics the emphasis is on jogging for seniors.

Over a period of 15 months, all newly enrolled and actually started participants of these 10 different exercise programs were asked to participate in the study. Inclusion criteria were (1) age older than 50 years, and (2) not being a member of any type of organized sports- or physical activity organization directly prior to the study, implying that all participants in our study were in the Action stage in the Stages of Change model (Prochaska & DiClimenti, 1983). It, however, does not imply that participants should be fully inactive prior to the study.

### **Measurement of entry correlates**

All data were collected using a postal questionnaire. The questionnaire covered a number of areas:

Demographic data: age, gender, marital status, level of education, and living situation. Physical activity: evaluated using questions derived from the Dutch Monitor on Physical Activity and Health (Ooijendijk et al., 2002), which covers compliance with Dutch publichealth guidelines (Kemper et al., 2000) during an average week in the summer and winter.

Other lifestyle components: alcohol consumption (yes/no, and how many glasses of alcohol per week) and smoking (non-smokers, former smokers, and smokers).

Body weight and height: were used to calculate body mass index (BMI; kg/m<sup>2</sup>). Health status: measured with the RAND 36, a multidimensional health questionnaire (Ware & Sherbourne, 1992), which has been translated into Dutch (Van der Zee & Sanderman, 1993). In this study, five of the nine RAND-36 subscales were used: vitality (Cronbach's alpha 0.82), pain (Cronbach's alpha 0.88), mental health (Cronbach's alpha 0.85), general feeling of health (Cronbach's alpha 0.81), and change in health status (a one-item subscale: no alpha available). Each subscale was scored 0-100, with 100 being the best score. Selection of the five sub scales was based on expert opinion about the relevance of the scale.

Motivation for joining the specific exercise program. Sixteen different motivation categories were distinguished: appearance, peer contact, acceptance by others, challenge, exercising together, health, fitness, weight reduction, quality of the instructor, social contact, self-esteem, recreation, pleasure, relaxation, doctor's advice, and competition. Answer options were yes/no.

Participants were offered a questionnaire as soon as they had enrolled in the program, and were asked to fill in the questionnaire within a week, receiving a reminder after 2 weeks. In this manner the response time was relatively short.

### **Statistical analyses**

Analyses included computing descriptive statistics of demographics, lifestyle factors, and health status (percentages, mean and standard deviation) of the participants that actually started in the programs. Participants were divided into preference subgroups (i.e. the ten exercise programs). Through homogeneity analysis (Homals), using SPSS 12.0 (SPSS, 2003), it was examined whether the motivational categories could be reduced to less dimensions (categories without responses were removed before the analysis). The Homals technique performs multiple correspondence analysis of two or more categorical variables treated as if the categories are unordered (so '2' is not higher or more than '1'). This can be viewed as a type of principal components analysis of categorical variables. The output includes a plot of the category quantifications, which gives insight into the relationships between the variables in the analysis. The method is iterative by nature, and searches the 'best' solution to represent the number of imported items on two dimensions. Resembling groups are represented in the same area (these points have a relatively smaller distance to one another). These groups derived from the Homals analyses, were then univariate compared on demographics, lifestyle and health status for nominal variables using a  $\chi^2$ -test, and for numerical variables with an Anova test. A p-level of 0.05 was regarded as a statistically significant difference.

### RESULTS

A convenience sample of more than 400 local intermediaries (exercise and sport instructors) agreed to recruit participants for the project. After recruitment and giving their informed consent, 2,350 people received the questionnaire and 2,020 completed and returned it (total response 86%). It was revealed that 6% of people who enrolled in the activity did, however, not actively participate in the programs. These non-participants haven not been taken into our study because of non-response.

Demographics. MBvO-gym attracted relatively older participants (X=67.7 years), followed by gymnastics (X=63.2 years). The participants of athletics were relatively younger (X=54.8 years; Table 1 and Figure 1). There were exercise programs with mainly female participants, such as MBvO-gym (85.7%), Walking (85.6%), and gymnastics (73.9%), and with specifically male dominated exercise programs, like cycling (87.1%), table tennis (82.9%) and HIB (76.8%; Table 1 and Figure 2). Participants with high education levels enrolled in athletics. A lower level of education was associated with MBvO enrollment. Most participants in the study lived in a multi-story house. Relatively many older adults who lived in a service flat enrolled in MBvO, compared to the other programs.

qet         18         57.3         66         62.2         60.4         60.4         67.6		athletics (N=133)	badminton (N=134)	cycling (N=263)	gymnastics (N=99)	skating (N=36)	table tennis (N=86)	FysioSport (N=186)	HIB (N=334)	MBvO-gym (N=583)	Walking (N=166)	Total (N=2020)
Cueder         F <th>Age*</th> <th>54.8</th> <th>57.3</th> <th>56.6</th> <th>63.2</th> <th>56.0</th> <th>59.0</th> <th>59.4</th> <th>59.7</th> <th>67.6</th> <th>59.6</th> <th>61.1</th>	Age*	54.8	57.3	56.6	63.2	56.0	59.0	59.4	59.7	67.6	59.6	61.1
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Martial tatue         ·····         ····         ····	Male	67.5	66.1	87.1	26.1	56.3	82.9	38.7	76.8	14.3	14.4	47.8
Maned         66         64         64         61         60         62         64	Marital status											
Moded         25         64         71         113         53         63         60         87         81           Hould         P	Married	85.8	84.4	84.8	79.1	90.6	92.1	85.3	90.1	59.2	74.0	78.1
Education         ·····         ····         ····	Widowed	2.5	6.4	7.1	11.3		5.3	5.3	6.0	30.7	9.6	13.0
Education         ·····         ····         ····												
High         36.7         24.8         24.5         17.4         21.1         21.3         14.0         71.1         21.3           Midde         45.8         35.5         35.5         35.5         35.5         35.5         56.8           Midde         45.8         35.5         35.5         35.5         35.5         35.5         56.8         56.3           Midde         75.5         35.7         36.2         37.4         28.7         36.7         35.5         56.3           Midterburdu         82.5         68.8         73.3         56.2         78.1         78.9         77.1         59.0         81.5           Mutterburdu         82.5         68.8         73.3         56.5         78.1         77.1         59.0         81.5           Mutterburdu         70.5         70.5         70.5         70.5         77.1         59.0         81.5           Mutterburdu         86.5         70.5         76.7         77.1         59.0         81.5         70.5           Mutterburdu         86.5         70.5         76.5         76.5         77.1         50.5         70.5         70.5         70.5         70.5         70.5         70.5 <th>Education</th> <th></th>	Education											
Middle         458         495         555         452         438         44.7         50.0         43.0         53.5         58           Low         17.5         5.7         400         37.4         28.1         44.7         50.0         43.0         59.4         213           Low         17.5         5.7         400         37.4         28.1         24.2         28.7         43.0         59.4         213           Muterotybuse         82.5         68.8         73.3         65.2         78.1         78.9         77.1         59.0         81.5           Muterotybuse         82.5         68.8         73.3         65.2         78.1         77.1         59.0         81.5           Muterotybuse         82.5         68.8         73.3         65.2         78.1         77.1         59.0         81.5           Muterotybuse         86.6         84.7         78.9         76.7         77.1         50.0         81.5         81.5         81.5         81.5         81.5         81.5           Muterotybuse         86.6         84.7         78.9         76.1         77.1         81.5         81.5         81.5           Muterotybuse	High	36.7	24.8	24.5	17.4	28.1	21.1	21.3	14.0	7.1	21.9	18.0
low         17.5         5.7         4.00         37.4         28.1         34.2         28.7         43.0         59.4         21.3           Living stuation                 29.3          29.4         21.3           Living stuation                 29.4         21.3           Multi-story lows                29.5 </th <th>Middle</th> <td>45.8</td> <td>49.5</td> <td>35.5</td> <td>45.2</td> <td>43.8</td> <td>44.7</td> <td>50.0</td> <td>43.0</td> <td>33.5</td> <td>56.8</td> <td>42.0</td>	Middle	45.8	49.5	35.5	45.2	43.8	44.7	50.0	43.0	33.5	56.8	42.0
Lyng stration $\ldots$	Low	17.5	25.7	40.0	37.4	28.1	34.2	28.7	43.0	59.4	21.3	40.0
Multi-storey house         B25         B88         733         B52         781         771         590         815           Iffettie         1	Living situation											
Itestyle         · · · · · · · · · · · · · · · · · · ·	Multi-storey house	82.5	68.8	73.3	65.2	78.1	78.9	76.7	77.1	59.0	81.5	71.3
% notmatche         366         284         295         41.7         37.5         31.6         29.3         38.1         36.5         32.9           % notmatche         i         i         i         i         i         i         36.5         32.9         32.9           Model         i	Lifestyle Physical activity											
Smoking         9.2         25.7         12.3         10.4         3.1         2.3.7         3.3.3         8.6         12.7         11.6           Mill 30+         9.2         25.7         12.3         10.4         3.1         2.3.7         33.3         8.6         12.7         11.6           Mill 30+         5.0         8.3         4.3         8.9         3.4         6.8         17.2         13.2         14.7         12.4           Mill 30+         5.0         8.3         4.3         8.9         3.4         6.8         17.2         13.2         14.7         12.4           Motobil         10         18.4         13.3         25.2         9.4         18.4         13.8         43.2         13.2	% norm active	36.6	28.4	29.5	41.7	37.5	31.6	29.3	38.1	36.5	32.9	34.6
Smoking         9.2         25.7         12.3         10.4         3.1         23.7         33.3         8.6         12.7         11.6           Image: Image												
BM: 30 +         5.0         8.3         4.3         8.9         3.4         6.8         17.2         13.2         14.7         12.4           BM: 30 +         5.0         8.3         4.3         8.9         3.4         6.8         17.2         13.2         14.7         12.4           Alcohol         1 <t< th=""><th>Smoking</th><th>9.2</th><th>25.7</th><th>12.3</th><th>10.4</th><th>3.1</th><th>23.7</th><th>33.3</th><th>8.6</th><th>12.7</th><th>11.6</th><th>13.2</th></t<>	Smoking	9.2	25.7	12.3	10.4	3.1	23.7	33.3	8.6	12.7	11.6	13.2
BMI: 30+         5.0         8.3         4.3         8.9         3.4         6.8         17.2         13.2         14.7         12.4           Alcohol         1												
Alcohol         Alcohol         10.8         18.4         13.3         25.2         9.4         18.4         21.3         31.8         43.2         19.2	BMI: 30 +	5.0	8.3	4.3	8.9	3.4	6.8	17.2	13.2	14.7	12.4	11.1
No alcohol         10.8         18.4         13.3         25.2         9.4         18.4         21.3         31.8         43.2         19.2	Alcohol consumption											
	No alcohol	10.8	18.4	13.3	25.2	9.4	18.4	21.3	31.8	43.2	19.2	26.9

 TABLE 1:
 Background characteristics of subjects in different exercise programmes in percentage (%), or average in years (\*)



FIGURE 1: Age of participants in the ten different types of exercise programmes (in years)



FIGURE 2: Gender of participants in the ten different types of exercise programmes (in percentage)

Life-style factors (Table 1): Physical activity. The overall compliance to the public health guidelines of physical activity was 34.6%. There were, however, differences between the several exercise programs regarding this feature. In gymnastics participants relatively often complied with the health-enhancing physical activity (HEPA) guidelines. Badminton, Fysiosport, and cycling were associated with the lowest compliers'.

Smoking. In total 13.2% of the participants reported smoking behavior. Fysiosport was associated with the most smoking. Alcohol consumption. MBvO-gym, HIB, and gymnastics were associated with the highest abstinence (non alcohol drinking). Most alcohol was consumed (>5 glasses a week) by participants in athletics.

Health status. Cycling had the highest frequency of healthy participants in terms of a general feeling of health (i.e. a score> 75 points), and HIB, and MBvO-gym had the lowest frequency of healthy participants. In all participants 'change in health status' score was low, and the differences between groups were not very distinct. Athletics, cycling, and badminton was associated with a relatively high vitality score. Athletics, and cycling was associated with relatively high scores on mental health, and athletes and cyclists reported relatively little pain. Especially MBvO-gym, HIB and Fysiosport were associated with relatively low overall health status scores; and athletics, cycling and badminton were associated with relatively high overall health status scores.

The participants with the highest BMI participated in Fysiosport and MBvO. Widowed participants participated more frequently in MBvO.

### **Motivational groups**

Homogeneity analysis on the data on motivation, and type of exercise, resulted in Figure 3. There were 11 categories left after correction for 5 non-response categories: appearance, peer contact, acceptance by others, challenge, and exercising together. Interpreting this figure reveals three groups of motivational categories (the authors emphasize their choices by drawing lines around the distinct groups) that can be identified as: 'Relax & Enjoy' (dominated by relaxation, pleasure, quality of the instructor, and fitness), 'Cure & Care' (dominated by doctor's advice, health, weight reduction, and self esteem), and 'Competition' (dominated by recreation and competition) (see figure 3). Participants of MBvO fit into the motivation group 'Relax and Enjoy'; participants of Fysiosport, and HIB fit into the motivation group 'Care & Cure'; participants of the six organized sports fitted into the motivation group 'Competition' (Figure 3).



FIGURE 3: Exercise dimensions: specific exercise programmes versus motivations of participation

Participants of Walking fit into all three motivational groups. ANOVA on the three motivation groups revealed several statistical differences: Relax & Enjoy exercisers' were relatively older participants, were more often widowed, and often had a lower education; Care & Cure exercisers' had a relatively higher BMI, and their general health tended to be lower; Competition exercisers' were less often obese, had more often a higher level of education, and were more often male (table 2).

 TABLE 2: Background comparisons of the three motivational groups (Relax & enjoy / Care & cure / Competition; N=2020)

Variables	Relax & enjoy	Care & Cure	Competition	p-value, X <sup>2</sup> , (df)
Mean age in years (yrs, sd)	65.6 (8.3)	59.6 (7.4)	57.5 (6.4)	P<.0001, 240 (2)
General health (RAND-36) *)	65,5 (17,2)	62,3 (18,4)	73,2 (15,6)	P<000 <sup>1</sup> , 67 (2)
Vitality (RAND-36) *)	65,0 (16,4)	62,3 (18,4)	71,5 (15,1)	P<.000 <sup>1</sup> , 51 (2)
				p-value, X <sup>2</sup> (df)
BMI (kg/m², (%, n))				P<.000 <sup>2</sup> , 68 (6)
20-25 (normal)	41 (294)	32 (164)	48 (352)	
30-plus (obese)	14 (101)	15 (77)	6 (42)	
Gender (%, n)				P<.000 <sup>2</sup> , 467 (2)
- male	17 (127)	64 (331)	69 (519)	
- female	83 (614)	36 (189)	31 (232)	
Marital status (%, n)				P<.000 <sup>2</sup> , 150 (8)
- married (living together)	60 (443)	81 (419)	77 (574)	
- widowed	25 (182)	6 (32)	8 (59)	
Level of education (%, n)				P<.000 <sup>2</sup> , 135 (10)
- Highest	11 (79)	18 (92)	24 (177)	
- Lowest	19 (137)	9 (44)	7 (48)	

1 Kruskal-Wallis one-way ANOVA, 2 Chi square test

\*) score is from 0-100 (with the sd) on the RAND items General health, and Vitality

### DISCUSSION

This study reports on correlates associated with entry (enrollment and actual participation), and motivational factors in older participants of organized exercise programs in the Netherlands. In a sample of N=2350 the response on the questionnaire was 86%, which is very high. This is one of the few studies on this issue in which older adults enter an exercise program voluntarily; most such studies are directed to people who are recruited actively for the study purpose.

Only a very small proportion (6%) of the enrollees did not start in the program after all. It would be advisable to study why people who enroll in physical activity programs dropout even before they start.

Only a few adults over 70 years of age participated in the organized exercise programs in our study; whenever they did participate - it was associated with MBvO activities. The younger seniors in this study were participating in organized sports activities (especially athletics, skating, cycling, and badminton). This is in accordance with the literature which states that people when aging tend to change from sports to other (often less competitive) exercise formats (Visser, Launer, Deurenberg, et al., 1997). It is also known that there is a general decrease in participation in physical activity with increasing age (King, Blair, Bild, et al., 1992; Ooijendijk et al., 2002). The most popular activities among seniors are cycling, walking, swimming, and gardening (Ooijendijk et al., 2002). This study suggests that in older adults MBvO tended to be the most popular exercise program. More than 300,000 seniors participate in MBvO programs on a weekly base (Kroes & De Greef, 2000).

In the total study sample females were in the majority. The majority of this age group in the Netherlands consists of women, so our finding is representative for the general older aged population. However, there is a possibility that women are more likely to join organized physical activities than men.

Vigorous activity levels and sports activities are generally lower among women than men. When lower and moderate intensity levels are included the sex differences in activity levels between women and men diminishes or even disappears (King et al. 1992).

The absolute number of participants in the various exercise programs was different: MBvO was overrepresented (n=463) and skating (n=32) was underrepresented. This may be due to the fact that every community in the Netherlands has at least one or more MBvO group(s), whereas there are only few speed skating rinks in the country, and the distance to the accommodation could have been a threshold for participation. This argument also counts for HIB groups, and FysioSport at the time of the study (there were only approximately 90 FysioSport centers, and about 140 HIB organizations nationwide). The results of our study may be seen as representative for the Netherlands, both related to the type of exercise and number of older adults participating in the specific exercise program.

The number of participants that met the HEPA-guidelines in our study was relatively low. Only gymnastics reported over 41% of the participants to comply with the guidelines, whereas in the whole population this was 46% (Hildebrandt et al., 2004). Most others were under 40%, and badminton was even 28.4%, and cycling reporting 29.5%. These results show that the study population is certainly an interesting population in terms of need of more exercise, as they underreported the score on physical activity.

In a focus group interview we carried out among older adults before the start of our study, it was mentioned that health is often an important determinant for older adults to enroll

and start in an exercise program or to remain active. In our study the most important motivation for entrance in a program was indeed health, followed by enhancing one's fitness and relaxation. Hereby, our study offers comparable evidence of health as an important motive for exercise in older adults, however independent of the type of exercise program. Jongert et al. (2005) distinguished three motivational constructs of importance for the enrollment in a fitness program. Eleven motivation questions in our study could be reduced to the same three constructs: i.e. Relax & Enjoy; Care & Cure; and Competition. In our study we applied a homogeneity analysis for data reduction on the motivation questions. Participants of MBvO may be categorized as Relax & Enjoy exercisers. Participants of Fysiosport, and HIB fit into the category Care & Cure. Fysiosport and HIB participants often join their program after enduring illness or injury, and therefore are prone to join an exercise program which tackles the underlying problems. Older adults having specific physical problems may be sent to such programs.

The participants of the six organized sports fit into the category Competition. The explanation for this choice may be easy, as people joining actual sports often choose their program for the element of having competition.

It was quite interesting that people who participated in walking covered all the motivation constructs, which means that the exercise walking is a preferable option for nearly all seniors. In terms of exercise promotion, and public health this should be seen as important, since walking may be advised to many seniors. It is also an exercise form which has a low threshold for participation, it can be done nearly everywhere (and even from the doorsteps), it is healthy with little risk of injury, and it is inexpensive (one needs little equipment).

There were several differences in the distribution of correlates between the three motivational groups. Older participants, and widowed participants, were more often found in the Relax exercise group. Therefore we should offer older and widowed people programs like MBvO. As expected, people with a relatively high BMI, and a relatively low health status were more often found in the Care & Cure exercise group, and therefore these people should be offered likewise programs, i.e. HIB or Fysiosport. Competition exercise was often associated with people with a BMI<25, with male participants and with higher educated people. All of this information offers an interesting potential for exercise promotion for seniors in the future: for instance we could try to recruit new members for the Relax' exercise groups in the widowed people or amongst people with a lower education status or we could target the attention in the recruitment of participants for Care & Cure exercise groups in people with relative higher BMI, and people who experience their health as being relatively low. Finally, we could target our attention in the recruitment of participants in Competition exercise groups at males with a higher education level. In primary care one could advise older adults with a relatively low health status and higher BMI to join a Fysiosport group, or when they have suffered heart failure to join a HIB group; older adults (with no direct health problems) may be advised to join a MBvO or walking group, and older adults who tend to be more competition oriented may be advised to join a sports club, which offers exercise programs fitting such older adults.

This study had a number of limitations. Ten different exercise programs have been identified being representative for the 50+ population in the Netherlands. However, exercise programs such as tennis, and golf – also quite popular – have not been taken into account. Hereby we lack certain popular types of exercise. However, one of the main criteria for a type of exercise to be part of our study was the fact that the national sports association should have a specific policy related to seniors in the Netherlands, which was not the case in tennis, and golf at the time of the study. Also several non-organized exercise forms are popular in seniors, such as swimming, and gardening. This study however, only accepted participants who joined an organized exercise group or club. Another limitation is the cross-sectional aspect of the study, as to which no hard conclusions may be derived. It, however, does certainly offer clear indications for future research in this area, especially on the usefulness of the motivational subgroups labels in recruitment.

In conclusion. Differences in demographics, lifestyle factors, and health status between newly started participants in ten popular exercise programs for older adults in the Netherlands were found. More Exercise for Seniors (MBvO) attracted relatively older seniors, whereas organized sports mainly attracted the younger seniors. Walking, MBvO, and gymnastics attracted more women, whereas skating, and table tennis were reported to attract more male participants. Badminton and cycling attracted relatively higher educated participants, whereas MBvO attracted relatively lower educated participants.

Three separate constructs of exercise motivation were identified: 'Relax & enjoy', 'Cure & care', and 'Competition'. Participants of MBvO may be categorized as Relax & Enjoy exercisers, participants of Fysiosport, and HIB fit into the category Care & Cure; the participants of the six organized sports fit into the category Competition, and participants in walking finally fit in all three categories.

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# The effects of exercise programs for older adults on functional status, and health-related quality of life;

a systematic review

Stiggelbout M, Popkema D, De Greef M, Mechelen W van, Hopman-Rock M. The effects of exercise programs for older adults on functional status, and health-related quality of life; a systematic review. *Submitted for publication* 

# ABSTRACT

This sytematic review concerns the effectiveness of exercise programs for older adults on functional status, and health related quality of life (HRQoL).

## Methods

Randomised controlled trials were identified by literature searches. Papers were included on the basis of predefined inclusion criteria. Two independent reviewers assessed methodological quality according to a standardised criterion list. Furthermore, data on study populations, characteristics of exercise interventions, and evaluation results were extracted.

#### Results

Eleven studies of good quality on functional status were selected. Seven studies reported improvements on several dimensions of functional status. Twelve studies of good quality on HRQoL were selected. Six studies reported improvements of HRQoL.

#### Conclusion

Based on best evidence synthesis it is concluded that there is strong evidence of positive effects of exercise for older adults on both functional status as well as HRQoL in older adults.

It is expected that by 2050 about 25% of the population will be older than 65 years. In particular, the number of people older than 80 years is increasing rapidly (DiPietro et al., 2006). Aging is associated with a decline in health-related physical fitness and functional status (Shephard, 1993). Functional status refers to a person's ability to perform activities in daily living and to fulfil social roles. Thus a good physiological and psychological function helps to maintain personal independence and reduces the need for acute and long term care. Physical activity has been shown to be a determinant of functional status in older adults. Consequently, it will enhance functional independence (McMurdo & Rennie, 1993; Skelton et al., 1994; Skelton & McLaughlin, 1996; Resnick, 2000). The functional status in older adults is also related to health related quality of life (HRQoL). Dimensions of HRQoL are cognitive, social, physical and emotional functioning, as well as personal productivity and intimacy (USDHHS, 1996). Physical activity plays an important role in enhancing HRQoL of the older adult (Shephard, 1993; Rejeski et al., 1996). The most direct effects are likely in the areas of psychological wellbeing, perceived physical functioning, physical wellbeing and cognitive functioning (USDHHS, 1996).

Most intervention studies have focused on exercise and training programs rather than on daily physical activity. Exercise and training programs are often of fixed duration, and participants are usually recruited for the specific intervention under study. In contrast, daily physical activity focuses on lifestyle associated physical activity, i.e. walking and cycling, activities which are often performed daily and without time restriction. This review investigates the effects of exercise- and training programs, rather than daily exercise, on functional status and HRQoL.

A review by Van der Bij et al. (2002) evaluated the effectiveness of physical activity interventions among older adults. Home-based, group-based, and educational physical activity interventions can result in increased physical activity, but changes are small and shortlived. Participation rates of home-based and group-based interventions were comparable, and both seemed to be unrelated to type or frequency of physical activity. The beneficial effect of behavioral reinforcement strategies was not evident. This review did not include effects of exercise programs on functional status and HRQoL.

Several systematic reviews have investigated the relationship between exercise and functional status in older adults (Keysor, 2002; Freedman et al., 2002; Rydwik et al., 2004).

While Keysor (2002) showed that exercise increases muscle strength and aerobic capacity and reduces functional limitations, it was less clear whether exercise improved functional status. Furthermore, there was a discrepancy between prospective and experimental studies: several well-conducted prospective studies showed a beneficial effect of exercise on functional status, whereas the majority of experimental studies did not show positive effects on functional status.

In another systematic review Freedman et al. (2002) found that several studies reported exercise to improve the functional status in older adults. Rydwik et al. (2004) have carried out a systematic review on the effects of physical training on functional status. They

found that there is strong evidence for an effect of physical training on muscle strength, and mobility; moderate evidence for an effect on range of motion; and contradictory evidence regarding gait, activities of daily living, balance, and endurance. These results are, however, related to older adults with multiple diagnoses, living institutionalised.

No systematic reviews have specifically addressed the relationship between exercise and HRQoL. Bize et al. (2007) found HRQoL to be associated with the level of physical activity in the general population, and concluded that cross-sectional data showed a consistently positive association between physical activity level and HRQoL. However, the limited evidence from randomized controlled trials and cohort studies precluded a definitive statement about the nature of this association.

Functional status and HRQoL are very important health parameters. Although literature states that functional status, and HRQoL might be enhanced by exercise, the relationship is still not clear. The aim of this study is to review systematically the effectiveness of exercise programs on functional status, and HRQoL of older adults.

# METHODS

#### **Study selection**

- 1. A computerised literature search of Pubmed, Embase, PsychInfo and Sportdiscus between 1980 and (July) 2007 and a research of the TNO (Institute of applied research in The Netherlands) literature database on Exercise and Health; followed by
- 2. Screening of references cited in the retrieved studies; followed by for completeness
- 3. Personal communication with six experts in the field, who were requested to review the primary list of identified studies.

Table 1 presents the search strategy (including the number of hits per database and relevant keywords.

The following inclusion criteria were applied:

- The study results were based on a randomised controlled trial (RCT);
- The outcome measures were functional status, and (health related) quality of life;
- The article was published in the English language.

#### *TABLE 1:* Search strategy (databases, hits per database and keywords) used for literature search

Databases	Key words
MEDLINE (n=781) EMBASE (n=760) PSYCHINFO (n=69) Sportdiscus (n=740) TNO database (n=21)	(Exercise or Physical Activity or Sport or Training) and (Older adult, Elderly or Ag(e)ing) and (QALY or Quality of Life or Health Related Quality of Life or Functional performance or Physical function or Functional status, or ADL or IADL, Activities of daily living) and (Intervention or Evaluation or Randomis* or Randomiz* or Control or Effect)
Limite	01/01/1020 to 01/07/2007; English language
Linito	o 1/0 1/ 1900 to 0 1/0//2007, English language

#### **Quality assessment**

Two reviewers (MS and DP) reached agreement on the content, and implementation of a set of predefined criteria (table 2). The Cochrane Collaboration Review Group have developed a set of methodological criteria for systematic literature reviews for interventions in back pain. Because of the differences in interventions and research methodology these criteria were modified by Proper et al. (2002; table 2) for the area of physical activity / exercise interventions. These modified criteria were the basis for this review.

*TABLE 2:* Methodological quality assessment criteria. See table 3 for the operationalisations of the criteria (based on Proper et al., 2002)

- 1. Randomisation procedure
- 2. Inclusion or exclusion criteria
- 3. Drop-outs
- 4. Blinding person, who carries out the tests
- 5. Compliance
- 6. Intention to treat analysis
- 7. Timing outcome parameters
- 8. Follow-up > six months

Two reviewers (MS and DP) then reviewed identified studies according to this standardised set of modified criteria.

Each item of a selected study that met the respective criterion was assigned '1' (positive). If the item did not meet the criterion or was not described at all, a '0' was assigned. Thus the highest attainable score was '8'.

In a consensus meeting both reviewers tried to reach agreement on items on which they had different opinions. A best evidence synthesis on the effect of the exercise programs on several outcome parameters was done using a rating system as to levels of evidence based on Proper et al. (2002). The following five levels of evidence were distinguished: (i) strong evidence: at least two randomised controlled trials of high quality with consistent

results; (ii) moderate evidence: one randomised controlled trial of high quality and at least one randomised controlled trial of low quality or one randomised controlled trial of high quality and at least one controlled trial of high quality (for both situations consistent results were required); (iii) limited evidence: one randomised controlled trial of high quality and at least one controlled trial of low quality or more than one randomised controlled trial of high quality and at least one controlled trial of low quality or more than one randomised controlled trial of low quality or more than one controlled trial of high quality (for all situations consistent results were required); (iv) inconclusive evidence: only one study or multiple controlled trials of low quality or contradictory results; and (v) no evidence: more than one study with the consistent result that no significant or relevant results were shown. A study was considered to be of high quality if more than 50% of the methodological criteria were scored positively (i.e. a score of 5 or more).

*TABLE 3:* Operationalisation of the criteria for assessment of the quality of studies on the effects of exercise programs on functional status, and health- related quality of life for older adults (based on Proper et al., 2002)

- 1 The score is '1' if a method of randomisation was performed and the randomisation method has been described and performed adequately. If this was not the case the score is '0'.
- 2. The score is '1' if inclusion or exclusion criteria were specified. Else the score is '0'.
- 3. Score is '1' if the percentage of drop-out during the study period did not exceed 20% for short-term follow-up (< 3 months) or 30% for long-term follow-up (> 3 months).
- 4. The score is '1' if the person performing the assessments was blinded to the assignment of subjects to the groups; if questionnaires were used, a score '0' was given.
- 5. The score is '1' if the participants attended at least 75% of the prescribed frequency; if several subgroups of participants were distinguished, the high frequency group had to attend at least 75% of the prescribed frequency to score '1'.
- 6. The score is '1' if the intervention and reference subjects were analysed according to the group belonging to their (initial) assignment, irrespective of non-compliance and co-interventions.
- 7. The score is '1' if the timing of the outcome measurement was identical for all intervention and reference groups, and for all important outcome assessments.
- 8. The score is '1' if follow-up was 6 months or longer.

# RESULTS

The first search identified 2371 articles, only 22 of which met the inclusion criteria. Initially, the two reviewers disagreed on the methodological quality of 25 of the 176 (22 x 8) items (14%). Cohen's kappa was 0.58. The quality scores ranged from 3 to 7 (8 max) for all the trials. Fifteen of the trials were of high quality (Table 4).

1 <sup>st</sup> Author	1	2	3	4	5	6	7	8	Qu sco	ality ore
Barnett, 2003	1	1	1	1	0	1	1	1	7	+
Buchner, 1997	0	1	1	1	1	1	1	1	7	+
McMurdo, 1992	1	1	1	1	1	0	1	1	7	+
Binder, 2002	1	1	1	0	1	0	1	1	6	+
Cress, 1999	0	1	1	0	1	1	1	1	6	+
King, 2002	1	1	0	1	0	1	1	1	6	+
Li, 2002	1	1	1	0	1	0	1	1	6	+
Vincent, 2002	1	1	1	0	1	0	1	1	6	+
Barret, 2002	1	1	1	0	0	1	1	0	5	+
De Vreede, 2005	1	1	0	1	1	0	1	0	5	+
Hopman-Rock, 2002	0	1	1	1	0	0	1	1	5	+
McMurdo, 1993	0	1	1	0	1	0	1	1	5	+
Peel, 1999	1	1	1	0	1	0	1	0	5	+
Rubenstein, 2000	1	1	1	0	1	0	1	0	5	+
Wallace, 1998	0	1	1	0	1	0	1	1	5	+
Kalapotharakos, 2006	0	1	0	0	1	0	1	1	4	-
Rogers, 2002	0	1	0	1	1	0	1	0	4	-
Damush, 1999	0	0	1	0	1	0	1	0	3	-
O'Hagan, 1994	0	1	0	0	0	0	1	1	3	-
Teoman, 2004	1	1	0	0	0	0	1	0	3	-
Tsutsumi, 1997	0	1	1	0	0	0	1	0	3	-
Brown, 2000	1	1	0	0	0	0	1	0	3	-

TABLE 4: Scores of the quality assessment of evaluated studies

1. Randomisation procedure

3. Drop-outs 5. Compliance

7. Timing outcome parameters

2. Inclusion or exclusion criteria

4. Blinding person who carries out the tests6. Intention to treat analysis

8. Follow-up

#### **Functional status**

Eleven high quality RCT's on the effects on functional status were identified, and three low quality RCTs. Seven high quality RCT's showed positive results (Barnett et al., 2003; Binder et al., 2002; Cress et al., 1999; De Vreede et al., 2005; King et al., 2002; McMurdo & Rennie, 1993; Vincent et al., 2002), and four showed no effects (Buchner et al., 1997; Hopman-Rock & Westhoff, 2002, Peel et al., 1999; Rubenstein et al., 2000). None of the studies reported negative effects. The three low quality RCT's reported positive effects

(Brown et al., 2000; Kalapotharakos et al., 2006; Rogers et al., 2002). Conclusion: there is strong evidence for a positive effect of exercise on functional status in older adults.

#### HRQoL

Twelve high quality RCT's were identified, and four low quality RCT's. Six high quality RCT's (Buchner et al., 1997; McMurdo & Rennie, 1992; Binder et al., 2002; Li et al., 2002; Rubenstein et al., 2000; Wallace et al., 1998) reported positive effects; six studies reported no significant effects (Barnett et al., 2003; Barrett & Smerdely, 2000; Hopman-Rock & Westhoff, 2002; King et al., 2002, McMurdo & Rennie, 1993; Peel et al., 1993), and no study reported negative effects. Three low quality RCT's (O' Hagan et al., 1994; Teoman et al., 2004; Tsutsumi et al., 1997) reported positive effects, and one reported no effects (Damush & Damush, 1999). Conclusion: there is strong evidence for a positive effect of exercise programs on HRQoL in older adults.

Results	Significant effect on ADL: + (p<0.05)	No significant effects IADL: 0 There may have been a ceiling effect	Significant effect on physical functional performance (14%; ES: 80	No significant effect on PPT. 0 Program may be too short, participants may regain functional skills at a slow rate.	Significant effect on PPT: + (p<0.05) Ex 29 ± 6 vs 31 ± 4 Co 29 ± 6 vs 29 ± 6	Phys funct: 0	PPT: + (p=0.002) FSQ: + (p=0.002)
Adherence	Exp: 91% Con: 86%	95%	81%	88%	Not reported	91%	100%
Measures/ parameter	ADL measurements by Barthel Index	Lawton IADL	CS-PFP**)	РРТ	РРТ ***)	Self-reported Physical functioning	PPT-8 ADL via OARS FSQ
Population	N=41 Exp=15 Con=26	N=105 ET=25 ST=25 ET+ST=25 Con=30	N=49 Exp=23, Con=26	N=24 Exp=13 Con=11	n=84 Exp=48 C= 36	N=7054 community living men n=59 Exp=31, Con=28	N=444 n=115 Exp=66 Con=49
Activity: Frequency Intensity Time (min, ) Duration (weeks)	Seated strength training exerc 2x/week 45 m/session 7 months reminiscence group	Endurance vs strength training 3x/week 60 min. 24-26 weeks	Endurance-/ strength training expervised 60 min. 75-80% max 3x/wk months	Walking 20 min, Strength: 20 min 60 min.3x / week	Low intensity exercise program Supervised 3x/week 3 months	Exercise training 3x/wk Low-moderate 90 minutes 3 months	Flex/resistance/ balance train 3x/week
Age group/ sexes	X=81 yrs	X=75 yrs	Men+ Women Exp: 75 yr Con: 76 yr	Older adults With ADL problems Exp=78 Con=76	X= 83 Physically frail	X=74 y M with mobility problems	X=83 y M+W
1ªi Author year	McMurdo 1993	Buchner 1997	1999	Peel 1999	Brown 2000	Rubenstein 2000	Binder 2002

# TABLE 5: Effects of physical activity on functional status

Hopman-Rock 2002	Heatthy Elderly people 63% Women	Exercise training 1x/week low intense 60 minutes 6 weeks	N=551 n=50 Exp=25 Con=25	Таа	Not reported	No significant group x time effects: p>0.05 The intervention may be too low intense for healthy older adults
King 2002	Community Dwelling + mobility problems X=77 yrs W: 79%	<ol> <li>Center bases versus endurance, strength, balance, flex</li> <li>T5 m/session</li> <li>T6 m/session</li> <li>Nome ex</li> <li>Nome ex</li> <li>Nome ex</li> <li>Nome endurance ex</li> </ol>	N=155 Exp=80 Con=75	PPT-8 Mc Arthur battery	Not reported	PPT: 0 Mc Arthur: + (p<0.05; espec. balance and chair fise) improvement after 6 months 3x/week, maintaining effect after 12 months with 1x/weel + 2x home sessions/weekly
Rogers 2002	Senior center Minority W X=75 yrs	Thera band exerc 3 x/ week 50 min / session 4 weeks each ex 3 sets 8-15 repetitions	N=22 Exp=16 Con=6	5 Chair Stand 30 sec chair stand Up& Go test	Adherence: 95%	Time to complete 5 chair stand: + (20%; p<0.05) Balance assessed by Up-&-Go test: + (10%; p<0.05)
Vincent 2002	Older adults 60-83	Resistance training whole body 3x/week 6 months	N=84 n=60 High: 22 Low: 24 Con=16	Stairclimbing ability	Participants must attend 85+% of the total sessions	Both the low-intensity as well as the high intensity group had significant effects on their stairclimbing ability: + (p<0.05)
Barnett 2003	Older adults 65+ I: 74 yrs C: 75 yrs	Exercise of balance, coord, aerobic, muscle strength 60 min 1X/week 12 months	N=163 109 W + 54 M	Sway Reaction time Walking speed		All 3 mentioned measures: + (p<0.05)
De Vreede 2005	Healthy women 70+	Functional task versus resistance training groups 60 min 33 / week 12 week	N=98 Funct gr = 33 Resist gr = 34 Con= 31	Assessment of Daily Activity Performance		Functional task group improved more than both other groups (p<0.05)
Kalapotharakos 2006	Healthy older adults 60-75 yrs	Aerobic exercises 3x / week, 12 weeks	N=22 Exp = 12 Con = 10	Chair rising time Whole body reaction time		Both measures: + (p<0.05)
X Average aç *) Instrument: **) CS-PFP : C	ge al Activities of daily Livin ontinuous Scale – Physi rformance Test (Reuber	ig Scale (adaptation of Lawton & E cal Functional Scale (Cress, 1999) n & Siu, 1991)	srody (1991)) ).			

 TABLE 5: Effects of physical activity on functional status

esults	ignificant effects on SI: + (p<.05) ealth status: + (p<.05)	o significant effect on LSI: 0	ignificant effect on physical functioning: + xp group improve compared to control group = .05). lean and fastest test: + (p<0.05)	o significant effect on Total SIP: 0 ffect on physical dimension SIP: + (p=0.02) o effect on psycho socials dimension SIP: 0 /ell being lower for drop-outs	igh ATEF group had higher Life satisfaction cale after 9 months than low ATEFF group ><0.05)	the older segment of participants: ocial functioning: + (p=0.04	fler 9 months: leneral health: + (p<0.05) ole physical : + (p<0.05)	oth training groups improve in PSES: (p<0.05) compared to control group laybe the positive health was a factor that fluenced effects
Adherence	83% F.	Exp: 91% Con: 86%	No adherence S rate was reported; (f Drop-out rate: 35.3%	78% M	T õ L	58% si	95% G R	<u>n ← &gt; </u> 2
Measures / parameter	Life Satisfaction Index (LSI) Health Status	Life Satisfaction Index (LSI)	Physical function by sit stand test	Sickness Impact Profile (SIP) General wellbeing	RAND-36 Life Satisfaction scale	SF-36	SF-36	Physical Self-efficacy scale
z	N=87	N=41 Exp=15 Con=26	N=71 Exp=34 Con=37	N=500 n=43 Adher=23 Drop-out=20	N=300 60+ volunteers n=66 ATEF+:37 ATEF-:20	N=2554 n=93	N=105 ET=25 ST=25 ET+ST=25 Con=30	High: 19 Low: 14 Con: 14
Activity / duration / frequency intensity /	Exercise training	Seated strength training exercise 45 m/session 2x/week 7 months versus reminiscence group	Exercise class full range of motion, strength, co-ordination, flexibility and strength 1/wk 1 hr & 2/wk 10 min	Gerofit program 1,5 hrs, 3x/wk conditioning 65-75% HRR 5 yrs	Supervised aerobic training 3x/week prescribed HR 9 months	Strength training, 30 minutes 3x/week 12-15 weeks	Endurance vs strength training 24-26 weeks 3x/week 60 min	Strength tr, 12 weeks high/low. vs contr
Age group / sexe	Elderly M+W X=65 yrs	X= 81 y	Frail elderly from residential homes 62-95 yrs XE=83 yrs XC=80 yrs	Elderly M (94%) +W X=68 yrs	Older adults M+W	Non-disabled older adults 65 + 10 M / 48 W	X=75 yrs	Healthy older adults X=68 yrs
1st Author year	McMurdo 1992	1993 1993	0'Hagan 1994	1994 1994	Topp 1994	Jette 1996	Buchner 1997	Tsutsumi 1997

 TABLE 6 : Effects of physical activity on Health Related Quality of Life

SF-36: + (p<0.05) Role limitation physical " emotional social functioning mental health energy general health perception	No significant group x time effects: 0 Strength: +	SF-36: no significant group x time effects: 0 Program may be too short	Significant effect on general health (p=0.005);+ Trend towards physical functioning (p=0.08); +	No significant group x time effects: 0 There may be too small numbers Type II error possible	Change of health: + Social functioning: + Mental health: + p=0.02	No significant group x time effects: 0 The intervention may be too low intense for healthy older adults	No significant group x time effects: 0
%06<	85%	88%	91%	No adherence rate reported	100%		Exp: 71% C: 66%
SF-36	SF-36	SF-36	SF-36	SF-36	SF-36	RAND-36	SF-36: Physical functioning Mental health .:
N=100 Exp=53 Con=47	N=62	N=24 Exp=13 Con=11	N=7054 community living men n=59 Exp=31, C=28	N=44	N=444 n=115 Exp=66 / Con=49	N=551 n=50 Exp=25 Con=25	N=16579 n=155 Exp=80 Con=75
6 months 60 min 3x/week 20m strength, 20m aerobics, flex / coord	Strength training With elastic bands	Walking 20min, Strength: 20min ca 60 min 3x/week	Exercise training 3x/week low-moderate 90 minutes 12 weeks	Resistance / flexibility 60 min 2x / week 10 weeks	Hex/resistance/ balance train 3x/week	Exercise training 60 minutes 11/week 10w intense 6 weeks	<ol> <li>Center bases versus endurance, strength, balance, 75 m/session 3x/week m1-6 2) home ex 1/week + 2 home sessions, versus</li> <li>2) home endurance exercise</li> </ol>
Older adults X=71.9 70% F	Retirement residential comunities X= 68	Older adults With ADL problems E=78 C=76	X=74 y M with mobility problems	Older adults 60-plus	M+W 65+ X=83	Healthy Elderly people 63% W	X=77 y W 79% Comm Dwelling problems
Wallace 1998	Damush 1999	Peel 1999	Rubenstein 2000	Barret 2002	Binder 2002	Hopman-Rock 2002	2002 2002

Li 2002	Low active older adults, 65-plus X=73	Tai Chi 60 min 22/week 6 months	N=148 n=72 Exp=40 Con=32	PSPP Domain specific self esteem (PSPP) (PSPP) Blobal self esteem Rosenbergs self esteem scale	%06	Significant effects on all domains: + (p<0.05)
Barnett 2003	Older adults at risk of falling X=75 109 Women 54 Men	Exercise of balance, coordination, aerobic, muscle strength 60 min 1X/week 12 months	N=601 n=163	SF-36	62%	No significant group x time effects: 0 The frequency of once a week may be too low
Teoman 2004	Postmeno-pausal women X=51	Sub-maximal aerobic exercises 3x / week, 6 weeks	N=81 Exp = 41 Con=40	Nottingham Health Profile		Significant effects on improved quality of life (p<0.05)
X AIMS: CCRQ: CCRQ: C LSES/LSI: C C C C C C C C S SWLS S SWLS S SWLS S SPPP	verage age rrthritis Impact Measure hronic respiratory Dise ife Satisfaction in the El iatisfaction With Life Sc <sup>2</sup> ox & Gorbin, 1989; Li,	ment Scale; ass Questionnaire derly Scale (McMurdo, 1992; 1993) ale (Diener et al., 1985) 2002)				

#### DISCUSSION

The purpose of this review was to examine the effectiveness of exercise programs for older adults on functional status and HRQoL.

The results are compelling and provide strong evidence that exercise programs for older adults improve functional status and HRQoL, and thereby promote functional independence. Of the high quality RCT's focused on functional status, there were four studies which reported no statistical significant effects. In all cases the authors offered information as to why no effects were found.

- 1) Buchner et al. (1997) stated that there may have been a ceiling effect of the measurement instrument applied;
- 2) Peel et al. (1999) explained that the population size of the study was too low to find significant effects;
- 3) Rubenstein et al. (2000) concluded, in retrospect, that the intensity of the exercise had been too low;
- 4) In the RCT by Hopman-Rock & Westhoff (2002) the low intensity of the exercise may have influenced the results negatively.

In addition: in the studies by Hopman-Rock & Westhoff (2002), and Peel et al. (1999) the study duration of the intervention may have been too short to find already positive effects on the functional status or HRQoL.

Of the 12 high quality RCT's related to HRQoL six found no effect on HRQoL. Hopman-Rock & Westhoff (2002), and Peel et al. (1999) offered the same explanation for a lack of effectiveness as mentioned in the section above. Barret & Smerdely (2002) also found no HRQoL effects. They stated that this could be due to too small sample size (post hoc sample size analysis suggested the possibility of Type II statistical errors). In the study by Barnett et al. (2003) it was said that the low frequency of the intervention was one of the main reasons for the lack of effectiveness. King et al. (2000) assumed that in their trial there was a ceiling effect, due to the relatively high-functioning of the sample being used in their study. They also raised doubt about the lack of sensitivity of the measurement instrument used in the study. McMurdo & Rennie (1993) speculated that the physical activities in the intervention could have been too light to improve HRQoL.

A number of methodological characteristics of the studies included in this systematic review are relevant for the interpretation of the results of this review.

The instruments which were applied to measure the effectiveness of the interventions were different. Functional status was measured in several ways. The Physical Performance Test (PPT, by Reuben & Siu, 1990; used by Peel et al., 1999; Brown et al., 2000; Binder et al., 2000; Hopman-Rock & Westhoff, 2002; King et al., 2002) was the measurement instruments most used. O'Hagan et al. (1994) used the sit to stand test as a measure to assess the functional status. The Instrumental Activities of Daily Living Scale (by Lawton & Brody 1991) was applied by Buchner et al. (1997). Cress et al. (1999) used the Continuous Scale

– Physical Functioning Scale, and Rogers et al. (2002) used the Up & Go test, in combination with the Chair Stand test. In the HRQoL studies also several instruments were applied. The SF 36 (or RAND 36) was used most commonly (Buchner et al., 1997; Wallace et al., 1998; Damush & Damush, 1999; Peel et al., 1999; Barret & Smerdely, 2002; Binder et al., 2002; Hopman-Rock & Westhoff, 2002; King et al., 2002; Barnett et al., 2003). Other applied instruments were the Nottingham Health Profile (Teoman et al., 2004), Sickness Impact Profile (SIP; Morey et al., 1994), and the Life Satisfaction Index (LSI; McMurdo & Burnett, 1992).

This overview shows that there is no unique measurement instrument to assess functional status. The PPT seems to be quite popular for this measurement. It is recommended to use the same – or at least comparable – measurement instruments in this area in future research.

In the exercise studies included in our review there were considerable between-study differences in the type of activities used, their frequency, intensity, and duration, and the duration of the intervention or the duration of follow-up. In general, the best results were found in studies with a frequency of three times a week. However, Barnett et al. (2003) already found positive effects in an exercise intervention with a frequency of once a week, and Li et al. (2002), and McMurdo & Rennie (2003) reported positive effects with a frequency of twice weekly. This suggests that the baseline level of the outcome measure might also play a role here, with leaving ample room for improvement. This line of reasoning is fed by the fact that our review showed that even programs of 8 weeks already were effective in improving functional status (Brown et al., 2000; Rubenstein et al., 2000). Although there is insufficient information on the dose-response relationship between dose of exercise and effectiveness, it seems likely that low intensity exercise may already provide improvement in functional status in older adults (Brown et al., 2000). However, based on the studies in this review it is not possible to recommend the best exercise dose, as there were too many differences in the exercises, the intensity of the program, the duration of the sessions, the length of the program (or study), and the frequency of the sessions. More data are needed on this topic to draw solid conclusions

#### Limitations of the studies

Few studies primarily investigated the effect of exercise on the functional status or HRQoL of older adults. Primary goals were often strength, endurance, flexibility, or balance. In many studies, functional status and HRQoL were secondary goals. For this reason several studies could have been underpowered, and therefore we might have a wrong judgement about the effect. In future studies of functional status, and HRQoL researchers use uniform goals, and instruments to enable comparison of study results.

Many studies failed to provide information about intention to treat analyses, blinding of the person who carried out the testing, and compliance.

Compared to other systematic reviews (Freedman et al., 2002; Keysor, 2002; Proper et

al., 2002; Rydwik et al., 2004; Bize et al., 2007), we include relatively many high-quality studies.

#### Limitation of the review

As we did not include unpublished studies, we might have missed some relevant studies. In addition, because we only included studies written in English, we may have biased data collection.

The study by Hopman-Rock & Westhoff (2002) consisted a RCT, and a Community Intervention Trial (CIT). In this review we only included the RCT, as this was an inclusion criterion, and we only included effects on functional status and HRQoL. We found no effects on both parameters. This study did, however, find effects on other health parameters, such as overweight, and blood pressure.

#### **Conclusions and recommendations**

There is strong evidence that exercise programs for older adults have a positive effect on both functional status and HRQoL. Considering these results and the potential impact of an improved functional status on independence of older adults it would be advisable to establish which exercise mode and dosage is most effective, and whether there is a minimum threshold for frequency, intensity and duration of exercise sessions. A problem regarding HRQoL and functional status as outcome measures is the lack of comparable data because of the different operationalization of goals and the use of different instruments. To improve data collection in the future it is important that researchers choose the same instruments.

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# 4

Once a week is not enough: effects of a widely implemented group-based exercise programme for older adults;

a randomised controlled trial

Stiggelbout M, Popkema D, Hopman-Rock M, Greef M de, Mechelen W van. Once a week is not enough: A widely implemented group-based exercise programme for older adults; a randomised controlled trial. Journal of Epidemiology and Community Health 2004;58:83-88.

#### Abstract

#### Objectives

To determine the effects of gymnastics on the health related quality of life (HRQoL) and functional status of independently living people, aged 65 to 80 years. Gymnastics formed part of the More Exercise for Seniors (MBvO in Dutch) programme, a group based exercise programme for older adults in the Netherlands. It has been widely implemented since 1980.

#### Design

Randomised controlled trial with pretest and post-test measurements.

#### Intervention

The exercise programme given by experienced instructors lasted 10 weeks and was given weekly (MBvO1; n=125, six groups) or twice weekly (MBvO2; n=68, six groups). The control group (n=193) was offered a health education programme.

#### Setting

Community dwelling of older people, with a comparatively low level of fitness as assessed with the Groningen Fitness test for the Elderly.

#### Results

No significant effects were found on the HRQoL (Vitality Plus Scale, TAAQoL, and RAND-36) and the functional status (Physical Performance Test and the Groningen Activity Restriction Scale). The MBvO2 group, with a low level of physical activity at baseline, showed the only improvement found on the Vitality Plus Scale (F=4.53; p=0.01).

#### Conclusions

MBvO-gymnastics once a week did not provide benefits in HRQoL and functional status after 10 weeks. However, participants with a low level of physical activity may benefit from MBvO-gymnastics if they participate twice a week. In order to improve the health of the general public, sedentary older adults should be recruited and encouraged to combine MBvO with the health enhancing physical activity guidelines.

There is clear evidence of the benefits of exercise programmes for older people (USDHHS, 1996; ACSM, 1998a). Exercise plays an important part in encreasing the quality of life of the older adult, by improving physiological and psychological function, which helps to maintain personal independence and reduces the demands for short term and long term care services (Shephard, 1993). However, there is no consensus on the amount of gain in this area (O' Brien & Horne, 1999). Recent guidelines for health enhancing physical activity emphasize the importance of moderately intense physical activity (Pate et al., 1995). Moderately intensive physical activity is often more appropriate for older people because the chance of getting injured is reduced, and their continued participation is more likely than in more vigorous intensive physical activity. More Exercise for Seniors (MBvO in Dutch) is a moderately intensive exercise programme, offered once a week, that was started on an experimental basis in 1966 and has been implemented widely since 1980. It was designed specifically for people of 65 years and older. The goal of MBvO is to promote optimal functioning in older adults, not only physically, but also mentally and socially (Kroes & De Greef, 2000). Currently, more than 300,000 older people over 65 years of age participate weekly in various types of MBvO programmes. The basic form of MBvO consists of gymnastics once a week. Until now, no study has been carried out on the effectiveness of MBvO in terms of health gain. In this chapter, the effects of MBvO-gymnastics on health-related quality of life (HRQoL) and functional status of independently living participants (age 65 to 80 years) are evaluated. HRQoL includes several dimensions, such as cognitive, social, physical, and emotional functioning (USDHHS, 1996). Functional status refers to a person's ability to perform tasks and to fulfil social roles associated with daily living, over a broad range of complexity (USDHHS, 1996).

#### METHODS

This section and the result section are ordered following the criteria of the CONSORT statement for reporting randomised trials (Moher et al., 2001).

#### Design

The study was a multicentre randomised controlled trial, with a cross over design and pretest and post-test evaluations. Subjects were randomised to an experimental group and a control group. The participants in the experimental group were divided into two groups participating once a week (MBvO1), or twice a week (MBvO2). The control group received a health education programme. The trial was designed to detect a minimum difference in effect size of 0.25-0.30 with 80% power at alpha=0.05 (Cohen, 1988). According to this calculation 360 participants were needed (180 in the experimental group and 180 in the control group). Randomisation took place before baseline measurements were taken. In the second phase, after the post test evaluation, the control group was also offered either one of the two exercise programmes and the experimental group was offered the health

education programme. The medical ethics testing committee of both TNO Prevention and Health and the University of Groningen approved the study protocol.

#### **Recruitment procedure and study population**

The Groningen Active Living Model (GALM) was used to recruit subjects (De Greef et al., 1997). Approximately 4,600 older adults - selected at random from the municipal registers of the cities of Emmen, Leiden, and Roden (in The Netherlands) - received a written invitation for a screening procedure and were visited at home by a member of the local project team. Door-to-door approaches have been shown to increase participation in previous studies (De Greef et al., 1997). During this visit, potential participants were screened using a short questionnaire based on the criteria of the Public Health recommendations for physical activity (Pate et al., 1995). People who were not sufficiently active according to these criteria and who met the inclusion criteria (i.e. age 65 to 80 years and living independently) were invited to participate in a fitness test. In total 721 subjects participated in this test, which consisted of a performance-based fitness test (Groningen Fitness test for the Elderly (Lemmink, 1998)) and a health appraisal questionnaire (PAR-Q) applied to identify participants for whom exercise might be risky. The subjects whose test scores were below the median on the walking endurance test were invited to participate in the trial. To compensate for the expected drop-out, 26 extra participants were invited. Figure 1 shows a flow chart of the study. Written informed consent was obtained from each subject.



FIGURE 1: Flow chart of the study

#### Intervention

MBvO1 participants followed the exercise class once a week and MBvO2 participants twice a week. All exercise sessions took place at a community centre. The sessions for both groups were comparable regarding the type of exercise, duration, and intensity. The intervention lasted 10 weeks. Each exercise class consisted of 10-18 participants and each exercise session lasted 45 minutes and consisted of three stages: 5 minutes warm-up, 35 minutes of light to moderately intensive aerobic exercises, mainly muscle strengthening exercise and exercises aimed at improving co-ordination, followed by a 5 minute cooldown period. The lessons took place in a gymnasium and were supervised by a trained and experienced instructor. At the end of each exercise session, participants drank a cup of coffee together as a social event.

The control group followed a health education programme designed to provide attention, social interaction, and health education on lifestyle aspects (excluding information about the benefits of physical activity, exercise and nutrition). Participants were assigned to groups of 15-25 persons. During the intervention period control group participants received a monthly 1.5 hour education session led by a trained instructor.

#### **Assessment of HRQoL and Functional Status**

Trained interviewers interviewed the subjects to assess HRQoL and functional status. Pretest and posttest interviews were held at the subjects own home (in Leiden) and at two municipal facilities (in Emmen/Roden).

Three instruments were used to measure HRQoL, namely the Vitality Plus Scale (VPS (Myers et al., 1999)), the RAND-36 (Ware & Sherbourne, 1992) and the TNO Leiden Academic Hospital Adult Quality of Life questionnaire (TAAQOL; Fekkes et al., 2001). The VPS consists of questions concerning sleep, tiredness, appetite, obstipation, pain, energy, morning stiffness, relaxation, and feeling well (reliability: Cronbach's alpha 0.81; Myers et al., 1999). The RAND 36 is a multi dimensional health questionnaire, that has been translated into Dutch (Van de Zee & Sanderman, 1993). It consists of nine sub scales. In this study five sub scales were used: vitality (reliability: Cronbach's alpha 0.82; Ware & Sherbourne, 1992), pain (Cronbach's alpha 0.88), mental health (Cronbach's alpha 0.85), general feeling of health (Cronbach's alpha 0.81), and change in health status (a one-item sub-scale: no alpha available). The TAAQOL measures health problems in relation to the way people experience these as problems. The TAAQOL was developed specifically for adults to measure the effects of interventions. It consists of 12 dimensions, which may also be used separately. The sub scales social contact (reliability: Cronbach's alpha 0.85 (Fekkes et al., 2001)) and cognition (Cronbach's alpha 0.87) were used. Functional status was evaluated with the short form (7-item scale) Physical Performance Test (PPT; Cronbach's alpha 0.79; Reuben & Siu 1990). The PPT consists of seven tasks of daily living.

Subjective functional independence was measured with the Groningen Activity Restriction Scale (GARS). The GARS consists of 18 questions about daily activities, and the sum score provides information on the level of difficulty a person experiences in care-taking and household activities (Kempen et al., 1993).

Background information on age, gender, marital status, housing situation, and level of education was obtained during the interview. Body weight and height were measured. Body mass index (BMI) was calculated by dividing weight (in kilograms) by the square of height (in m<sup>2</sup>).

Physical activity was measured using a questionnaire especially designed for use in older people (Spearman correlation with objective measures:  $\rho$ = 0.89) 17. The questions cover three areas, namely, household activities (mean score of 10 items), sports activities (intensity, hours per week, and period of the year for two sports maximum), and leisure-time activities (such as knitting, sewing and reading; intensity, hours per week, and period

of the year, six activities maximum). Walking, cycling, and gardening were regarded as sports activities. For the purpose of this study only the household and sports activity questions were used. The sports activity score was calculated by using a formula with weight for intensity, hours per week, and months per year (this is explained in more detail in Voorrips et al. (1991), resulting in an index from zero to  $\infty$  (level of physical activity by Voorrips et al. (1991) for a research group of 29 older adults is  $13.6 \pm 6.8$  (min  $1.2 - \max 31.4$ ).

Other lifestyle components included in the questionnaire were drinking alcohol, and smoking. Chronic diseases were characterized using the list of chronic diseases used in the national health survey (Konig-Zahn et al., 1994).

#### **Statistical analyses**

#### Assignment

All participants were allocated to the experimental or control condition at random. The intervention group participants were divided into two groups: MBvO1 (participating once a week) and MBvO2 (participating twice a week). Participants who were not willing or able to participate twice a week were permitted to participate once a week.

#### Analyses

The analyses were carried out in two stages. In the first stage, the randomised groups were analysed, with the exercise groups MBvO1 and MBvO2 being combined to form one exercise group score. In the second stage, the analyses were carried out for the two experimental groups (MBvO1 and MBvO2) separately. Descriptive statistics (Kruskal-Wallis one-way ANOVA with Tukey B for interval data and chi-square tests for nominal data) were used for the background data.

Repeated-measures MANOVA was used to test for significant time x group interactions between the experimental group and control group and between the three groups (MBvO1, MBvO2, and the control group) at a 0.05 level of significance (two-sided). If there was a difference between groups on specific parameters at baseline, the parameter was used as covariate in the analysis. Posthoc tests were carried out using Tuckey B. In the analyses only data were included of participants who completed at least 50% of the exercise sessions (MBvO1  $\geq$  5 sessions; MBvO2  $\geq$  10 sessions). To facilitate the interpretation of the results, effect sizes, calculated according to the method of Cohen (1988), are also reported, using the differences between scores. The effect size is computed by dividing the difference between the means of the experimental and the control group, by a sample-size weighted average of the standard deviations of the scores in the two groups. An effect size of 0.2 is regarded as a small effect, 0.5 as a medium-sized effect, and 0.8 as a large effect (Cohen, 1988).

Statistical analysis was performed with the Scientific Package of Social Sciences (SPSS) version 10.0.

#### Blinding

Data were collected by trained staff, blinded to the treatment assignments. During the fitness tests, and the interviews, the participants were requested not to mention to which group they were assigned.

# RESULTS

In total, data for 277 participants were analysed. A total of 109 of the participants dropped-out during the 10 weeks (Figure 1).

#### **Background variables**

There was a small – but significant - difference in age between the experimental group and the control group (Table 1a). However, age was not associated with the outcome variables, and was therefore not used as covariate. There were no differences between the MBvO groups and the control group for BMI, gender, marital status, the level of education, and the housing situation at baseline (Table 1a).

#### TABLE 1a: Background characteristics of subjects at randomisation

Variables	MBvO1	(n=98)	MBvO2	(n=53)	Control group	(n=126)	Total	(n=277)	p-value
Mean age in years (yrs, sd)	71.6	(4.0)	71.5	(4.1)	70.3	(4.0)	71.0	(4.1)	.05 <sup>1</sup>
BMI (kg/m², sd)	27.1	(3.5)	26.8	(3.6)	28.0	(4.1)	27.4	(3.8)	.111
Gender (%, n)	%	N	%	N	%	n	%	n	.12²
- male	30	(29)	45	(24)	40	(50)	37	(103)	
- female	70	(69)	55	(29)	60	(76)	63	(174)	
Marital status (%, n)									.49²
- married (living together)	77	(75)	72	(38)	66	(83)	71	(196)	
- unmarried (living together)	1	(1)			1	(1)	1	(2)	
- divorced	3	(3)	2	(1)	2	(3)	3	(7)	
- widowed	17	(16)	26	(14)	26	(32)	23	(62)	
- never lived together	2	(2)			5	(6)	3	(8)	
Level of education (%, n)									.99 <sup>2</sup>
- High	5	(5)	13	(7)	8	(10)	8	(22)	
- Middle	41	(40)	43	(22)	41	(51)	41	(113)	
- Low	54	(52)	45	(24)	51	(64)	51	(140)	
Housing situation (%, n)									.34 <sup>2</sup>
- multi-storey house	66	(64)	60	(27)	62	(77)	61	(168)	
- apartment building	33	(32)	49	(26)	37	(46)	38	(104)	
- service flat	1	(1)			2	(1)	1	(3)	

1 Kruskal-Wallis one-way ANOVA (with Tukey B),

2 Chi square test

#### **Lifestyle factors**

There were no differences in the level of physical activity between the experimental group(s) and control group at baseline (Table 1b). There were significantly more smokers in MBvO2 (21%) than in both MBvO1 (10%) and the control group (11%). Because smoking may bias the effects of the exercise programme, an analysis was carried out to assess which outcomes were associated with smoking, and if so smoking was used as a covariate.

There were no differences between the MBvO group(s) and the control group in relation to alcohol consumption (Table 1b).

Variables	MBvO1	(n=98)	MBvO2	(n=53)	Control group	(n=126)	Total	(n=277)	p-value
Life style factors									
Physical activity (index, sd)									
Household activities	1.92	(.57)	1.93	(.51)	1.98	(.53)	1.95	(.59)	.72 <sup>1</sup>
Sports activities3	3.33	(3.79)	4.36	(4.98)	3.71	(4.87)	3.70	(4.54)	.42 <sup>1</sup>
Total household/sports act <sup>3</sup>	5.26	(3.92)	6.29	(4.87)	5.69	(4.87)	6.65	(4.64)	.42 <sup>1</sup>
Smoking (%, n)	%	n	%	n	%	n	%	n	.0272
Yes	10	(10)	21	(11)	11	(14)	13	(35)	
No, formerly yes	41	(40)	53	(28)	55	(69)	50	(137)	
No, never	49	(47)	26	(14)	34	42)	38	(103)	
Alcohol (%, n)									.73 <sup>2</sup>
Yes, maximal 5 glasses daily	39	(38)	34	(18)	35	(4)	36	(100)	
Yes 6-10 glasses daily	17	(16)	23	(12)	17	(21)	18	(49)	
Yes 11-21 glasses daily	4	(4)	11	(6)	7	(9)	7	(19)	
Yes 21 glasses daily	1	(1)			2	(2)	1	(3)	
No	39	(38)	32	(17)	39	(49)	38	(104)	

#### TABLE 1b: Lifestyle characteristics of subjects at randomisation

<sup>1</sup> Kruskal-Wallis one-way ANOVA (with Tukey B)
<sup>2</sup> Chi square test
<sup>3</sup> Corrected for smoking

#### Adherence rate

MBvO1 subjects participated in the intervention on average 8.9 times, and the MBvO2 subjects on average 17.8 times (adherence rate 89% in both groups).

#### **HRQoL** and functional status

No significant differences were found between time x group (i.e. the MBvO1 + MBvO2 group versus the control group) in the categories of HRQoL, functional status (PPT), and subjective functional status (GARS). No significant differences were found between the MBvO1 and MBvO2 group which were analysed separately versus the control group (Table 2).

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Variables	MBv01		MBvO2		Control group		MANOVA Group xTime inte	raction
	Pre-test (n = 98)	Post-test (n = 98)	Pre-test (n = 53)	Post-test (n = 53)	Pre-test (n = 126)	Post-test (n = 126)	ш	p-value
HEALTH STATUS, HRQoL								
RAND-36 scales								
Vitality	70.1 (17.5)	67.1 (17.3)	71.2 (18.2)	70.0 (18.5)	68.3 (18.0)	67.8 (17.9)	.67	.51
Pain'	77.3 (21.7)	79.8 (20.4)	85.4 (17.5)	83.6 (21.8)	81.0 (19.9)	83.2 (19.8)	.97	.38
Mental health	77.1 (15.0)	77.1 (16.4)	80.0 (13.3)	77.9 (17.8)	76.8 (17.9)	77.7 (16.7)	.93	.40
General feeling of health	63.8 (17.7)	63.4 (16.0)	63.9 (16.0)	63.9 (15.7)	63.3 (15.0)	63.0 (15.8)	.01	66.
Change in health status	47.7 (21.2)	49.0 (19.2)	50.5 (18.7)	49.5 (14.3)	50.8 (18.6)	49.4 (15.5)	.59	.56
TAAQOL scales								
Social contacts	86.3 (17.5)	83.4 (19.2)	83.6 (16.9)	80.2 (18.6)	86.4 (17.8)	86.1 (18.6)	.53	.59
Cognition	75.8 (23.3)	74.8 (23.0)	78.2 (23.0)	77.0 (22.5)	75.8 (22.1)	77.7 (21.2)	.91	.40
Vitality Plus Scale	39.32 (6.31)	39.59 (6.53)	39.33 (6.54)	40.38 (7.06)	39.54 (6.54)	39.80 (6.65)	69.	.50
FUNCTIONAL STATUS:								
GARS	20.23 (3.68)	20.12 (3.16)	19.81 (3.75)	19.31 (2.63)	20.15 (3.66)	20.33 (3.68)	1.09	.34
PPT-7 score (0-28)	24.24 (2.82)	25.33 (1.94)	24.75 (2.48)	25.43 (1.43)	24.31 (2.87)	24.66 (2.27)	2.65	.07
GARS = Groningen Activity Restricti PPT-7 = 7 item Physical Performance <sup>1</sup> Corrected for smoking	ion Scale Test							

# TABLE 2: Summary of the RAND-36 items, TAAQOL and Vitality Plus Scale, the GARSand the Physical Performance Test (PPT 7-items) (means and standard devia-<br/>tions) for MBvO1, MBvO2 and control group

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In the subgroups with a level of physical activity below the median at baseline, a significant improvement was found in the MBvO2 group on the Vitality Plus Scale (p=0.01, Cohen effect size 0.18), compared with both the MBvO1 and control groups (Table 3). No statistically significant effects were found for any other HRQoL parameters or for functional status in this sub group.

TABLE 3: Summary of health-related quality of life and general health outcomes for intervention and control groups by Vitality Plus Scale for the least physical active population. The least active group are people who scored under the median of the Voorrips scale at baseline (median = 4.10)

Variables	MBvO1		MBvO2		Control group		MANOVA Group x Time	
	Baseline (n = 98)	Post-test (n = 98)	Baseline (n = 53)	Post-test (n = 53)	Baseline (n = 126)	Post-test (n = 126)	F	p-value
Vitality Plus Scale	39.11 (7.08)	39.04 (7.43)	37.09 (7.15)	40.00 (6.97)	38.92 (6.81)	38.73 (6.79)	5.36	.011

<sup>1</sup> There is a difference between MBvO2 and MBvO1 and control group: Post Hoc test Tukey B: p < 0.05

# DISCUSSION

This study examined the effects of the widely implemented MBvO-gymnastics programme on HRQoL and functional status of independently living older adults aged 65-80 years. People who participated once a week, the regular MBvO regimen, did not show improvement on any of the outcome measures after 10 weeks of exercise. However, in people whose physical activity was below the median at baseline and who participated in the programme twice a week an improvement was observed of HRQoL, but not in functional status.

Very few studies have evaluated the effects of community-based exercise programmes in this age group. Most studies were carried out in clinical settings or were aimed at people with specific chronic diseases (Jette et al., 1996; Ettinger et al., 1997; Singh et al., 1997; Damush & Damush, 1999).

Myers & Hamilton (1982) evaluated the Canadian Red Cross Society's Fun and Fitness Programme on the social and cognitive functioning of independently living older adults. Although the authors concluded that the exercise programme was well suited for healthy inactive older adults, once a-week participation without additional regular physical activity did not improve the outcome parameters. Our study provided similar results and it seems valid to conclude that participation in MBvO-gymnastics once a week only is not sufficient to improve HRQoL, and functional status in the short term. This indicates that the organisations responsible for MBvO in the Netherlands should endeavour to promote participation of MBvO at least twice a week. If this provides organizational problems

MBvO, i.e. too little staff or insufficient adequate accommodations, participants should be encouraged to combine participation in regular MBvO classes with compliance to the health enhancing physical activity guidelines (HEPA: ".... at least 5 days a week participation in minimum of 30 minutes of moderate physical activity daily"; Pate et al., 1995; Ooijendijk et al., 2002).

Hopman-Rock & Westhoff (2002) carried out a community intervention trial to evaluate the effectiveness of "Ageing Well and Healthily" - an exercise promotion programme in the Netherlands for older adults aged 65 years and older which lasted 6 weeks contained group-based health education and a low-intensity exercise programme. The authors found an improvement in vitality and subjective health (measured by the RAND-36) after 6 weeks. However, at baseline the participants in this programme had a lower physical activity score than the MBvO population in our study and subjects continued the exercises at home for 3-4 times a week. The results of our study and the results of other studies confirm the theory that short term health effects of low to moderate intense exercise are more likely to be reported by the least physically active older population, since sedentary individuals are expected to benefit most from increasing their level of physical activity.

The protocol finally used may have caused methodological bias after randomisation. A substantial number of older adults refused to participate when they were expected to follow the MBvO-gymnastics twice a week. We did not carry out an intention to treat analysis. However, at baseline the only difference between MBvO1 and MBvO2 was smoking behaviour. One may speculate about the wish of smoking MBvO2 participants to improve their health as quickly as possible.

Studies with short-term follow-up have certain limitations. Older participants may take several weeks to adapt to the initial rigour of training and need a longer adaptation period to gain the optimal benefit from an exercise programme (ACSM, 1998b). This may explain why MBvO had no effect on the HRQoL, and functional status. However, it is very difficult to carry out a randomised controlled intervention in the general population over a longer period of time because it is difficult to recruit a control group who is not offered the intervention too.

De Greef et al. (2002) carried out a process evaluation study to compare whether the MBvO-gymnastics classes in our study were comparable to the regular MBvO-gymnastics classes in the Netherlands, as evaluated by Klijnstra-Rooks (1994). On the basis of this evaluation, it was discovered that the participants in our study had opinions about the characteristics of the exercise programme comparable to those of the participants of the regular MBvO classes. It can be concluded from this comparison that the MBvO classes offered in this study are ecologically valid, and that consequently the results of our study can be generalised to regular MBvO-gymnastics classes in the Netherlands.
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Once a week is not enough

## 5

### **More Exercise for Seniors**

report of programme evaluation

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#### Abstract

Since 1980, More Exercise for Seniors (MBvO in Dutch) has provided a number of different physical activities for seniors. The aim is to promote optimal functioning in older adults, not only physically, but also mentally and socially. Despite the fact that MBvO has been offered since 1966, and 300,000 people participate weekly in gymnastics, swimming, dancing, etc, no effect on fitness and health has been proven to date.

The study was carried out in two regions: Drenthe and South Holland. Using the GALM (Groningen Active Living Model) method, 4,600 people aged 65-80 years, and living independently, were asked to participate in a motor fitness test. Of the 721 people who participated, 386 (the least fit at baseline) were invited to take part in the study. They were then randomly divided into an experimental and a control group. The experimental group was offered gymnastics once or twice a week. The control group received a health education programme (excluding physical activity, and healthy nutrition as subjects).

Pre-test and post-test (after 10 weeks) assessments were carried out. In the group that participated in MBvO gymnastics once a week, no effects were found on subjective health, functional status or quality of life, and only minor effects on diastolic bloodpressure, leg strength, and functional reach. In the group that participated in MBvO gymnastics twice a week, some beneficial effects were found on the quality of life, and functional reach in the people who were least physically active at baseline. Relatively more individual improvement in the physical fitness was found in the older adults (70+).

It is recommended that the frequency and intensity of the regular MBvO gymnastics should be increased, that education should be provided about the importance of an active lifestyle, and that relatively inactive and older individuals (70+) should be recruited.

It has been known for years that adequate physical activity is healthy and that this also applies to older people (ACSM, 1998). The Dutch guidelines for health enhancing physical activity (NNGB; Kemper et al., 2000) is moderately intensive physical activity at least 30 minutes a day on five, but preferably all, days of the week. Compliance with the guidelines results in, for example, less cardiovascular disease and type II diabetes, improved quality of life, and less care dependence (Kesaniemi et al., 2001). Unfortunately, older Dutch people (> 65 years) exercise relatively little compared to their European age peers (Jacobusse et al., 2004), and only 43% comply with the NNGB (Ooijendijk et al., 2004). More Exercise for Seniors (MBvO in Dutch) instructors have been providing a number of organised physical activities specially adapted for older people since 1966. The aim is to to promote optimal functioning in older adults, not only physically, but also mentally and socially. Despite the fact that MBvO already exists for more than 40 years, with an estimated 300,000 people participating in various activities (gymnastics, dancing, swimming, etc.) organised by local groups, there have never been any studies of the possible effects of the programme on health, and fitness. Using financing from the Netherlands Organisation for Health Research and Development (ZonMw), the Netherlands Organization for Applied Scientific Research (TNO) collaborated with the Institute for Human Movement Sciences of the University of Groningen and the Dutch Institute for Sport and Physical Activity (NISB) on a randomised controlled evaluation study. The study was conducted in the provinces of Drenthe and South Holland among older people living independently, and aged between 65 and 80. This chapter presents the impact of 10 weeks of MBvO-gym (once or twice a week) on health-related quality of life, functional status, and health related physical fitness. It is in part a re-working of Stiggelbout et al. (2004; see Chapter 4).

#### METHODS

The method section has been structured in accordance with the CONSORT criteria for reporting randomised research (Moher et al., 2001).

#### Study design

The study was a multi-centre randomised and controlled study with pre-test and posttest evaluations. The participants in the experimental group were allocated to groups who exercised once or twice a week. The control group was given an education programme once a month. The study was designed to detect a minimum difference in effect size of 0.25 to 0.30, with 80% power at alpha=0.05 (Cohen, 1988). At least 180 participants were therefore needed for each condition (experimental and control), based on a drop-out rate of 30%. Randomisation took place before the start of the pre-test evaluations. After the post-test evaluations, the control group was given MBvO for ethical reasons and in order to prevent contamination, and the experimental group was offered the education pro-

gramme (so that no one felt they had been sold short). The Medical Ethics Committees of TNO and the University of Groningen approved the study protocol.

#### **Recruitment of participants and description of study population**

The method of the Groningen Active Living Model (GALM; De Greef et al., 1997) was used to recruit participants. Approximately 4,600 addresses of older people (65-80 years) were randomly selected from the municipal records of Emmen and Roden (both in the province of Drenthe), and of Leiden (in province South Holland). The potential participants were sent an invitation for screening, and a member of the project team visited them at home. Potential participants who did not comply with the NNGB (and in whom the potential for benefit was therefore highest), who were living independently and were aged between 65 and 80 years were invited to participate in the fitness test (Groningen Fitness Test for Seniors, GFO, Lemmink, 1996). A short questionnaire (PAR-Q) was completed beforehand to identify any possible medical counter-indications. A sports physician was present at the tests. The participants whose score for the fitness test was below the median for the 'walking endurance' element were then invited to participate in the evaluation study. To compensate for the expected drop-out, the 26 participants with the next lowest scores were then also asked to participate in the study. Figure 1 contains the flow chart for the study. Informed consent was obtained from all participants.



FIGURE 1: Flow chart of the study

#### Intervention

Of the 193 participants in the experimental group, 125 participated in MBvO once a week (MBvO1) and 68 twice a week (MBvO2). All the exercise sessions took place in gym halls or community centres. There were no differences between MBvO1 and MBvO2 in terms of intensity or types of exercise. The intervention lasted 10 weeks. Each group consisted of 10 to 18 participants and a session lasted approximately 45 minutes (there was no strict time limit of the kind that is usual for MBvO). The sessions started with 5 minutes of warming-up, followed by 35 minutes of light to moderately intensive aerobic exercises, power exercises and coordination exercises. The sessions ended with 5 minutes of cooling-down. Qualified MBvO instructors supervised the sessions. The groups had a cup of coffee together after the sessions.

The control group was given a health education programme. However, it was deliberately

decided not to include information about physical activity, and nutrition in this programme and to concentrate on the symptoms of old age and safety at home. These participants met in groups of 15 to 25 for an hour and a half, once a month, during the intervention period. **Measurement of health-related quality of life, functional status and fitness.** 

Interviewers with specific training examined all participants to determine their healthrelated quality of life and functional status. The pre-test and post-test interviews took place at the participants' homes (in Leiden) and at two municipal facilities (in Emmen and Roden). Three instruments were used to assess health-related quality of life: the Vitality Plus Scale (VPS; Myers et al., 1999), the RAND-36 (Ware & Sherbourne, 1992), and the TNO Leiden Academic Hospital Quality of Life Questionnaire (TAAQOL; Fekkes et al., 2001). The VPS consists of questions about sleep, fatigue, appetite, constipation, pain, energy, morning stiffness, relaxation and feeling of health (reliability: Cronbachs alpha 0.81; Myers et al., 1999). The Dutch translation of van der Zee & Sanderman (1993) was used for RAND-36. Five sub-scales were selected: vitality (alpha 0.82), pain (alpha 0.88), mental health (alpha 0.85), general perception of health (alpha 0.81) and changes in health status (single-item sub-scale).

The TAAQOL assesses both health problems and the degree to which people suffer from them. It was developed specially for use in adults in intervention research. It consists of 12 sub-scales that can be used independently. We used the social contacts (alpha 0.85) and cognition (alpha 0.87) sub-scales.

Functional status was measured with the short form of the Physical Performance Test (Reuben & Siu, 1990). This test requires participants to perform seven everyday tasks (such as putting on a coat, picking up a coin, etc.) as quickly as possible. Reliability is high (alpha 0.79). The maximum score is 28 points.

Subjective care dependency was measured with the Groningen Activities Restriction Scale (GARS; Kempen et al., 1993). The GARS consists of 18 questions about everyday activities and the total score (18-72) provides an indication of the difficulties the participants have with these activities.

Finally, the GFO was carried out during both the pre-test and post-test evaluation. The GFO consists of the following components: manual skills, reaction time, grip strength, flexibility of lower back and hamstrings, shoulder flexibility and walking endurance. The tests have been extensively described by Lemmink (1996) and were carried out in accordance with the protocol. Reliability varies between 0.85 and 0.95. The Timed Stands test (measure for leg strength; Csuka & McCarty, 1985) and the functional reach test (measure for dynamic equilibrium; Duncan et al., 1990) were added. In combination with the GFO, blood pressure was also measured (both diastolic and systolic pressure were measured with the Omron M4).

Background variables such as age, gender, marital status, housing situation, and level of education were recorded in the first interview (see table 1). Body weight and height were measured in order to determine Body Mass Index (BMI, kg/m2) (BMI is a measure for overweight. Chronic disorders were identified using the concise list of Statistics Netherlands (Konig-Zahn et al., 1994).

During the pre-test evaluation, the level of physical activity was also determined using Voorrips's list (Voorrips et al., 1991). The Voorrips list has a correlation of 0.89 with pedometers. The questionnaire provides an overview of the level of physical activity in the home, during sports and in leisure time. In this study, walking, cycling and gardening were classified as sports, and the leisure item was dropped (since it took up too much time in the interview). The sports activities were calculated using a formula that includes weighting for intensity, number of hours a week and months a year (see, for details, Voorrips et al., 1991). All other lifestyle components were included in the pre-test evaluation about alcohol use and smoking (see Table 1).

Variables	MBvO1 (n=98)	MBvO2 (n=53)	Control (n=126)	Total (n=277)	p-value
Age in years (gem, sd)	71,6 (4,0)	71,5 (4,1)	70,3 (4,0)	71,0 (4,1)	Anova (0,05)
BMI (kg/m <sup>2</sup> , sd)	27,1 (3,5)	26,8 (3,6)	28,0 (4,1)	27,4 (3,8)	Anova (0,11)
Male (%)	30	45	40	37	Chi-square (0,12)
Living together (%)	78	72	67	72	Chi-square (0,49)
Education (%)					Chi-square (0,99)
- High (HBO, university)	5	13	8	8	
- Middle	41	43	41	41	
- Low (primary aducation)	54	45	51	51	
Living in house with stores (%)	66	51	62	61	Chi-square (0,34)
Physical activity (Voorrips score, sd)					
- Housework	1,92 (0,57)	1,93 (0,51)	1,98 (0,53)	1,95 (0,59)	Anova (0,72)
- Sports activities	3,33 (3,79)	4,36 (4,98)	3,71 (4,87)	3,70 (4,54)	Anova (0,42)1
- Total physical activities	5,26 (3,92)	6,29 (4,87)	5,69 (4,87)	6,65 (4,64)	Anova (0,42)1
Smoking yes (%)	10	21	11	13	Chi-square (0.027)
Alcohol (%)					Chi-square (0,73)
- Ja, maximal 5 glasses a day	39	34	35	36	
- Yes > 5 glasses	22	34	26	26	
- No	39	32	39	38	

TABLE 1: Background characteristics of subjects at randomisation

<sup>1</sup>Corrected for differences on smoking behaviour NOTE: the tests are done on the experimental groups MBvO 1 and 2 combined versus control group).

#### **Statistical analyses**

All the participants were allocated randomly to the experimental or control group. The experimental group was then allocated randomly to MBvO1 (once a week) and MBvO2 (twice a week). However, participants who thought that twice a week was too much and for whom drop-out was therefore a possibility (n=26) were allowed to join the group attending MBvO once a week.

The analyses took place on two levels. First of all, the entire experimental group was compared to the control group since the main issue addressed by this study was the effect of MBvO and randomisation took place at that level. In the next stage, we conducted separate analyses of MBvO1 and MBvO2 and also a separate analysis of the subgroup

(< median) with the lowest level of physical activity at baseline. Given the fact that fitness is associated with gender and age, sub-analyses were carried out for each age group and gender for the fitness measures at both levels. The control group and experimental group were compared in terms of background variables using ANOVA for interval levels and chi-square testing for nominal levels. An analysis of variance with repeat measurements took place to detect significant group x time interactions between the experimental and control groups, and between the three groups separately. The level of significance was 0.05. If there was a difference in terms of background variables in the pre-test evaluation, this was corrected for in subsequent analysis (covariate). The post hoc analyses were carried out with Tuckey B. The analyses were confined to data for people who had completed at least 50% of the MBvO sessions. Statistical analysis was carried out with SPSS version 10.0.

#### Blinding

The data were gathered by trained physiotherapists who were blind for the trial condition. During the tests and interviews, the participants were expressly asked not to say which group they had been assigned to.

#### RESULTS

Data were analysed for a total of 277 participants (see figure 1). The most common reason for drop-out was illness.

The control group was slightly younger than the experimental group, but this proved to be unrelated to the outcome variables. No further correction was made for this. There were no other differences in background characteristics (including number and type of chronic disorders). A difference was found for smoking as a lifestyle factor. There were more smokers in the MBvO2 group than in the MBvO1 group and the control group. Because smoking is associated with the outcome variables, this was used as a covariate in subsequent analyses.

The participants in the MBvO1 group attended an average of 8.9 sessions, and those in the MBvO2 group attended an average of 17.8 sessions. Participation in both groups was 89%.

Variables:	MBvO1 (n=98)		MB <sup>i</sup> (n=	vO2 :53)	Contro (n=	l group 126)	ANOVA (group versus time)		
	t1 Mean (SD)	t2 Mean (SD)	t1 Mean (SD)	t2 Mean (SD)	t1 Mean (SD)	t2 Mean (SD)	F	Р	
RAND-36 scales									
- Vitality	70.1 (17.5)	67.1 (17.3)	71.2 (18.2)	70.0 (18.5)	68.3 (18.0)	67.8 (17.9)	.67	.51	
- Pain <sup>1</sup>	77.3 (21.7)	79.8 (20.4)	85.4 (17.5)	83.6 (21.8)	81.0 (19.9)	83.2 (19.8)	.97	.38	
- Mental health	77.1 (15.0)	77.1 (16.4)	80.0 (13.3)	77.9 (17.8)	76.8 (17.9)	77.7 (16.7)	.93	.40	
- General feeling of health	63.8 (17.7)	63.4 (16.0)	63.9 (16.0)	63.9 (15.7)	63.3 (15.0)	63.0 (15.8)	.01	.99	
- Change in Health (subjective)	47.7 (21.2)	49.0 (19.2)	50.5 (18.7)	49.5 (14.3)	50.8 (18.6)	49.4 (15.5)	.59	.56	
TAAQOL scales									
- Social contact	86.3 (17.5)	83.4 (19.2)	83.6 (16.9)	80.2 (18.6)	86.4 (17.8)	86.1 (18.6)	.53	.59	
- Cognition	75.8 (23.3)	74.8 (23.0)	78.2 (23.0)	77.0 (22.5)	75.8 (22.1)	77.7 (21.2)	.91	.40	
Vitality Plus Scale	39.32 (6.31)	39.59(6.53)	39.33 (6.54)	40.38 (7.06)	39.54 (6.54)	39.80 (6.65)	.69	.50	
GARS	20.23 (3.68)	20.12 (3.16)	19.81 (3.75)	19.31 (2.63)	20.15 (3.66)	20.33 (3.68)	1.09	.34	
PPT-7 (0-28)	24.24 (2.82)	25.33 (1.94)	24.75 (2.48)	25.43 (1.43)	24.31 (2.87)	24.66 (2.27)	2.65	.07	

#### TABLE 2: Summary of the RAND-36 items, TAAQOL and Vitality Plus Scale, the GARS and the Physical Performance Test (PPT 7-items) (means and standard deviations) for MBvO1, MBvO2 and control group

1 higher score= less pain. NOTE: the tests are done on experimental groups (MBvO 1 and 2 combined versus control group)

We found no significant interaction effects between the experimental and the control conditions for the variables measured with VPS, RAND-36, TAAQOL, PPT and GARS (see table 2). Nor were any statistically significant effects found for the second-phase analyses (comparison MBvO1, MBvO2 and control). Sub-group analysis of the group with the lowest level of physical activity at baseline (below the median for the scores on the Voorrips list) identified a statistically significant improvement for the MBvO2 group on the VPS vitality scale (p=0.01).

Comparison of the combined group (MBvO1 + MBvO2) with the control group identified a significant interaction effect for leg strength (F = 4.07, p =0.04). The time required to stand fully upright from a chair 10 times fell by 2.5 seconds in the MBvO groups, and by 1.2 seconds in the control group.

The separate comparison of MBvO1, MBvO2, and the control group did not identify any significant effects on fitness (see table 3). Sub-group analyses for each age group and gender identified an effect in some age groups on Body Mass Index (BMI) (65-69 years: F=7.2, p=0.008; and 75-80 years F=5.98, p=0.01) and walking endurance (70-74 years; F=7.07, p=0.009). In addition, a significant effect on BMI was found in women (F=4.14, p=0.04). Here, no additional effect was found that was correlated to participation once or twice a week.

MBvO1 (n=98)		MBvO2 (n=53)		Contro (n=	l group 126)	ANOVA (group versus time)		
t1 Mean (SD)	t2 Mean (SD)	t1 Mean (SD)	t2 Mean (SD)	t1 Mean (SD)	t2 Mean (SD)	F	Р	
27.0 (3.58)	27.3 (3.62)	26.8 (3.56)	26.9 (3.48)	27.8 (3.94)	28.2 (3.82)	0.45	.62	
159.2 (18.14)	155.5 (20.45)	161.7 (20.52)	160.9 (20.81)	154.3 (21.64)	154.8 (20.13)	1.29	.26	
85.1 (10.20)	84.6 (9.50)	86.1 (9.72)	83.3 (10.83)	83.6 (11.83)	84.4 (10.38)	2.32	.10	
51.9 (8.47)	50.7 (8.52)	51.3 (8.03)	50.2 (5.52)	50.6 (7.00)	49.9 (6.14)	0.34	.70	
248.2 (65.40)	237.7 (49.00)	227.9 (32.74)	225.0 (26.77)	243.7 (56.43)	242.6 (47.22)	1.11	.32	
32.8 (8.95)	29.9 (9.47)	35.5 (8.69)	31.8 (8.97)	34.6 (9.43)	31.6 (9.87)	0.71	.48	
26.1 (8.48)	27.4 (8.13)	24.6 (9.69)	27.1 (9.89)	26.3 (9.30)	27.6 (9.46)	1.51	.22	
23.0 (9.44)	20.6 (6.07)	20.7 (7.29)	18.1 (6.76)	21.7 (4.96)	20.5 (5.07)	2.05	.12	
33.5 (6.41)	34.1 (6.34)	32.9 (5.49)	36.3 (6.90)	33.2 (5.78)	34.7 (7.35)	2.39	.08	
46.9 (6.69)	41.2 (10.04)	44.2 (6.93)	39.6 (9.57)	46.3 (6.66)	42.1 (9.81)	0.54	.58	
39.1 (14.85)	40.5 (14.97)	39.7 (15.11)	41.4 (16.43)	37.2 (15.11)	37.0 (14.97)	1.00	.36	
	It         It           1/4ear (55)         27.0 (3.58)           27.0 (3.58)         35.1 (10.20)           35.1 (10.20)         35.1 (10.20)           248.2 (65.40)         32.8 (8.95)           26.1 (8.48)         33.5 (6.41)           33.5 (6.41)         46.9 (6.69)           39.1 (14.85)         34.1 (4.85)	Biblic Bi	MB           L2         Man (SD)           Mann (SD)         27.3 (3.62)         86.3 (3.66)           27.0 (3.62)         27.3 (3.62)         86.3 (3.66)           27.0 (3.62)         16.7 (3.62)         16.7 (3.62)           15.0 (2.10)         36.5 (3.64)         86.1 (3.7 (3.62)           15.0 (3.7)         27.7 (3.62)         16.3 (3.64)           24.2 (6.54)         20.7 (7.40)         27.9 (3.64)           24.8 (3.80)         20.9 (3.7)         25.6 (3.64)           24.1 (3.44)         20.4 (3.64)         26.4 (3.64)           23.0 (3.44)         20.4 (3.64)         20.7 (7.29)           33.5 (6.41)         34.1 (6.34)         20.9 (3.64)           40.4 (3.64)         41.2 (3.04)         41.2 (3.04)           39.1 (4.45)         40.5 (4.77)         39.7 (15.11)	H         I	$M_{mer}$ $M_{max}$ <	$M \\ mer $ $I \\ m$	$H_{Herric}$ $H_{1}^{LC}$	

## *TABLE 3:* Summary of the BMI, blood pressure, and fitness tests (means and standard deviations) for MBvO1, MBvO2 and control group

NOTE: the tests are done on experimental groups MBvO 1 and 2 and control group. For tests on total experimental group vs control group see text.

#### DISCUSSION

This evaluation study of MBvO has shown that, after 10 weeks, there were only minor effects on perceived health, fitness and quality of life. The main question was whether MBvO has an impact on health. This was addressed in a design with two randomised groups (MBvO v. non-MBvO). An attempt was made to achieve further randomisation in the MBvO group by allocation to two similar groups exercising once and twice a week respectively. However, this was not very successful because of the strong possibility of drop-out from group 2. Many of these participants were then allowed to exercise once a week. All analyses were carried out for the main design (MBvO v. control) and for the MBvO1 v. MBvO2 v. control design. The analyses of the main design identified an improvement for leg strength only. This was despite the selection of relatively inactive older people (with whom it is reasonable to expect most benefit) and the fact that the numbers in the experimental and control groups were large enough to be able to trace any effects.

However, standard MBvO activities once a week is certainly too little to result in effects on health, fitness and quality of life that are demonstrable in the short term in previously inactive older people. Short-term effects on vitality can be demonstrated only when the sub-group that has previously been very inactive physically engages in MBvO more frequently.

We know of very few studies that have evaluated the short-term health effects of more exercise in this age group at the population level. Generally, they have been clinical studies or studies of populations with more specific chronic disorders (Jette et al., 1996; Ettinger et al., 1997).

Our results are comparable with the study of Myers & Hamilton (1982) looking at the

social and cognitive functioning of older people after participation in a Canadian Red Cross programme with education and exercise. In that study, participation once a week had no impact on health in the short term.

Since it is known that health effects can primarily be expected in excess of 30 minutes a day of moderately intensive exercise (preferably every day of the week), it is reasonable to ask whether MBvO, as it has been provided for many years now, makes an adequate contribution to the exercise levels of older Dutch people. An intervention in which non-intensive exercise for older Dutch people was also provided once a week did succeed in demonstrating various effects on health after six weeks (Hopman-Rock & Westhoff, 2002). The difference with MBvO was that the participants were taught a home exercise programme that they also followed at home another three times a week on average.

Our MBvO evaluation study and other studies justify the conclusion that short-term health effects from non-intensive and moderately intensive exercise activities can mainly be expected among the older participants who are least physically active at baseline. The study protocol ran into some difficulties because people sometimes refused to be allocated to the twice-a-week condition. This finding shows that it is not easy to encourage older people to exercise more than once a week in a group. Because of the very low effect established by the per protocol analysis, we decided not to proceed with any 'intention to treat' analysis (also because of the fact that the most common reason for drop-out was 'illness'). It is striking that there were more smokers in the MBvO2 condition. These people were possibly more motivated to achieve improvements in their health quickly.

Short-term studies in this area have their limitations. It may be the case that participants need more time to adjust. However, it is very difficult to provide longer interventions because the control group would then have to wait for a disproportionately long period of time for an intervention that is assumed to be healthier than the control condition. This would not be ethical.

De Greef et al. (2002) conducted a process evaluation to see whether the intervention provided in our study was comparable to the normal MBvO programme as described by Klijnstra-Rooks (1994). It can be concluded that the MBvO in our study was ecologically valid. In other words, our results can be generalised to MBvO groups in the Netherlands.

MBvO for older people is a unique system globally. It can therefore certainly not be concluded that it should not continue. If, therefore, the aim is to improve public health with this intervention, it is possible on the base of our study to recommend increasing the frequency or intensity of standard MBvO, to provide more education about the importance of an active lifestyle and, during recruitment, to concentrate primarily on the more physically inactive and older participants.

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# 6 **Drop-out from exercise programs for seniors:** A prospective cohort study Stiggelbout M, Hopman-Rock M, Tak E, Lechner L, Mechelen W van. Drop-out from exercise programs for seniors; a prospective cohort study. Journal of Aging and Physical Activity 2005,13:409-421. 93

#### ABSTRACT

This study examines drop-out incidence, moment of drop-out, and switching behavior in organized exercise programs for seniors in the Netherlands, as determined in a prospective cohort study (with baseline measurements at the start of the exercise program and follow-up after six months; N=1,725, response rate 73%). Participants were community-living individuals 50+ who participated in different forms of organized exercise programs. The average drop-out incidence was 0.15 per six months, which is lower than that for the general population. The drop-out incidence and the timing of drop-out differed substantially between the exercise programs. In total, 31% of people who dropped out of one type of exercise program switched to another type of exercise. The type of program and exercise had a strong effect on differences in this switching behavior. It is recommended that switching behavior be monitored in future studies.

There is clear evidence of the benefits of exercise programs for older people (American College of Sports Medicine, 1998). Regular physical activity has been associated with a variety of health benefits, such as improved cardiovascular, respiratory, and muscular function, and reduction of risk factors associated with chronic disease states. Exercise also plays an important role in enhancing the quality of life of the older adult, by improving physiological and psychological function, which helps to maintain personal independence and reduces the demand for acute and chronic care services (Pate et al., 1995; USDHHS, 1996). It is therefore important to promote exercise participation among older individuals.

Drop-out from exercise programs is a problem (Carmody et al., 1980; Dishman, 1982; Oldridge, 1988; Dishman & Sallis, 1994), and drop-out incidence in adults of approximately 0.50 in the first six months, mostly in the first 12 weeks, have been reported (Dishman, 1982; Dishman & Sallis, 1994). Unfortunately, it is difficult to compare data because many researchers have neither explicitly defined drop-out nor monitored participants over an extended period (Oldridge, 1982; Ecclestone et al., 1998). The available studies generally looked at drop-out data for younger adults (i.e., <50 years old), and this may not be representative for older populations (King et al., 1992). Some researchers have suggested that older adults may exercise more consistently because they are more concerned about their health and have more time to exercise than younger adults (Oldridge, 1988; Lee et al., 1996). By contrast, other researchers have shown that, in community exercise programs, older people are no more compliant than younger people (Ecclestone et al., 1998). Older people may also be more likely to interrupt their exercise programs because the incidence of chronic diseases increases with advancing age.

Obstacles to habitual exercise may lead to extended lapses, defined as 'a slight period of non-participation in the exercise program' (Sforzo et al., 1995), and ultimately to drop-out. In our study, we have defined drop-out in terms of stopping with a specific exercise program, rather than a cessation of all physical activity. To date, only one study (Ecclestone et al., 1998) investigated the behavior of participants in switching from one exercise program to another. These authors found that 21% of the participants switched to another program during the 3-year study and concluded that older adults join, leave, rejoin, and switch as their commitments and interests change.

The aim of this study was to determine the drop-out incidence, moment of drop out in different types of program, and exercise program switching behavior of older adults in the Netherlands.

#### **METHODS**

This was a prospective cohort study with baseline (at the individual start of the exercise program) and follow-up measurements (six months after the start).

#### Recruitment procedure and study population

In collaboration with several experts in the field, ten different forms of exercise programs were identified as being representative of the exercise programs available to older individuals in the Netherlands, namely, More Exercise for Seniors Gymnastics (MBvO in Dutch), organized sports in sports clubs (specifically, athletics, badminton, cycling, gymnastics, skating, and table tennis), FysioSport (i.e. a fitness program delivered by physical therapists/sports physical therapists), Exercise for Heart Patients (HIB in Dutch), and Walking for sports (referred to as Walking in this paper). These exercise programs are supported by national organizations, which facilitated data collection and participant recruitment. Local organizations were approached through the national organizations and recruited clubs or groups which were known to encourage participation by older adults.

Over a period of 15 months, all new members of these clubs or groups were asked to participate in the study. Inclusion criteria were (1) age older than 50 years and (2) not being a member of an organized sports organization directly prior to the study. The participants gave their written informed consent before joining the study. They completed a baseline questionnaire when they started the exercise program. Non-responders received a reminder after three weeks. After six months, all participants who had finally returned the first questionnaire received a second questionnaire. Non-responders to the second questionnaire received a reminder after three weeks. The Medical Ethics Testing Committee of TNO approved the study protocol.

Drop-out in this study was defined as 'no longer participating in the specific organized exercise program', according to the opinion of the respondent. Drop-out should be distinguished from lapsing. Lapses were defined as 'a slight period of non-participation in the exercise program' (Sforzo et al., 1995), whereas in the case of drop-out the cessation is definite. It was elaborated that one may merely speak of drop-out whenever one has terminated ones membership of an organization. So, in the case of a seasonal sport as speed-skating one does not speak of drop-out when there is a seasonal lapse; speed-skaters only drop-out if they had terminated their membership of the sports club (which was asked for in the questionnaire), which in most cases was not the case.

The baseline questionnaire covered a number of areas. Demographic data were collected concerning age, gender, marital status, level of education, housing situation, and work status. Physical activity was evaluated using questions derived from the Dutch Monitor on Physical Activity and Health (Ooijendijk et al., 2002), which covers compliance with Dutch public-health guidelines during an average week in the summer and winter (Kemper et al., 2000). These guidelines are based on international guidelines (Pate et al., 1995; USDHHS, 1996; ACSM, 1998). Other lifestyle components, such as alcohol consumption (yes/no, and how many glasses of alcohol per week) and smoking (non-smokers, former smokers, and smokers), were also evaluated. Weight and height were recorded and used to calculate the body mass index (BMI; kg/m2).

Health status was measured with the RAND 36, a multidimensional health questionnaire (Ware & Sherbourne, 1992), which has been translated into Dutch (Van der Zee & Sanderman, 1993). In this study, five of the nine subscales were used: vitality (reliability:

Cronbach's alpha 0.82), pain (Cronbach's alpha 0.88), mental health (Cronbach's alpha 0.85), general feeling of health (Cronbach's alpha 0.81), and change in health status (a one-item subscale: no alpha available). Each subscale was scored 0-100, with 100 being the best score.

In the follow-up questionnaire particular attention was paid to continued participation and drop-out, the occurrence of lapses, the frequency of lapses, the duration of lapses (i.e. how long the individual lapses lasted, devided in: 1 week, 2-3 weeks, 4-6 weeks, and >6 weeks), and the moment of drop-out (measured in weeks after the start of the program). To distinguish between lapses and drop-out, the participants were asked to fill in questions containing both definitions in the second questionnaire, before putting forward the questions related to drop-out and lapsing behavior. In our study we have collected the time point of drop-out, but not the time point of lapses. The reason for not taking the time point of lapses was that the occurrence of lapses was predicted as being quite frequent, and we only had two measurements per individual; this would certainly lead to a (too) high amount of memory bias.

Participants who dropped out were asked whether they had taken up another form of exercise, and if so, which. This was an open answer question. The answers were then categorized into 17 forms of exercise.

Statistical analyses were carried out on the data of the participants who completed both questionnaires. Means and standard deviations of the general characteristics were calculated. The adherers and drop-outs were compared in univariate analysis for nominal variables using a  $\chi$ 2-test, and for numerical variables with a t-test. The drop-out incidence is defined as the number of cases (i.e. people dropping-out) in 6 months (available per program), per 100 enrolled participants. The software used was SPSS 11.0 (SPSS Inc., 2003).

#### RESULTS

More than 400 local intermediaries (exercise and sport instructors) agreed to recruit participants for the project. After recruitment and giving their informed consent, 2,350 people received the baseline questionnaire and 2,020 completed and returned it. Of these 2,020 participants, 1,725 also returned the follow-up questionnaire at six months. The data for these 1,725 subjects were analyzed (see Figure 1). The total response was 73%.



FIGURE 1: Flow chart for the study. The information on non-response was based on data for a random selection of 50 non-responders

The mean drop-out incidence for all programs was 0.15 per 6 months (see Figure 2). The highest drop-out incidence was for FysioSport (0.37), followed by badminton (0.25) and skating (0.22). The lowest drop-out incidence was for cycling (0.05).



FIGURE 2: Six-month drop-out incidence for different exercise programs (number between 0-1)

#### Background characteristics

Table 1 presents the background characteristics of the drop-outs (N=250) and the adherers (i.e. the non-drop-outs; N=1,475). There were no differences between the drop-outs and the adherers in age, gender, housing situation, working status, and lifestyle factors (physical activity, smoking, and alcohol consumption). There were, however, significant differences in marital status, level of education, and BMI. More people who had always been single and fewer widowed people reported dropping out. Fewer people with a low level of education dropped out compared with people with a higher level of education. More people with underweight (BMI<20) and overweight (BMI>25) dropped out compared with people with a normal weight (BMI 20-25). There were also significant differences between the drop-outs and the adherers in health status: drop-outs reported lower scores on vitality and general feeling of health, and they reported lower pain scores (i.e. they experienced more pain).

Background variables	Adherers (N=1,475)		Drop-outs (N=250)		Total (N=1,725)	Test- statistic	
	М	Sd	М	Sd	Μ	Sd	
Age in years	61.1	8.1	60.5	8.4	60.9	8.2	NS
	%	Ν	%	Ν	%	Ν	X <sup>2</sup> df
<b>Gender</b> -male -female	49 51	723 752	45 55	113 137	48 52	836 889	NS
Marital status -married (living together) -divorced -widowed -never lived together	78 5 14 3	1151 74 206 44	78 7 9 6	195 18 22 15	78 5 13 3	1346 92 228 59	13.1* 3
Level of education -High -Middle -Low	18 41 41	265 605 605	24 49 27	60 123 67	19 42 39	325 728 672	10.8* 2
-house/flat with stores -house/apartment -service flat -living in elderly home	70 26 3 1	1032 384 44 15	73 26 0.5 0.5	183 65 1 1	70 26 3 1	1215 449 45 16	NS
Working status Income from work Income from other sources	38 62	538 892	41 59	100 144	38 62	638 1036	NS
Life style factors -Physical Activity: % norm active1	33	487	30	75	33	562	NS
-Smoking	12	177	16	40	13	217	NS
-Alcohol no alcohol 1-5 glasses/week 6-10 glasses/week 11-21 glasses/week >21 glasses/week	27 39 22 10 2	398 575 325 147 30	27 38 20 12 3	67 95 50 30 8	27 39 22 10 2	465 670 375 177 38	NS
<b>Body Mass Index</b> <20 20-25 25-30 >30	3 43 43 11	44 634 634 162	6 36 48 10	15 90 120 25	3 42 44 11	59 724 754 187	12.9* 3
Health status Vitality Pain Mental health General feeling of health Change in health status	M 67.5 83.2 75.6 68.2 55.4	Sd 16.5 19.8 15.2 17.2 20.2	M 64.3 77.9 73.6 65.2 53.4	Sd 17.7 20.1 15.8 18.2 21.2	M 67.0 82.4 75.3 67.8 55.1	Sd 16.7 19.9 15.3 17.4 20.4	F=7.0** F=14.8** NS F=5.9** NS

#### TABLE 1: Background characteristics of subjects at baseline

x<sup>2</sup> test, \* p<0.01; T-test,\*\* p<0.01

<sup>1</sup>Moderate activity for minimally 30 minutes during at least 5 days a week

Differences between drop-outs and adherers in terms of lapses Seventy-six percent of the drop-outs reported lapses during the study period, compared with 58% of the adherers ( $\chi 2$  =53, df=1, p<0.01). The drop-outs also had significantly more, and longer lapses than the adherers (Table 2).

*TABLE 2:* The percentage of adherers and drop-outs who lapsed in program participation in the last six months, lapse frequency, and length of lapses (in percentages and absolute numbers).

Variables	Adherers % (n)	Drop-outs % (n)	x2 (df)
Occurrence of lapses during past 6 months Yes No	58 (856) 42 (619)	76 (190) 24 ( 60)	28.6 (1) *
Frequency of lapses >1x per month 1x per z month 1x per 2 months 1x per 3 months <1x per 3 months	28 (240) 20 (171) 18 (154) 15 (128) 19 (163)	58 (110) 11 (21) 9 (17) 9 (17) 13 (25)	63.6 (4) *
Length of lapses 1 week 2-3 weeks 4-6 weeks >6 weeks	33 (283) 40 (342) 16 (137) 11 ( 94)	18 ( 34) 19 ( 36) 16 ( 31) 47 ( 89)	145.3 (3) *

\* p<0.01

#### Moment of drop-out

There were large exercise program-specific differences in the moment that participants dropped out. People who participated in athletics or cycling dropped out relatively soon (mainly within 8 weeks) after the start of the program, whereas people who participated in skating, table tennis, or walking mainly dropped out later (weeks 17 through 26; Figure 3).



FIGURE 3: Moment of drop-out (comparison months 0-8 weeks versus 9-16 weeks and 17-26 weeks; in percentage 0-100)

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#### Switching to another form of exercise program

Thirty-one percent of the people who dropped out switched to another form of exercise. There were large differences between the exercise programs in switching behavior. For example, many people who dropped out of skating switched to another form of exercise, whereas few people who dropped out of cycling switched to another type of exercise (Figure 4). Many of the people who dropped out switched to fitness, swimming, tennis, and walking.



FIGURE 4: The percentage of people who dropped out (n = 250) who switched to another form of exercise. Total drop-out: 250

Exercise/ switched to exercise form (n)	Athl	Badm	Cycl	Gymn	Skat	TaTe	Fysio	HIB	MBvO	Walk
Cycling (n=9)	1	2			3	2			1	
Dancing (n=1)									1	
Fitness (n =17)	2	2		2	1	1	3	4		2
Gardening (n =3)							2			1
Golf (n =2)							2			
Home exercise (n=5)				2			2	1		
MBvO (n =2)		1						1		
Rowing (n =1)	1									
Skating (n =1)				1						
Skeelering (n = 1)					1					
Slender you (n =1)		1								
Swimming (n =17)		1	1				5	6	3	1
Table tennis (n =1)									1	
Tennis (n =12)		1		1			3	3	2	2
Volleybal (n =1)								1		
Walking (n =14)				1		1	5	3	4	
Tv-exercise (n =3)						1			2	
Total (n =91)	4	8	1	7	5	5	22	19	14	6

## TABLE 3: The number of people who dropped out of a specific exercise program (horizontal) who switched to another form of exercise (in absolute numbers (n))

Athl=Athletics, Badm=Badminton, Cycl=Cycling, Gymn=Gymnastics, Skat=Skating, TaTe=Table tennis, Fysio=FysioSport, HIB=clubs for (ex) heart patients, MBvO=More Exercise for Seniors, Walk=Walking for sports

#### DISCUSSION

This study investigated the drop-out incidence, and timing of drop-out among seniors taking part in organized exercise programs in the Netherlands. The average drop-out incidence was 0.15 per six months.

In the general population, the average drop-out incidence in exercise programs is about 0.50 during the first six months (Carmody et al., 1980; Dishman, 1982; Oldridge, 1988; Dishman & Sallis, 1994). This difference in drop-out incidence may partly be explained because we focused on organized exercise programs. Older adults often adhere better to a specific kind of exercise behavior, whereas younger people tend to change more often.

This may be due to a stronger sense of responsibility, especially when social interaction is involved, such as in a group-based exercise program. Older people may also have more time for exercise programs than younger people.

The overall drop-out incidence among seniors attending organized exercise programs in the Netherlands was lower than that reported in US and Canadian studies. Ecclestone et al. (1998) found that, in organized exercise programs for seniors in Canada, the drop-out incidence was 0.41 during the first six months. In that study the exercise programs consisted mainly of aerobics and fitness classes, whereas we compared ten different types of exercise programs. It should be noted that we observed considerable variations in the drop-out incidence for the different programs, with FysioSport having the highest drop-out. FysioSport is an aerobics and fitness class, and therefore the form of exercise most similar to the exercise programs of Ecclestone et al. (1998). The drop-out incidence for FysioSport was comparable to that reported by Ecclestone et al. (1998) (0.37 and 0.41, respectively). People who dropped out were asked whether they did so because of the intensity of the program. This reason was, however, not mentioned in FysioSports. This high drop-out incidence may in part be due to the cost, because FysioSport is a relatively expensive exercise program.

The drop-out incidence appeared to be associated with marital status and level of education, housing situation, and BMI. Among those who dropped out, there were significantly fewer people with a lower level of education. These results are in accordance with the results of King et al. (1997), but on the whole there is little information in the literature about the association between level of education and drop-out. Among the dropouts there were significantly more people who had always been single and significantly less widowed people. This may be because organized exercise programs are an important aspect of the social life of people who have lost their partner since it offers the chance to make new social contacts. Among the drop-outs there were significantly more people with overweight and underweight. In the focus group interviews TNO held with seniors (50-plus) before the start of th study, overweight was mentioned as an important potential determinant of drop-out, although there is little scientific evidence to support this. The results indicate that this aspect warrants further investigation, especially because exercise is often recommended to people with overweight. The higher drop-out incidence among people with a BMI under 20 was unexpected and difficult to explain. Underweight may be associated with underlying illnesses or frailty, but because of the relative low number of subjects in this subgroup this hypodissertation cannot be proven. There were significant differences in vitality, pain score, and general feeling of health between the drop-outs and the adherers. People with a lower perceived health status tended to drop-out more often than those with a higher perceived health status. Other investigators have reported poor health to be a determinant of drop-out (Dishman & Sallis, 1994; Ecclestone et al., 1998; Rhodes et al., 1999; Martin & Sinden, 2001). This is in accordance with the results of the current study.

The literature suggests that drop-out mainly occurs during the first three months of a program (Carmody et al., 1980; Dishman, 1982; Dishman & Sallis, 1994; Oldridge, 1988).

We found that the type of exercise program influenced the moment that people dropped out. In several programs (i.e. skating, table tennis, and walking) participants tended to drop out after four months, whereas in other programs (i.e. cycling and athletics) people mainly dropped out in the first eight weeks. It seems that certain exercise programs are more prone to early drop-out than other programs.

This study is one of the first to investigate whether seniors who drop out of an exercise program actually switch to another form of exercise. Thirty-one percent of the people who dropped out subsequently took up another form of exercise. There were large differences in such switching behavior between the ten exercise programs. For example, many people who dropped out from skating took up another form of exercise. This may be influenced by the seasonal aspects of the sport, as people can only skate in the winter and thus tend to take up another sport in the summer. Three of the five skaters who took up another form of exercise took up cycling. Few of the people who dropped out of cycling took up another type of exercise. Ecclestone et al. (1998) found that in a period of three years 21% of the participants switched to another exercise program in their center. However, they did not take into account the participants who quit an exercise program and switched to another form of exercise outside of their initial centre. We took other forms of exercise into account, which may explain the differences in results (21% in Ecclestone et al. in three years versus 31% in this study in six months). It was found that people who switched from one program to another often switched to fitness, swimming, tennis, and walking, exercises which appear to be popular among seniors (Ooijendijk et al., 2001). However, it was not reported that people switched to another sport because they preferred it or thought it to be more beneficial to their health.

This study had a number of limitations. The number of drop-outs may have been biased by non-response (Figure 7.1). A random non-response analysis revealed that participants had not responded because they were ill or injured (20%), had moved to another city (12%), or had died (4%). Based on these responses one may certainly expect these people to have dropped out of the exercise programs. The drop-out incidence would then be about 0.20. While different types of exercise were included, it was not possible to ensure that the same number of participants followed each type of exercise program, which may have biased the results. In this study the occurrence of lapses, the amount of lapses and the duration of lapses were taken into consideration. An aspect which could have offered additional information was the time-point of the lapse(s). However, this information was not recorded. In future studies it could be added.

In conclusion, the results suggest that the drop-out incidence for organized exercise programs for seniors (0.15) is lower than that for such programs in the general population. There are substantial program-specific differences in the moment that older people drop out, but 31% of people who dropped out of one exercise program took up another form of exercise. Future studies should take switching behavior into account when dealing with drop-out from exercise programs.

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Prediction of older adults maintenance in exercise participation using an integrated social psychological model

Stiggelbout M, Hopman-Rock M, Crone M, Lechner L, Mechelen W van Prediction of older adults maintenance in exercise participation using an integrated social psychological model. Health Education Research 2006,21;1:1-14.

# ABSTRACT

Little is known about the predictors of maintenance in organized exercise programmes. The aim of this study was to investigate the behavioural predictors of maintenance of exercise participation in older adults, using an integrated social psychological model. To this end, we carried out a prospective cohort study (n= 1,725; age  $\geq$ 50 years) involving ten different types of exercise programmes, with measurements at baseline and after 6 months. Predictors of intention to continue participating, and the actual maintenance of exercise participation in the exercise programme were assessed using a stepwise logistic regression model.

Significant odds ratios predicting the intention to continue with the exercise programme were found for female gender, younger age, being married, being a non-smoker, being in paid employment, having a positive attitude towards exercise, and having a high self-efficacy at baseline. Significant odds ratios predicting actual maintenance of exercise participation were short lapses, absence of lapses, high intention to remain participating at baseline, high perceived quality of the programme, positive attitude towards exercise at baseline, and few risk situations at baseline. In order to promote maintenance of exercise participation for older adults, effort should be taken to prevent lapses, to help people cope with risk situations for lapses, to improve the attitude towards exercise participation, and to improve the quality of the programme.

Regular participation in exercise confers a variety of health benefits on older adults, such as improved cardiovascular, respiratory, and muscular function, and a diminished risk of disease states (American College of Sports Medicine, 1998; US Department of Health and Human Services, 1996). Yet despite the potential benefits of exercise, many people are still physically inactive. Although considerable effort has been put into promoting exercise programmes to increase levels of physical activity, less attention has been paid to ensuring that people continue to participate in these programmes. In the exercise promotion literature six months is often accepted as the time-frame for behaviour change to become imbedded (Prochaska & DiClementi, 1983), and so we accept this time-frame as relevant to maintenance of exercise participation. Research shows that about 50% of the participants of exercise programmes drop out during the first 6 months (Carmody et al., 1980; Dishman, 1982; Dishman & Sallis, 1994; Oldridge et al., 1988). Very few theoretically driven studies have investigated predictors of maintenance of exercise participation among older adults (Rhodes et al., 1999), yet an understanding of these determinants is important because a physically active lifestyle can alter the course of frequently occurring chronic diseases. The aim of this study is to identify determinants of exercise maintenance in organized exercise programmes for seniors (i.e. people over 50 years of age).

#### Theoretical model for prediction of maintenance of exercise participation

Several theoretical health behaviour models have been developed to predict actual exercise participation, but few are available to predict maintenance of exercise participation. In this study, Bandura's Social Learning Theory (Bandura, 1986) has been used related to attitude and social influence, The Theory of Planned Behaviour (Ajzen, 1991; Ajzen & Driver, 1992) was used related to self-efficacy, the Triandis model of past behaviour (Triandis, 1977; Triandis, 1979) was integrated related to past behaviour, and the Relapse Prevention model (Marlatt & Gordon, 1985) was used related to (re)lapses, coping behaviour, and (perceived) risk situations. All these separate models were integrated to elaborate factors constituting an integrated social psychological model of exercise maintenance (Figure 1).

A central aspect of the Theory of Planned Behaviour (Ajzen, 1991) is the individual's intention to perform a given behaviour. Intentions are assumed to capture the motivational factors that influence behaviour – they are indications of how hard people are willing to try, or how much effort they are planning to exert, in order to perform a behaviour. The theory postulates three conceptually independent determinants of intention, namely attitude, social influences, and self-efficacy. Attitude consists of the advantages and disadvantages of a particular behaviour (referred to as outcome expectations in the Social Learning Theory of (Bandura, 1986). Social influences include subjective norms (beliefs of important referent people), perceived social support (support from others for a certain behaviour), and modelling (perceived behaviour of relevant others (Ajzen & Fishbein, 1980; Bandura, 1986). It is assumed to reflect past experience as well as anticipated impediments and obstacles.

The Theory of Planned Behaviour. Ajzen (1991) argues that the perceived Behavioral Control (PBC) and self-efficacy constructs are interchangeable. However,

self-efficacy is more clearly defined and operationalized than is PBC. Moreover, while self-efficacy and PBC account for equivalent proportions of variance in behaviour, self-efficacy explains somewhat more of the variance in intention than does PBC. Therefore we have decided to include self-efficacy instead of PBC.

We also included past behaviour (habits) in our model. A person's habits regarding a certain behaviour are very important (Triandis, 1977; Triandis, 1979), and several studies have shown that the inclusion of past behaviour can improve the prediction of intention and/or behaviour (Lechner & De Vries, 1995a; Lechner & De Vries, 1995b). In turn, intention is considered an immediate antecedent of actual behaviour: the stronger a person's intention to engage in a behaviour or to achieve his or her behavioural goals, the more successful he or she will be. However, barriers, such as lack of time or ill health, may influence a person's intention to continue exercising such that he or she ultimately stops exercising (Ajzen & Fishbein, 1980). The ability to cope with situations in which reversion to an old behaviour is likely may be an important predictor of maintenance of exercise participation. In the Relapse Prevention Model, Marlatt & Gordon distinguish between a 'lapse' and a 'relapse'. A lapse refers to a 'slight error or slip' (Marlatt & Gordon, 1985), whereas a relapse implies a breakdown in the person's efforts to control a particular problem (here: continuing exercise participation). Relapse is the act or instance of backsliding to the undesired behaviour (Marlatt & Gordon, 1985). A lapse does not mean that an individual has totally relapsed into the old behaviour. He or she may be able to cope with the reason for the lapse and to continue with the new behaviour again. Lastly, we added two specific factors that may be important to maintenance of exercise participation: the type of exercise and the perceived quality of the programme. The perceived quality was divided into three components: 1. the quality of the instructor, 2. the quality of the programme content, and 3. the quality of the programme conditions (price, distance to the accommodation, the accommodation itself, the time of day the programme is held).



FIGURE 1: The adapted planned behaviour model used in this study based on (1) the Social Learning Theory (Bandura, 1986), (2) The Theory of Planned Behaviour (Ajzen, 1991; Ajzen & Driver, 1992) the model of past behaviour (Triandis, 1977; Triandis, 1979) and (4) the Relapse Prevention model (Marlatt & Gordon, 1980; Marlatt & Gordon, 1985)

# **METHODS**

A prospective cohort study with baseline (before the start of the exercise programme), and follow-up measurements (6 months after the start) was performed to identify the predictors of maintenance of exercise participation in organized exercise programmes for older individuals (50-plus) living in the community.

#### Recruitment procedure and study population

In collaboration with four representatives of two important national organizations in the field of sports and physical activity in the Netherlands, i.e. the Netherlands Institute of Sports and Physical Activity (NISB), and the Netherlands Olympic Committee \* Netherlands Sports Confederation (NOC\*NSF), ten different types of exercise programmes in the Netherlands were identified which may be seen as representative for the organized exercise programmes for older adults in the Netherlands. Criteria for selection were based on 1) specific policy on exercise for older adults, and 2) popularity among

older adults. These exercise programmes include More Exercise for Seniors Gymnastics (MBvO, being a low to moderate community based group wise exercise programme attracting mainly older women (65-plus)), organized sports in sports clubs (specifically, athletics, badminton, cycling, gymnastics, speed skating and table tennis), FysioSport (i.e. a fitness programme delivered by physical therapists/sports physical therapists), Exercise for Heart Patients (HIB) and Walking for Sports (referred to as Walking in this chapter, being a group wise walking programme). The national organizations running these exercise programmes participated in the study, which facilitated data collection.

A network was set up for each exercise programme to recruit participants for the prospective study. Local organizations, clubs, or groups were approached through the national organizations. Over a period of 15 months, all new members of the clubs or groups were asked to participate in the study. Participation is defined as 'regularly taking part in an exercise programme'. Inclusion criteria were (1) 'being older than 50' and (2) 'not being a member of an organized sports organization when joining the study'. The participants were asked for written informed consent before joining the study. To prevent bias among the participants, they were not told that the study investigated programme drop-out, but instead were told that the aim of the study was to increase the quality of the exercise programmes. They completed a baseline questionnaire (administered by post) before they started an exercise programme. Non-responders received a reminder after one week. After 6 months, all the participants who had returned the first questionnaire received a second postal questionnaire. Non-responders to the second questionnaire received a reminder after 3 weeks. Non-response research (conducted by computer-assisted telephone interview (CATI) among a random sample of 50 non-responders to both questionnaires) was carried out to check whether there were significant differences between responders and non-responders, and whether non-responders may have biased the final results (see figure 2). The Medical Ethics Testing Committee of Netherlands Organization for Applied Scientific Research (TNO) approved the study protocol.

#### Measurements

Because this was one of the first studies to specifically investigate factors governing maintenance of exercise participation in an organized programme, existing measures were not appropriate, and therefore we had to develop a number of new ones. We performed a literature search and then held two focus-group interviews with people who had dropped out of earlier programmes, people who had continued to participate in exercise programmes, and instructors of exercise programmes, to gather information about self-efficacy, risk situations, barriers, and the quality aspects of an exercise programme (Stiggelbout & Hopman-Rock, 2002).

At baseline, information was collected on background variables: age (in years), gender (female/male), marital status (married living together, married living alone, unmarried living alone, never lived together, widowed), level of education (education was recoded in three categories: 1-primary education, 2=secondary education, and 3=higher education

(college/university)), housing situation (living in a house, apartment building, service flat, elderly people's home), and source of income (paid employment versus other sources of income).

Physical activity was evaluated using questions derived from the Dutch Monitor on Physical Activity and Health (Ooijendijk et al., 2002), which covers compliance with Dutch public-health guidelines (Kemper et al., 2000). These guidelines, which are based on international guidelines, recommend that all adults perform 30 or more minutes of moderate-intensity physical activity (such as brisk walking) on most, and preferably all, days – either in a single session or 'accumulated' in multiple bouts, each lasting at least 10 minutes (ACSM, 1998; Pate et al., 1995). This level of physical activity was considered to be the norm. Other lifestyle behaviours assessed were smoking (non-smokers, former smokers, and smokers) and alcohol consumption (yes/no, and how many glasses of alcohol a week). The participants were asked their weight and height, from which we calculated the body mass index (BMI; weight (kg) divided by the height squared (m<sup>2</sup>).

Health status was measured using the RAND 36, a multidimensional health questionnaire (Ware & Sherbourne, 1992) translated into Dutch (Zee van der & Sanderman, 1993). In this study, five of the nine sub-scales were used: vitality (reliability: Cronbach's alpha 0.82), pain (Cronbach's alpha 0.88), mental health (Cronbach's alpha 0.85), general feeling of health (Cronbach's alpha 0.81), and change in health status (a one-item sub-scale: no alpha available). Each sub-scale was scored 0-100, 100 being the best score. We chose these five sub-scales because earlier exercise studies showed the five sub-scales to be associated with exercise participation, and were relatively easy to assess.

#### Determinants of physical activity / exercise behaviour

To evaluate attitude, (perceived) social influence, and self-efficacy, we developed questions related to physical activity / exercise behaviour, based on Lechner (Lechner & De Vries, 1995a; Lechner & De Vries, 1995b). Scales derived from these questions were checked by 4-point factor-analysis and the consistency was computed. All questions were rated using a Likert-type scale.

Attitude was assessed by means of 10 questions on beliefs, such as "I think that participating in the exercise programme is...". Answers on a 4-point scale ranged from 'very bad for health' to 'very healthy', scored from 1 (very bad for health) to 4 (very healthy). Attitudes were found to be highly correlated and were treated as one scale (Cronbach's alpha.84).

Social influence was assessed with 9 questions on the influence on exercise participation of the partner (3 questions), friends (3 questions), and relatives (3 questions). These questions were related to (i) Social norms: "What do they think about your taking part in an exercise programme" ["What is their opinion about your exercise participation?"], 5-point scale ranging from 'very negative' to 'very positive', and scored from –2 to +2; (ii) Social support: "How much do they support your participation in the exercise programme?", 3-point scale ranging from 'very little support' to 'a lot of support', scored from –1 to +1; (iii) Modelling: "Do they exercise or take part in an exercise programme?", 4-point scale

ranging from 'no, never' to 'yes, always', scored from +1 to +4. Because the partner's, relatives' and friends' influence were poorly correlated, all social influence items (social norms, support, and modelling) were analysed separately.

Self-efficacy was evaluated with 14 questions: "Imagine you have missed one or more exercise sessions, would you feel able to participate again?" Answer categories were on a 5-point Likert type scale, ranging from 'certainly not', to 'certainly yes'. All these variables were scored from -2 (negative about continuation of exercise participation) to +2 (positive about continuation of exercise participation). The self-efficacy questions were highly correlated and were treated as one scale (Cronbach's alpha .81; the total score of the scale had a range from -28 to +28).

The intention to continue exercise participation was evaluated with the question 'Do you intend to continue participating in the exercise programme in the coming 6 months?'. Because the answers had a skewed distribution, the answer categories were dichotomized: 0 (low intention) and 1 (high intention). In the questionnaire there was also a question about earlier participation in exercise programmes (with answer categories yes/no).

The questionnaire mentioned 19 barriers to maintain active in an exercise programme, such as "I usually have too little time", and "I am not used to exertion". Answeres on a 4-point scale were ranked from 'not important barrier' to 'very important barrier', and they were scored from 1 (not important barrier) to 4 (very important barrier). The barriers were highly correlated and were treated as one factor (Cronbach's alpha .85; the total score of the factor had a range from 19 to 76).

In the follow-up questionnaire, the participants were asked whether they still took part in their exercise programme (no/yes). We had identified 14 risk situations that could influence maintenance of exercise participation. Participants were asked questions such as "If the weather was bad, did you continue to take part in the programme?" and "If you were bored by the programme, did you continue with it?". The answers on a 4-point scale ranged from 'no' to 'yes', and from 1 (no-risk situation) to 4 (high-risk situation). The risk situations were highly correlated and were treated as one scale (Cronbach's alpha .85; the total score of the scale ranged from 14 to 56). Coping was assessed using an adapted Dutch coping questionnaire containing 17 questions related to how people cope with specific problems (Tak et al., 1999). Questions asked were "Do you ask people for help?", with answer on a 4-point scale categories 1 (seldom) to 4 (very often). The coping questions were highly correlated and were treated as one factor (Cronbach's alpha .84; the total score of the factor had a range from 17 to 68). Three questions concerned lapses, i.e. the occurrence of lapses (yes/no), the number of lapses (N), and the duration of lapses (in weeks).

In general, exercise programme components may be divided into 3 main quality aspects: the conditions of the programme (the accommodation, the price, accompany, etc.), the content (type, intensity, duration, frequency), and the guidance (trainer). For this reason we have divided the perceived quality into these three main components. The choice of all aspects related to the components was based on literature survey, and the focusgroup interviews (Stiggelbout & Hopman-Rock, 2002). Answers were scored on a 5-point scale

ranging from 'very negative (1)' to 'very good (5)'. The perceived quality variables were found to be highly correlated and were treated as one factor (Cronbach's alpha .92; the total score of the factor had a range from 20 to 100).

#### **Statistical analyses**

Only the data of patients who completed both questionnaires were analysed. Factor analysis and consistency analysis (Cronbach's alpha) were used to check whether the scales were adequate to be used in the analysis. Attitude, social influence, self-efficacy, risk situation, coping, barriers, and perceived quality of the programme were entered into the analysis as total scores.

The model of exercise maintenance predicted the intention to continue participation and the actual maintenance of exercise participation in the exercise programme. To predict determinants of intention (at a 0.05 level of significance) a stepwise logistic regression was applied with intention to continue participation as dependent variable (no/yes).

Because 'attitude', 'social influence', 'self-efficacy', and 'habits' were theoretically expected to be the most important predictive variables, they were entered first, followed by the background characteristics (age, sex, marital status, level of education, housing situation, work status, life-style (physical activity, smoking, and alcohol consumption), and health status (BMI, and health-related quality of life). Another stepwise logistic regression analysis was carried out to identify which significant determinants were most important in predicting self-reported continued exercise participation (at a 0.05 level of significance). Maintenance of exercise participation (yes/no) was used as dependent variable. It was defined here as 'remaining to take part regularly in an exercise programme'.

'Occurrence and period of lapses', 'perceived quality of the programme', 'risk situation', 'barriers', and 'coping responses' were entered as independent variables in the first block, as they were expected to have the highest predictive value. 'Intention to continue participation' was entered in Block 2, 'attitude', 'social influence', 'self-efficacy', and ' habits' in Block 3, and background variables in Block 4. A difference was considered to be statistically significant when p<0.05. The Statistical Package for Social Sciences SPSS 11.0 was used for analyses (SPPS Inc., 2003).

# RESULTS

More than 400 local intermediaries (exercise and sport instructors) agreed to recruit participants for the project. After recruitment, 2,350 people gave informed consent and received the baseline questionnaire. Of these, 2,020 returned the questionnaire; 1,725 participants completed the follow-up questionnaire at 6 months. Only data for the latter participants were analysed (Figure 2). The total response was 73% (1,725/2,350). The main reason for non-response to the first questionnaire was 'not starting the programme after all' (34%), followed by 'refused to participate in the study' (30%); the main reason for



FIGURE 2: Flow chart of the study. The information on non-response was based on a nonresponse examination of a random selection of 50 non-responders

Table 1 presents the characteristics of the study participants There was a similar number of men and women. The mean age was 60 years. Most participants were married, had had a lower to middle education, lived in a multi-storey house, and received income from a source other than work. Only 33% of the participants complied with the national physical activity guidelines, and approximately 13% smoked. Participants scored higher on vitality and lower on change in health status than drop-outs.

Background variables	Adherers (n=1,475)		Drop-outs (n=250)		Total (n=1,725)	
	Mean	Sd	Mean	Sd	Mean	Sd
Age in years	61.1	8.1	60.5	8.4	60.9	8.2
	%	Ν	%	Ν	%	Ν
<b>Gender</b> -male -female	49 51	723 752	45 55	113 137	48 52	836 889
Marital status -married (living together) -divorced -widowed -never lived together	78 5 14 3	1151 74 206 44	78 7 9 6	195 18 22 15	78 5 13 3	1346 92 228 59
Level of education - higher education - secondary education - primary education	18 41 41	265 605 605	24 49 27	60 123 67	19 42 39	325 728 672
Housing situation -multi-storey house -house/apartment -service flat -living in elderly home	70 26 3 1	1032 384 44 15	73 26 0.5 0.5	183 65 1 1	70 26 3 1	1215 449 45 16
Working status - income from work - income from other source	38 62	538 892	41 59	100 144	38 62	638 1036
Life style factors						
<b>Physical Activity</b> % norm active <sup>1</sup>	33	487	30	75	33	562
Smoking	12	177	16	40	13	217
Alcohol no alcohol 1-5 glasses/week 6-10 glasses/week 11-21 glasses/week >21 glasses/week	27 39 22 10 2	398 575 325 147 30	27 38 20 12 3	67 95 50 30 8	27 39 22 10 2	465 670 375 177 38
<b>Body Mass Index</b> < 20 20-25 25-30 >30	3 43 43 11	44 634 634 162	6 36 48 10	15 90 120 25	3 42 44 11	59 724 754 187
Health status -pain -vitality -mental health -general feeling of health -change in health status	Mean 67.5 83.2 75.6 68.2 55.4	Sd 16.5 19.8 15.2 17.2 20.2	Mean 64.3 77.9 73.6 65.2 53.4	Sd 17.7 20.1 15.8 18.2 21.2	Mean 67.0 82.4 75.3 67.8 55.1	Sd 16.7 19.9 15.3 17.4 20.4

# TABLE 1: Characteristics of subjects at baseline

 $\chi 2$  test, \* p<0.01  $^1$  Moderate activity for minimally 30 minutes during at least 5 days a week (according to the guidelines)

# Prediction of intention to continue exercise participation

Multivariate analysis showed female gender (OR 1.81 CI 1.04-3.17), younger age (OR 1.07 CI 1.02-1.12), being married (OR 2.91 CI 1.10-7.69), being in paid employment (OR 4.97 CI 2.36-10.46), being a non-smoker (OR 3.23 CI 1.11-9.09), having a positive attitude at baseline (OR 3.30 CI 1.73-6.31, and having a high self-efficacy at baseline (OR 1.73 CI 1.09-2.75) to be significant and independent predictors of the intention to continue participation in the exercise programme (Table 2). Paid employment became a more important predictor of intention when it is controlled by age in the model.

# TABLE 2: Estimate parameters of the stepwise logistic regression model of the intention to maintain participating in the exercise programmes $(n=1,358^*)$

	Block 1 Step 1 OR (CI)	Step 2 OR (CI)	Step 3 OR (CI)	Block 2 Step 1 OR (CI)	Step 2 OR (CI)	Step 3 OR (CI)	Step 4 OR (CI)	Step 5 OR (CI)	Step 6 OR (CI)
Attitudes	3.42 (1.88-6.22)	2.91 (1.58-5.36)	2.29 (1.31-4.01)	3.45 (1.84-6.46)	3.40 (1.80-6.41)	3.45 (1.82-6.56)	3.56 (1.87-6.75)	3.77 (1.98-7.18)	3.30 (1.73-6.31)
Self-efficacy		1.95 (1.26-3.03)	2.29 (1.55-3.40)	2.05 (1.32-3.19)	1.92 (1.23-3.00)	1.82 (1.17-2.85)	1.74 (1.12-2.72)	1.66 (1.05-2.61)	1.73 (1.09-2.75)
Income from No job Job				1 2.76 (1.53-4.97)	1 2.63 (1.44-4.82)	1 4.47 (2.17-9.18)	1 4.68 (2.26-9.69)	1 4.72 (2.27-9.84)	1 4.97 (2.36-10.46)
Marital status Unmarried Married Widowed					1 2.96 (1.20-7.42) ns	1 3.5 (1.39-8.83) ns	1 3.82 (1.50-9.74) ns	1 3.16 (1.22-8.22) ns	1 2.91 (1.10-7.69) ns
Age						1.06 (1.01-1.10)	1.07 (1.02-1.11)	1.07 (1.02-1.12)	1.07 (1.02-1.12)
Smoking Yes No							1 3.13 (1.10-9.09)	1 3.13 (1.09-9.09)	1 3.23 ((1.11-9.09)
<b>Gender</b> Male Female								1 1.77 (1.02-3.09)	1 1.81 (1.04-3.17)

Only the significant determinants are reported in the table; \* It does not add up to 1,725, due to missing values

#### Prediction of maintenance of exercise participation

Absence of lapses (OR 6.6 CI 2.1-20.8), short duration of lapses (OR 9.0 CI 4.7-17.2), high intention at baseline (OR 3.9 CI 2.0-7.6), high perceived quality of programme (OR 2.7 CI 2.0-3.8), positive attitude at baseline (OR 1.9 CI 1.2-3.0), and few risk situations at baseline (OR 1.1 CI 1.01-1.14) were significant independent predictors of maintenance of exercise participation (Table 3).

	Block 1 Step 1 OR (CI)	Step 2 OR (CI)	Step 3 OR (CI)	Step 4 OR (CI)	Block 2 Step 1 OR (CI)	Block 3 Step 1 OR (CI)	Block 4 Step 1 OR (CI)
Period op lapse 1 week 2-3 weeks 4-6 weeks 6 weeks or more	8.7 (4.7-16.1) 8.5 (4.8-15.2) 5.3 (2.7-10.4) 1	8.5 (4.5-15.9) 8.1 (4.5-14.6) 5.6 (2.8-11.2) 1	8.5 (4.5-15.9) 8.1 (4.5-14.7) 5.6 (2.8-11.2) 1	8.2 (4.4-15.5) 8.1 (4.5-14.6) 5.3 (2.6-10.5) 1	8.3 (4.4-15.9) 8.2 (4.5-14.9) 5.2 (2.6-10.5) 1	9.0 (4.7-17.2) 8.3 (4.5-15.3) 5.1 (2.5-10.3) 1	9.0 (4.7-17.2) 8.3 (4.5-15.3) 5.1 (2.5-10.3) 1
Perceived quality of the programme		2.6 (1.9-3.5)	2.6 (1.9-3.5)	2.6 (1.9-3.5)	2.7 (1.9-3.6)	2.5 (1.8-3.5)	2.7 (2.0-3.8)
<b>Lapse</b> Yes No			1 6.4 (2.2-18.7)	1 7.0 (2.4-20.5)	1 7.2 (2.4-21.1)	1 7.2 (2.4-21.5)	1 6.6 (2.1-20.8)
Risk situation				1.1 (1.02-1.14)	1.1 (1.03-1.14)	1.1 (1.01-1.13)	1.1 (1.01-1.14)
Intention to continue Low High					1 4.7 (2.5-9.1)	1 4.3 (2.3-8.3)	1 3.9 (2.0-7.6)
Attitude						2.5 (1.5-3.7)	1.9 (1.2-3.0)

# TABLE 3: Estimate parameters of the stepwise logistic regression model of the maintenance of exercise participation in the excercise programmes $(n=1,270^*)$

Only the significant determinants are reported in the table;

\* It does not add up to 1,725, due to missing values

The occurrence and the number of lapses were important predictors of maintenance. Therefore we did additional stepwise logistic regression analyses for predictors of lapses. We found that there was a higher chance of lapses when there were more risk situations (OR 0.92 CI 0.89-0.95), and when participants had a lower self-efficacy (OR 1.45 CI 1.12-1.86). The chance of lapses was lower when the level of education was higher (OR 2.57 CI 1.80-3.64), when the vitality score was higher (OR 1.01 CI 101-1.02), and when there was less reported pain (OR 1.1 CI 1.01-1.02).

## DISCUSSION

We examined the predictors of the intention to continue participation in exercise programmes, and the actual maintenance of exercise participation in organized exercise programmes for older adults (50-plus) at 6 months, using an integrated social psychological model. We found that 85% of our study participants were still taking part in the exercise programme 6 months after they started. In the general population, about 50% of people who start exercising are still exercising 6 months later (Carmody et al., 1980; Dishman, 1982; Dishman & Sallis, 1994). This difference in maintenance of exercise participation may partly be because we focused on organized exercise programmes. Older people often adhere better to a specific type of exercise whereas younger people tend to change more often. Older people may have a stronger sense of responsibility, especially when social interaction is involved, such as in a group-based exercise programme. Moreover, they may also have more time than younger people to participate in such exercise programmes. Predictors of the intention to continue participation were age, gender, marital status, smo-

king, work status, attitude, and self-efficacy, and those of actual maintenance of exercise participation were the occurrence and duration of lapses, intention to continue participation in the programme, perceived quality of the exercise programme, number of risk situations, and attitude.

#### Intention to continue participation in the programme

According to McAuley & Courneya (1993), key variables of exercise participation, derived from the theories of reasoned action and planned behaviour in the physical activity domain, are attitude, self-efficacy, and intention. Attitude and self-efficacy are considered to be prime targets for intervention, because they affect an individual's intention to be physically active and ultimately his or her physical activity patterns. Consistent with this, we found that both attitude and self-efficacy were independent predictors of the intention to continue participation, which in turn was a predictor of actual maintenance of exercise participation. Some background variables (being married, in paid employment, and female gender) were also significant independent predictors of the intention to continue participation in the exercise programme. Although the Theory of Planned Behaviour states that social influence may be a predictor of intention, and therefore a predictor of maintenance (Oka et al., 1995), we found that social influence was not a predictor of either intended or actual maintenance of exercise participation. The inclusion of the measure of past behaviour has been shown to account for an important role in physical activity intention and behaviour, and may be seen as an important predictor (Hagger et al., 2002; Jackson et al., 2003). In our study, however, past behaviour did predict neither the intention nor the maintenance of physical activity. The discrepancy may be due tot the fact that most studies relate to exercise participation, whereas our study relates mainly to maintenance of exercise participation.

#### Maintenance of exercise participation

In the theoretical model, maintenance of exercise participation is predominantly determined by intention. Although this was partly the case, we found several factors to influence maintenance. For example, the perceived quality of the exercise programme was a predictor of maintenance of exercise participation. For this reason, an instrument should be developed to monitor the quality of exercise programmes, with a view to preventing people from dropping out because of 'poor' programmes. Because a positive attitude towards exercise participation at baseline was a predictor of maintenance of exercise participation, it may be worthwhile to highlight the positive effects of exercise participation to potential and new participants, in order to improve their attitude and indirectly decrease drop-out.

Both the occurrence and duration of lapses were predictors of maintenance of exercise participation. Analysis of the variables that predicted the occurrence of lapses revealed there to be a higher chance of lapses when there were more risk situations and when participants had a lower self-efficacy. There was a lower chance of lapses occurring when the level of education was higher, when the vitality score was higher, and when there was less

reported pain. Thus although one might expect health to predict maintenance of exercise participation, we found that it had an indirect influence, by affecting the likelihood of lapses. Not only did more risk situations predict the occurrence of lapses, but a smaller number of risk situations was also an independent predictor of maintenance of exercise participation.

The Relapse Prevention theory of Marlatt & Gordon (1985) includes the identification of situations that are high-risk situations for lapses and training in problem-solving to deal with risk situations. In a study of the effectiveness of relapse prevention training on maintenance of exercise participation, Marcus & Stanton (1993) found that while their programme did not appear to promote continued participation, it decreased the number of lapses. Belisle et al. (1987) reported a small but consistent effect of the relapse training programme on maintenance of exercise participation. Thus relapse prevention training appears to be a cost-effective means to increase maintenance of exercise participation. However, Belisle et al. studied younger adults, and it would be necessary to carry out a similar study with older adults. Such a programme may be beneficial for older individuals because we found that lapses and a lower number of risk situations were important predictors of continued participation.

Self-efficacy is reported to be an independent predictor of maintenance of exercise participation (McAuley & Courneya, 1993; McAuley et al., 2003; Oman & King, 1998). However, we found it to be a predictor of the intention to continue participation, and it was overruled in the final continued participation model (probably because intention was a predictor). Self-efficacy is a predictor of lapses, which in turn predict continued participation. For the sake of this study we integrated a social psychological model. Our results show that the model offers sufficient relevant predictors for explaining exercise maintenance. However, there are some questionable factors.

Coping was no predictor of maintenance of exercise participation. In this case we took coping behaviour in general into the questionnaire. It may be more relevant to take coping with risk situations into account. As this is more relevant as both risk situations as the occurrence of lapses are predictors of maintenance of exercise participation.

In the case of barriers to exercise it seems that there may be some overlap between the scales so that the influence of barriers is overshadowed by risk situations.

In this study the Theory of Planned Behaviour and the Social Cognitive Theory grounded the development of the integrated model that we applied for explaining exercise maintenance. By doing so, our first interest was to uncover leads for improving exercise maintenance rather than to improve theory. Nevertheless, the results of the regression analyses indicated a fairly good fit of the integrated model. A strength of the model is the inclusion of risk situations from the Relapse prevention model which seem to have an important effect on maintenance together with lapses. In the Relpase Prevention model lapses and risk perceptions and –situations are also important components. A limitation is the lack of influence of social influence; but also other studies have often found no effect of social influence.

#### Strength and limitations of the study

The study has a number of strengths: it is prospective in nature, it has a large sample size, does rely on a representative population of older participants, it considers a range of determinants that have been identified as important with respect to exercise behaviours, and it considers a range of types of organized programmes.

However, it also had some limitations, such a bias due to non-response (Figure 2), which means that the actual maintenance of exercise participation may have been lower than was suggested in our study. Although we included ten different exercise programmes in the study, we did not include all exercise programmes for older adults in our study. Thus the results of this study cannot be generalized to all exercise programmes for seniors. We assessed maintenance over 6 months, a time period generally accepted to reflect the time it takes exercise behaviour to be imbedded (Prochaska & DiClementi, 1983). A longer follow-up period may have led to a higher drop-out rate. Moreover, a longer study would have been more expensive, and it would have been more difficult to recruit organizations to participate.

#### **Conclusions and recommendations**

This study is one of the first to systematically investigate the predictors of the intention to continue participation in exercise programmes, and the actual maintenance of exercise participation in organized exercise programmes for older adults (50-plus), using an integrated social psychological model. We found gender, age, marital status, smoking, working status, attitude, and self-efficacy to be significant predictors of intention to continue participation at baseline. The occurrence and duration of lapses, the intention to continue participation, the perceived quality of the exercise programme, and baseline attitude were significant predictors of maintenance of exercise participation.

Thus in order to promote the actual maintenance of exercise participation in organized exercise programmes for older adults, it is important to increase the intention of participants to continue participation, possibly by changing their attitude at baseline, and to see how participants cope with potential risk situations with a view to decreasing lapses. The perceived quality of the programme could be evaluated by means of a satisfaction questionnaire, because people are more inclined to drop out of a programme they consider to be of poor quality. Relapse prevention training may help to increase maintenance in exercise programmes for older people.

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More Exercise for Seniors (MBvO in Dutch) is an umbrella organization that delivers physical activity programs, consisting of a variety of different activities such as gymnastics, swimming, fitness, yoga, games, and sports, throughout the Netherlands.

Programs are offered usually once a week. MBvO was started on an experimental basis in 1966 and has been widely implemented since then. It was designed specifically for people aged 65 years and older, with the aim of promoting optimal functioning in older adults, not only physically, but also mentally and socially (Kroes & De Greef, 2000). Currently, more than 300,000 older adults participate weekly in various types of MBvO activities. The basic form of MBvO consists of gymnastics (MBvO-gym) once a week. Until now, no study has investigated the health benefits of MBvO-gym.

This thesis is an attempt to explore the opportunities and challenges of MBvO-gym, in terms of health effects, prevention of drop-out, and implementation. The thesis is built up through two separate studies: a randomised controlled trial (RCT), and a prospective cohort study. Besides MBvO-gym the latter study also includes ten different kinds of physical activity programs. This general discussion starts by presenting the main results, followed by a general discussion of the results; the discussion is divided into three aspects: 'motivation of participants', 'health effects', and 'drop-out, and maintenance'. Then methodological considerations are presented, as well as Public Health aspects of the MBvO-gym. Finally recommendations are offered to increase the quality, and further implementation of MBvO-gym.

# MAIN RESULTS

MBvO-gym attracted relatively older seniors (65-plus), mainly women, and relatively lower educated participants. In the RCT, MBvO-gym once a week did not affect functional status or quality of life, and had only minor effects on diastolic bloodpressure, leg strength, and functional reach. MBvO-gym twice a week had some quality of life benefit in the least physically active people at baseline. These effects were found mainly in older participants (70-plus).

The average drop-out incidence in all the ten physical activity programs in our study was 0.15 per six months. In MBvO-gym the drop-out incidence was 0.10 per six months. The drop-out incidence and the timing of drop-out differed substantially between the several physical activity programs. In total, 31% of people who dropped out of one type of physical activity program switched to another type of exercise. The type of program and exercise was related to differences in this switching behaviour. Predictors of actual maintenance of exercise participation were: short lapses (=period of interruption of participation in the program); absence of lapses; high intention (to remain participating) at baseline; high perceived quality of the program; a positive attitude at baseline; and few perceived risk situations at baseline.

# **MOTIVATION OF PARTICIPANTS**

Our results suggested that MBvO-gym is more attractive for the older seniors (70+) than for younger seniors. In both studies, women were in the majority, as expected for this age cohort. People from lower socioeconomic status (SES) groups tend to be physically less active than people from higher SES groups (Ooijendijk et al., 2004). We found that relatively more lower educated than higher educated individuals participated in MBvO-gym, which suggests that MBvO is of importance for promoting physical activity among people from a low SES background. These results are especially interesting because national surveys (Beer, 2005) indicate that in the coming decades the number of elderly people will increase, and especially older seniors. MBvO-gym may be a way of attracting these older adults to physical activities.

#### HEALTH EFFECTS

Only a few studies have evaluated the short-term effects of a physical activity program on specific health parameters. Short-term studies like ours have their restrictions, namely, that participants need to invest a considerable amount of time in such programs in order to achieve measurable health benefits. Moreover, a physical activity intervention study by Westerterp & Meijers (2003) showed that some elderly subjects compensate for organized training by reducing their spontaneous physical activity, in contrast to younger subjects. From a purely practical standpoint, it is difficult to perform a longer program/study because the control group would have to wait too long to be able to join the program, thereby potentially delaying improvements in health in control group participants. Such a design would be unethical.

We found that once-weekly MBvO-gym had very few short-term health effects. There is a certain risk in presenting the results of studies like ours because of the current emphasis on evidence-based physical activity promotion. People could conclude that promotion of a program such as MBvO-gym should be stopped because of its limited effects. Even worse, policy makers may want to withdraw funding for participation in this program. It should, however, be emphasized how important MBvO-gym is in the Netherlands. It is the most widely used program in the country, with over 300,000 active participants on a weekly base, and perhaps one of the most popular programs for older adults worldwide. If program promotion were to be stopped or funding decreased or withdrawn, large numbers of older adults would become physically inactive. In addition, the attractiveness of the program among older adults from low SES backgrounds, and its low drop-out incidence are important aspects with regard to health promotion. The program is a social activity for large number of older adults in the Netherlands and contributes to the accumulation of their weekly physical activity.

Long-term health effects can be expected when people are moderately physically active for 30 minutes a day, for at least 5 days a week (ACSM, 1998). One may question whether

the activities of MBvO-gym are intensive and long enough for older adults to achieve benefits. In our systematic review (Chapter 3), we found that HRQoL and functional status showed the greatest improvements with programs that include at least three sessions per week. An earlier study by Hopman-Rock & Westhoff (2003) showed that a low-intensity physical activity program once a week, additional to home-based physical activities, might offer significant health benefits. The target group in the study of Hopman-Rock and Westhoff was the same as in our study (i.e., independently living sedentary Dutch seniors older than 65 years). Therefore, it seems plausible that adding home-based physical activities to MBvO-gym would result in additional health benefits. People who participate in MBvO-gym should be encouraged to take additional daily physical activity to ensure that they reach the HEPA guideline 'of 30 minutes of moderate physical activity at least 5 days a week'. In general, it is not relevant what type of physical activity is added to MBvOgym to comply with the health-promoting physical activity guideline. It is the 30 minutes a day of moderately intense physical activity that is important. NIB-tv may be one way to increase the amount of daily physical activity. NIB-tv is a televised physical activity program that is watched by relatively many older women, many of whom do the exercises shown. The viewing figures for NIB-tv are relatively high (more than 100,000 a day), and the program will continue for the coming years.

# **DROP-OUT, AND MAINTENANCE**

After six months of physical activity, people come into the maintenance stage. In this thesis we have combined a study on drop-out of the physical activity programs with a study on maintenance of participation in the physical activities. The drop-out analysis concerned the determinants of drop-out within the first six months of participation, whereas the maintenance analysis took into account the other side of the continuum: i.e. people maintaining activities for at least six months. The model we applied was a combination of several models used in health education. It has proven to be worthwhile for both drop-out research as well as developing a model for maintenance. The results of our study provide information to benefit exercise promotion in the future. Especially adding 'lapses' ('the number of lapses', 'the duration of lapses') to the model as well as 'the quality of the exercise program' are new insights, which may be useful in future research.

As health effects of a physical activity program diminish as soon as participants quit participating, it is important to prevent seniors from dropping-out of the physical activity program (Carmody et al., 1980; Dishman, 1982; Oldridge, 1988; Dishman & Sallis, 1994). Drop-out incidence in adults of approximately 0.50 in the first six months, mostly in the first 12 weeks, have been reported (Dishman, 1982; Dishman & Sallis, 1994). In our study the drop-out was 0.15 per six months overall (average of all programs), and was thereby substantially lower than the earlier mentioned 0.50 per six months. This difference in drop-out incidence may partly be because we focused on organized exercise programs.

Older adults may continue longer in physical activities, whereas younger people tend to change more often. This may be due to a stronger sense of responsibility, especially when social interaction is involved, such as in a group-based physical activity program. Older people may also have more time for physical activity programs than younger people. Drop-out incidence of participants of MBvO-gym was lower than drop-out incidence in the average program in our study (0.10 versus 0.15 per six months), which is of interest in

It is often mentioned that most drop-outs in physical activities dropout in the first few weeks after the start of participation. Our drop-out study has revealed that this is not necessarily true. It depends on the activities. In the case of MBvO-gym drop-out was not related to the first few months of participation. The drop-out incidence, and the moment of dropping out, differed substantially between the physical activity programs. In total, 31% of the people who dropped out of one type of physical activity program switched to another type of activity. The type of program and activity was strongly related to differences in this switching behavior. It is recommended that switching behavior will be monitored in future studies.

In terms of physical activity promotion the aspect of maintenance of physical activity participation is a very important aspect. Little was known about the predictors of maintenance in organized exercise programs. Predictors of actual maintenance of exercise participation were: short lapses; absence of lapses; high intention at baseline; high perceived quality of the program; positive attitude at baseline; and few risk situations at baseline. In order to promote maintenance of exercise participation for older adults, effort should be made to prevent lapses, to help people cope with risk situations for lapses, to improve the attitude towards exercise participation, and to improve the quality of the program. We may influence both the attitude of people, and the quality of the program by keeping a high standard in the training of the instructors. In the training we should offer specific information on the importance of complying with the HEPA guidelines, and the importance of physical activity for health benefits. We should, hereby, also inform participants that the health effects of physical activity diminish as soon as people drop-out of a physical activity program or do not maintain physical active in general.

# **METHODOLOGICAL CONSIDERATIONS**

terms of physical activity promotion in future.

This thesis is based on several studies. We carried out a multicentre RCT, using the Groningen Active Living Model (GALM; De Greef et al., 1997) to recruit participants to the MBvO groups. This approach was quite successful, with number of actual participants recruited to our study being comparable to that reported previously for seniors aged 55–65 years, an age group for which the method was developed (De Greef et al., 1997). Moreover, after the intervention period was over, more than 80% of the participants in the study setting actually continued with regular MBvO-gym classes. So, in terms of imple-

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mentation, our study was quite successful, even though this was not the purpose of the study.

Subjects were randomized to an experimental group and a control group (the participants in the experimental group were divided into two groups participating once a week (MBvO1) or twice a week (MBvO2). The randomization design presented some difficulties because some people refused to participate twice a week. Thus it appears difficult to get older adults to participate more than once a week in a group-based physical activity program. Chin A Paw et al. (2006) found somewhat comparable results: once a week exercise did not seem intense enough to provide benefit, whereas twice a week did not seem feasible for older adults.

Studies with short-term follow-up have certain other limitations. Older participants may take several weeks to adapt to the initial rigour of training and need a longer adaptation period to gain the optimal benefit from an exercise program (ACSM, 1998). This may explain why MBvO had no effect on the HRQoL and functional status. However, it is very difficult to carry out a randomised controlled intervention in the general population over a longer period of time because it is difficult to recruit a control group whom is not offered the intervention too.

The systematic review revealed that there is a lack of knowledge about the preferred type of physical activity, and the optimal frequency, intensity, and duration of physical activity sessions as well as programs needed to attain acceptable health benefits. There was, however, evidence of health benefits with physical activity programs lasting 8 weeks. There were also health benefits with low-intensity physical activity programs. Although most programs were offered three times a week, health benefits were also seen with twice weekly participation. It would be worthwhile to study the optimal combination of type of activity, the level of intensity, and the duration of the activity session as well as the duration of the program.

Our RCT was of 'good quality', with a score of five out of eight points when applying the methodological quality assessment criteria of our systematic review (based on Proper et al., 2002). The following aspects of our study were considered positive: inclusion or exclusion criteria; information on dropouts; blinding person who carried out the tests; information on compliance (being at least 75%; in our study 90%); and comparable timing of evaluation of outcome parameters.

De Greef et al. (2002) carried out a process evaluation to see whether the intervention provided in our study was comparable to the regular MBvO program, described by Klijnstra-Rooks (1994). Findings showed that the MBvO in our study was ecologically valid. In other words, our results can be generalized to MBvO groups in the Netherlands.

The prospective cohort study recruited new participants from ten different physical activity programs (including MBvO-gym) that are representative of exercise programs for the 50-plus population in the Netherlands. Our study was unique in that it was one of the first studies specifically carried out to study dropout from - and maintenance of partici-

pation in - physical activity programs. Dropout and maintenance are usually studied in combination with an intervention study. Our study had a large population, namely, 2,350 seniors at the start of the study (with a response of 73%), and was designed to: 1) study the characteristics of the seniors at study entry; 2) study dropout among senior participants of ten physical activity programs; and 3) develop a model of maintenance in physical activity programs. A limitation of our study was that we could only enroll people who actually participated. We know nothing about those participants who enrolled but who did not actually take part in a program. Such a study might identify barriers to participation in MBvO-gym.

The number of drop-outs may have been biased by non-response. A random non-response analysis revealed that participants had not responded because they were ill or injured (20%), had moved to another city (12%), or had died (4%). Based on these responses one may certainly expect these people to have dropped out of the exercise programs. The drop-out incidence would then be about 0.20. While different types of exercise were included, it was not possible to ensure that the same number of participants followed each type of exercise program, which may have biased the results. In this study the occurrence of lapses, the amount of lapses and the duration of lapses were taken into consideration. An aspect which could have offered additional information was the time-point of the lapse(s). However, this information was not recorded. In future studies it could be added, if the risk of memory bias is low.

In our study, more than 500 (of the 2,350) participants took part in MBvO-gym classes. This overrepresentation of MBvO-gym participants is not surprising because MBvO-gym is the most popular physical activity program in the Netherlands. MBvO-gym attracted older seniors, whereas the other activities mainly attracted younger seniors. This is consistent with everyday life, in which regular MBvO-gym programs also tend to attract mainly older seniors.

## **PUBLIC HEALTH CONSIDERATIONS**

The MBvO evaluation study, and other reviewed studies, justify the conclusion that shortterm health effects from low-intensity and moderate-intensity exercise can mainly be expected among the older participants who are the least physically active at baseline. Therefore our attention should focus on this subgroup, which is in line with the specific focus of the national campaign in the Netherlands '30 Minuten Bewegen' ('30 minutes of physical activity') of the National Institute for Sports and Exercise (NISB). In a recent Dutch policy report, De Greef & Bossenbroek (2007) concluded that there is a need for physical activity programs specifically for adults older than 75 years, and especially for adults from low SES backgrounds. MBvO is such a physical activity program that has great potential in terms of promoting health-enhancing physical activity among seniors in the Netherlands, especially for older, and physically inactive, seniors. The enormous popularity of the program, and the large network of groups and instructors work in favor

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of MBvO reaching many physically inactive seniors in the Netherlands. Although the health effects of MBvO-gym offered once a week seem limited, additional home-based physical activity (2–3 days a week) would increase the benefits.

In terms of promoting physical activity, it is especially important to reach relatively inactive and older individuals (70+), as these groups may benefit most from participation. We found the health benefits of physical activity to be the greatest in these subgroups. A way to reach these groups is to use general practitioners as a potential recruitment channel, because they often are in contact with these specific groups of older people.

One may also use already active members of MBvO as ambassadors to recruit new participants; this could lead to a snowball effect in newly recruited participants.

#### RECOMMENDATIONS

#### Recruitment

Pay more attention to the recruitment of physically inactive, and low SES older adults to MBvO activities. The step-in program 'Aging Well and Healthily' (6 weeks, once a week) could be used to reach these specific groups.

Use the Groningen Active Living Model as instrument to recruit the physically inactive older adult.

Use GPs as channels for the recruitment of new participants.

Attract more physically inactive people to the exercise classes, because increasing physical activity is most effective in the physically inactive population (ACSM, 1998).

#### **Promoting health effects**

Encourage MBvO participants to increase the level of daily habitual physical activity in addition to participation in the regular MBvO regimen.

#### Prevent drop-out, and improve maintenance in participation

Pay sufficient attention to the quality of MBvO instructors in the Netherlands, as the quality of the instructors is one of the most important quality aspects of the program, and hereby the maintenance of participation may be increased.

Pay more attention to the prevention of lapses, and the length, and duration of lapses, as lapses are important determinants of drop-out, and thereby influence maintenance in physical activity programs.

Inform (potential) MBvO participants about the importants of physical activity in terms of improving one's health, as hereby the attitude towards exercise at baseline can be increased, and the intention to remain active may be increased.

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# **Methodological issues**

More research is needed to discover the optimal exercise mode in terms of frequency, intensity, duration, and type of exercise for enhancing functional status, and HRQoL. Our study is one of the first studies to use a theoretical framework for maintenance of exercise participation. Because maintenance of physical activity is important for achieving sustained health benefits, it is recommended that more studies in this field should be performed.

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More Exercise for Seniors (MBvO in Dutch) is an umbrella organisation that delivers widely spread physical activity programs in the Netherlands, i.e. gymnastics, swimming, fitness, yoga, game & sports. Programs are usually offered once a week. MBvO was started on an experimental basis in 1966, and has been implemented widely since. The goal of MBvO is to promote optimal functioning in older adults, not only physically, but also mentally and socially. Currently, more than 300,000 older people participate weekly in various types of MBvO activities. The basic form of MBvO consists of gymnastics once a week. Until now, no study has been carried out on MBvO-gym in terms of health gain. This thesis is an attempt to explore the opportunities and challenges of MBvO-gym, in terms of health effects and implementation.

The aims of this thesis were as stated:

- To identify entry correlates and motivations of older adults (50-plus) participating in physical activity programs (including MBvO-gym).
- To review the literature on effectiveness of physical activity programs on functional status and health related quality of life (HRQoL) of older adults aged 65-plus.
- To examine the effectiveness of MBvO-gym on functional status, HRQoL, and healthrelated physical fitness of older adults aged 65 – 80.
- To study the drop-out incidence, and determinants of drop-out in MBvO-gym, and to compare with several other types of physical activity programs for older adults.
- To develop a social psychological model related to maintenance of physical activity participation in older adults.
- To recommend improvements on the efficacy, the effectiveness and the quality of MBvO-gym in terms of health enhancing physical activity promotion, and implementation.

# ENTRY CORRELATES AND MOTIVATIONS

In Chapter 1 entry correlates, and motivations of older adults participating in physical activity programs were identified. MBvO attracted relatively older seniors, whereas organized sports mainly attracted the younger seniors. Walking, MBvO, and gymnastics attracted more women, whereas skating, and table tennis were reported to attract more male participants. Badminton and cycling attracted relatively higher educated participants, whereas MBvO attracted relatively lower educated participants. Three distinct motivational constructs were found: 'Relax and Enjoy', 'Care & Cure', and 'Competition'. MBvO participants are mainly found in the motivational construct 'Relax & Enjoy', which is dominated by aspects relaxation, and pleasure.

# EFFECTIVENESS ON FUNCTIONAL STATUS, HEALTH RELATED QUALITY OF LIFE, AND HEALTH-RELATED PHYSICAL FITNESS

In Chapter 3 a review was reported of the effectiveness of exercise programs for seniors on functional status, and HRQoL. There is strong evidence for positive effects of exercise programs on both functional status as well as HRQoL in older adults. Considering these results and the potential impact on independence of older adults, it should be recommended to study which exercise modes are most effective, and whether there is a minimum threshold for frequency, intensity, and duration of exercise sessions. A problem regarding HRQoL, and functional status as an outcome measure is the lack of comparability due to the different operationalization of concepts, and the use of different measurement instruments. To improve data collection in the future it is important that researchers choose the same instruments.

In Chapter 4 and 5 the effects of MBvO gym on the health related quality of life, functional status, and health-related physical fitness of independently living people, aged 65 to 80 years were assessed through a randomised controlled trial in community dwelling of older people, with a comparatively low level of fitness. The study was carried out in two regions: Drenthe and Zuid-Holland. Using the GALM (Groningen Active Living Model) method, 4,600 independently living people aged 65 years and older were asked to participate in a motor fitness test. Of the 721 people who participated, 386 (the least fit) were invited to take part in the study. They were then randomly divided into an experimental and a control group. The experimental group did gymnastics once or twice a week. The control group received a health educational program.

Assessments were carried out at pretest and posttest (10 weeks). In the groups offered MBvO-gym once a week, no effects were found on subjective health, functional status or HRQoL and only minor effects on diastolic bloodpressure, leg strength, and functional reach. In the groups offered MBvO-gym twice a week, some beneficial effects were found on the HRQoL, and functional reach in the people who were least physically active at baseline. Relatively more individual improvement in the physical fitness was found in the older adults (70+).

It is recommended that the frequency and intensity of the regular MBvO-gym should be increased, to emphasize the importance of health education, and that relatively inactive and older individuals (70+) should be recruited.

# DROP-OUT INCIDENCE, AND DETERMINANTS OF DROP-OUT

Chapter 6 examined drop-out incidence, moment of drop-out, and switching behavior in organized exercise programs for seniors in the Netherlands, as determined in a prospective cohort study (with baseline measurements at the start of the exercise program and follow-

up after six months; N=1,725, response rate 73%). Participants were community-living individuals 50+ who participated in different forms of organized exercise programs. The average drop-out incidence was 0.15 per six months, in MBvO-gym drop-out incidence was 0.10 per six months. The drop-out incidence and the timing of drop-out differed substantially between the exercise programs. In total, 31% of the people who dropped out of one type of exercise program switched to another type of exercise. The type of program was related with differences in this switching behaviour. There is a need for more research in this area.

# SOCIAL PSYCHOLOGICAL MODEL RELATED TO MAINTENANCE OF EXERCISE PARTICIPATION

To assess predictors of the intention to continue participation, and the actual maintenance of exercise participation in exercise programs the dataset was used of the prospective cohort study earlier mentioned in Chapter 6. In this study a stepwise logistic regression model was applied. Significant odds ratios predicting the intention to continue with the exercise program were found for female gender, younger age, being married, being a non-smoker, being in paid employment, having a positive attitude towards exercise, and having a high self-efficacy at baseline. Significant odds ratios predicting actual maintenance of exercise participation were short lapses, absence of lapses, high intention at baseline, high perceived quality of the program, positive attitude at baseline, and few risk situations at baseline. In order to promote maintenance of exercise participation for older adults, effort should be taken to prevent lapses, to help people cope with risk situations for lapses, to improve the attitude towards exercise participation, and to improve the quality of the program.

#### **GENERAL CONCLUSIONS**

MBvO-gym is one of the most popular physical activity programs for seniors in the Netherlands. MBvO attracts relatively older seniors, more women, and relatively lower educated seniors. Drop-out in MBvO participants during the first six months was relatively low, compared to nine other programs for seniors which were embedded in the study. Of the MBvO participants who drop-out, 31% switch to other types of exercise. This is comparable to switching behaviour seen in other types of exercise programs. MBvO participants who switch to another type of activity mainly switch to walking, swimming, tennis and NIB-tv.

Once a week participation in MBvO does not lead to a measurable short term improvement on subjective health, functional status or quality of life and only minor effects on diastolic bloodpressure, leg strength, and functional reach. Twice a week MBvO participation was more effective in enhancing health, especially for older, and physically

inactive seniors. The enormous popularity of the program, the large network of groups and instructors works in favour of MBvO to reach the many (physically inactive) seniors in the Netherlands.

It is of importance to offer more education to the MBvO instructors on the health enhancing physical activity guidelines, and especially how to stimulate participants to comply to these guidelines.



Meer Bewegen voor Ouderen (MBvO) is een parapluorganisatie waaronder diverse beweegprogramma's worden aangeboden. Het betreft onder meer gymnastiek, zwemmen, fitness, yoga, spel & sport. De programma's worden meestal eenmaal per week aangeboden. MBvO bestaat sinds 1966 en is sindsdien breed geïmplementeerd in het hele land. Het doel van MBvO is het verbeteren van het zelfstandig functioneren van ouderen, zowel fysiek, mentaal als sociaal. Momenteel nemen naar schatting meer dan 300.000 ouderen wekelijks deel aan de diverse vormen van MBvO. MBvO-gymnastiek (MBvO-gym) is de meest populaire vorm van MBvO en wordt doorgaans eenmaal per week uitgevoerd. Tot op heden is er geen onderzoek gedaan naar de gezondheidswinst van deelname aan MBvO. In dit proefschrift worden de effecten van MBvO-gym onderzocht en wordt ingegaan op de kansen en uitdagingen met betrekking tot de (verdere) implementatie van MBvO-gym.

Doelen van dit proefschrift zijn:

- Het onderzoeken van het verband tussen het daadwerkelijk beginnen met een beweegprogramma (waaronder MBvO-gym) en de motivatieredenen van ouderen (50-plus).
- Systematisch onderzoek van de literatuur naar de effectiviteit van beweegprogramma's waar het gaat om zelfredzaamheid en de gezondheidsgerelateerde kwaliteit van leven van ouderen van 65-plus.
- Onderzoek naar de effecten van MBvO-gym ten aanzien van zelfredzaamheid, kwaliteit van leven en gezondheidsgerelateerde lichamelijke fitheid (fitheid) van personen van 65 tot 80 jaar.
- Onderzoek naar uitvalincidentie en determinanten van uitval in MBvO-gym in relatie tot diverse andere vormen van beweegprogramma's voor ouderen.
- Ontwikkeling van een sociaal-psychologisch model met betrekking tot behoud van beweeggedrag bij ouderen.
- Het geven van aanbevelingen ter verbetering van de effectiviteit en de kwaliteit van MBvO-gym met betrekking tot gezondheidsgerelateerde beweegstimulering en implementatie.

# Het verband tussen daadwerkelijk starten en de motivatie daarvoor

In Hoofdstuk 1 zijn startersverbanden en de motivatie van ouderen die deelnemen aan bewegingsprogramma's onderzocht. MBvO sprak vooral oudere senioren aan, terwijl de georganiseerde sport juist de jongere senioren aansprak. Wandelen, MBvO en gymnastiek trokken vooral relatief veel vrouwen; schaatsen en tafeltennis echter trokken meer mannen. Badminton en fietsen trokken relatief veel hoger opgeleide senioren, MBvO daarentegen is juist gericht op de lager opgeleide senioren. Er zijn drie verschillende motivationele dimensies te onderscheiden: 'Ontspan & Geniet', 'Zorg & Genees' en 'Competitie'. MBvO-deelnemers behoorden vooral tot de categorie 'Ontspan & Geniet'.

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#### Effecten op zelfredzaamheid, kwaliteit van leven en fitheid

In Hoofdstuk 3 is een systematisch literatuuronderzoek beschreven naar de effecten van beweegprogramma's voor ouderen op zelfredzaamheid en kwaliteit van leven. Er is sterk bewijs voor positieve effecten van beweegprogramma's met betrekking tot zowel zelfredzaamheid als kwaliteit van leven bij ouderen. Kijkend naar de resultaten en de gevolgen die de beweegprogramma's hebben voor de zelfstandigheid van ouderen, is het aan te bevelen om te onderzoeken welke vorm van lichaamsbeweging het meest effectief is en of er voor het behalen van effectiviteit een minimumdrempel is voor frequentie, intensiteit en duur van beweegactiviteiten. Een probleem ten aanzien van de zelfredzaamheid en de kwaliteit van leven als uitkomstmaten betreft het gebrek aan vergelijkbaarheid van resultaten. Dit komt door de verschillende wijzen van operationaliseren van onderzoeksmethoden en procedures en het gebruik van verschillende meetinstrumenten. Om de kwaliteit van dataverzamelingen in de toekomst te verbeteren is het belangrijk dat wetenschappers dezelfde meetinstrumenten gebruiken.

In Hoofdstukken 4 en 5 zijn de effecten onderzocht van MBvO-gym op kwaliteit van leven, zelfredzaamheid en gezondheidsgerelateerde lichamelijke fitheid bij zelfstandig wonende ouderen van 65-80 jaar. Dit gebeurde door middel van een gerandomiseerd gecontroleerd onderzoek (RCT) bij ouderen met een relatief lage fitheid. Het onderzoek is uitgevoerd in de provincies Drenthe en Zuid-Holland. Via het Groningen Actief Leven Modelmethode (GALM) zijn 4.600 zelfstandig wonende personen tussen 65 tot 80 jaar oud benaderd om deel te nemen aan een initiële fitheidstest. Van de 721 personen die deelnamen zijn 386 (de minst fitte bij aanvang) uitgenodigd om deel te nemen aan het onderzoek. Ze zijn vervolgens aselect verdeeld over de experimentele groep en de controlegroep. De experimentele groep kreeg eenmaal respectievelijk tweemaal per week MBvO-gym aangeboden. De controle groep ontving een voorlichtingsprogramma, zonder aandacht voor voeding en bewegen.

Er zijn metingen verricht voorafgaande aan het programma en na tien weken. In de groepen die eenmaal per week MBvO-gym kregen aangeboden, zijn geen effecten gevonden op de ervaren gezondheid, de zelfredzaamheid en de kwaliteit van leven; er zijn slechts beperkte effecten gevonden op diastolische bloeddruk, beenkracht en balans. In de groep die tweemaal per week MBvO-gym kreeg aangeboden zijn bij de deelnemers die bij aanvang het minst lichamelijk actief waren positieve effecten gevonden op de kwaliteit van leven en balans. Relatief meer individuele vooruitgang in lichamelijke fitheid is gevonden bij relatief oudere ouderen (70+).

Het is aan te bevelen om de frequentie en intensiteit van het MBvO-gym te verhogen, het belang van meer voorlichting over de Nederlandse Norm Gezond Bewegen voor MBvOdeelnemers te benadrukken en meer nadruk te leggen op de werving van lichamelijk inactieve en oudere ouderen.

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#### Uitval incidentie en determinanten van uitval

In Hoofdstuk 6 is een onderzoek beschreven over de uitvalincidentie, moment van uitval en de mate waarin deelnemers die aan georganiseerde beweegprogramma's voor ouderen in Nederland deelnamen van het ene beweegprogramma overstapten naar een andere beweegactiviteit. Het betrof een prospectieve cohort studie (met metingen bij aanvang van deelname aan het betreffend programma en na zes maanden; N=1.725, response: 73%). Deelnemers waren zelfstandig wonende personen van 50-plus die in tien verschillende georganiseerde beweegprogramma's deelnamen. Gemiddeld bedroeg de uitvalincidentie 0,15 per zes maanden, in MBvO-gym bedroeg de uitvalincidentie 0,10 per zes maanden. Er waren tussen de tien programma's grote onderlinge verschillen in de uitvalincidentie en het moment van uitval. Van de uitvallers is 31% overgestapt naar een andere beweegactiviteit. MBvO-deelnemers verschilden hierbij niet van de andere deelnemers aan beweegprogramma's. Er is wel verschil gevonden in de mate van 'overstap' gedrag tussen de verschillende programma's. Er is behoefte aan meer onderzoek op dit terrein.

#### Sociaal psychologisch model gerelateerd aan het behoud van beweeggedrag

Om te bekijken wat de intentie tot blijvende deelname en daadwerkelijk gedragsbehoud bepaalt, is de dataset gebruikt van het eerder beschreven prospectieve cohort onderzoek. In dit hoofdstuk is een stapsgewijze logistische regressiemethode toegepast. Significante odds ratio's voor het voorspellen van de intentie tot blijvende deelname aan het beweegprogramma zijn gevonden waar het gaat om het vrouwelijk geslacht, de jongere leeftijd, het getrouwd zijn, het niet-roker zijn, het hebben van een betaalde baan, het hebben van een positieve houding ten aanzien van bewegen en het hebben van een hoge zelfeffectiviteit bij aanvang van het programma. Significante odds ratio's voor het voorspellen van blijvende deelname aan een beweegprogramma zijn gevonden voor korte perioden van tijdelijke uitval, helemaal geen tijdelijke uitval, hoge intentie tot blijvende deelname bij de aanvang van het programma, ervaren van hoge kwaliteit van het programma, positieve attitude bij de aanvang van het programma en het in beperkte mate ervaren van risicosituaties bij de aanvang van het programma. Ten einde het behoud van beweeggedrag voor ouderen te stimuleren moet aandacht worden besteed aan het voorkomen van tijdelijke uitval, aan het helpen van mensen met het omgaan met risicosituaties voor (tijdelijke) uitval, aan de verbetering van attitude ten aanzien van bewegen bij de aanvang van het programma en aan de optimalisering van de kwaliteit van het programma.

# **ALGEMENE CONCLUSIES**

MBvO is een van de bekendste beweegprogramma's voor ouderen in Nederland. Aan MBvO nemen vooral veel oudere- en lager opgeleide ouderen en met name vrouwen deel. Het aantal uitvallers van deelnemers in MBvO gedurende het eerste half jaar was relatief

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laag vergeleken bij de andere negen onderzochte beweegprogramma's. Van de MBvOdeelnemers die uitvielen, is 31% overgestapt naar een ander beweegactiviteit. Dit is vergelijkbaar met 'overstap' gedrag bij de andere beweegactiviteiten. MBvO-deelnemers die andere beweegactiviteiten gingen doen, stapten vooral over naar wandelen, zwemmen, tennis en NIB-tv. Eenmaal per week deelname leidde op korte termijn niet tot verbetering van de ervaren gezondheid, de zelfredzaamheid of de kwaliteit van leven en gaf slechts beperkte effecten op diastolische bloeddruk, beenkracht en balans. Tweemaal per week deelname aan MBvO leidde tot meer verbetering(en) van de gezondheid, vooral bij oudere en lichamelijk inactieve ouderen. De enorme populariteit van MBvO, het uit-gebreide netwerk van MBvO-docenten en MBvO-groepen bieden extra kansen om de vele (lichamelijk inactieve) ouderen in Nederland te bereiken. Het is daarom van belang om de MBvO-docenten voor te lichten over de Nederlandse Norm Gezond Bewegen en in het bijzonder over de wijze hoe de MBvO-deelnemers gestimuleerd kunnen worden hieraan te voldoen.

Samenvatting

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Appendix A	History of MBvO
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#### Appendix A History of MBvO

1966: The first gymnastics club for the elderly was set up. Exercises were typically physiotherapeutic: mobilisation, flexibilisation, enhancing muscle stength and tone. Gymnastic programs for the elderly were primarily based on care. From 1966 until 1980 the precursor of MBvO the organisation of MBvO has been put up. In all twelve provinces and in Amsterdam and the Hague so-called consultants were appointed by provincial or local community care agencies, sports organisations and welfare institutes. In addition the National Foundation MBvO was founded. Untill 1987 the local, regional, as well as the National Organisations were funded entirely by the national Government.

1972: A report was published by professor Rijsdorp, entitled "More Exercise for Seniors (MBvO)", which then became the name of the organisation that evolved from it. The goal of physical activity is to contribute, through exercise, to an optimal functioning of elderly people, not only physically, but also mentally and socially. This was the starting point of MBvO.

1975: The government document "Policy on older people" recognised exercise as an instrument that could give shape to policies on the elderly. MBvO was extensively discussed in this document as an important mean of living longer in independency.

1976: The Directorate of Sports of the Ministry of Welfare, Public Health and Culture (WVC) subsidised projects on leadershipstraining for f 25.000,- .

The Directorate of Sports of the Ministry of WVC took the initiative for a project "Games by Elderly". It was a 4 year lasting project. The aim was to let elderly people participate in sportive activities; it was expected that the activities would continue independent after the project period.

1987: On January 1st 1987 the Welfare Act came into operation. The immediate effect for MBvO is that available government budgets can now be seperated in a provincial and local authority funds. This means that provincial and local authorities can now determine their own policies. The Government continues to directly subsidise national tasks only.

2000: Foundation of the Netherlands Institute of Sports and Exercise (NISB). On a national level MBvO was coordinated by the NISB.

Since 2004 most MBvO activities are transferred from NISB to national sportsorganizations, such as the Royal Dutch Gymnastics Federation (KNGU).

In 2001-2004 research on the effectiveness of MBvO-gymnastics was done by TNO and the University of Groningen, and study was carried out on drop-out, and maintenance of exercise participation in MBvO-gym, and related exercise programs. In 2008 the thesis of Maarten Stiggelbout is presented.

A very distinct aspect throughout the history of MBvO is the tremendous growth in the total numbers of participants. In 1980 – when the foundation of MBvO was founded – there were about 80,000 participants on a weekly base, in 2000 there were over 300,000 MBvO participants. The most recent statistics signify the numbers are still climbing to over 400,000 participants in 2006. Hereby it may be seen as the most popular exercise program for seniors in the Netherlands, but also perhaps worldwide.

Appendices

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### Appendix B Publications related to this thesis

STIGGELBOUT M, HOPMAN ROCK. TNO doet samen met FysioSport onderzoek naar bewegingsuitval bij 50-plussers. Nieuwsbrief NVFS 1999; 31-32.

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Appendices

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# DANKWOORD

Dit proefschrift kon niet tot stand komen zonder hulp van velen.

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Het cohort onderzoek naar uitval gedrag is mede tot stand gekomen door steun van meer dan vierhonderd betrokkenen (van landelijke koepelorganisaties tot lokale beweeggroepen) en ruim 2.300 nieuw startende deelnemers. Bij het MBvO-gymeffectonderzoek hebben meer dan 150 medewerkers ondersteuning geboden en hebben ruim 750 deelnemers meegedaan aan de initiële fitheidstest, verspreid over de regio's Leiden, Emmen en Roden. Het bijzondere aan dit onderzoek was de goede samenwerking tussen twee geheel uiteenlopende centra - in Leiden TNO en vanuit Groningen de afdeling Bewegingswetenschappen van de Rijksuniversiteit Groningen, met steun vanuit het NISB. Bij het cohort onderzoek hebben de landelijke organisaties een cruciale rol gespeeld. Het gaat dan om NOC\*NSF (Erik Lenselink en Desiree Jenniskens), de landelijke stichting MBvO (en later het NISB: Marianne Henzen), de stichting Hart in Beweging (Jan Oudhof en Jan Benedictus), NVFS (Laetitia Dekker), Sportief Wandelen, de Koninklijke Nederlandse Gymnastiek Unie (Noel van Tilburg), de Nederlandse Toerfiets Unie (Jolanda de Vries en Rianne Mulder), de Koninklijke Nederlandse Schaatsenrijders Bond (Lia Pasveer), de Nederlandse Badminton Bond (Bart de Wolf), de Nederlandse Tafeltennis Bond (Corinne Haij) en de Koninklijke Nederlandse Atletiek Unie (Frank Koomen). Ik dank hen allen voor hun medewerking.

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#### **ABOUT THE AUTHOR**

The author of this thesis, Maarten Stiggelbout, was born in Kaduna, Nigeria, on September 25 in 1958. He passed his secondary school at the Koninklijke Scholen Gemeenschap (KSA) te Apeldoorn in 1979. After his Military draft, as chauffeur-radio-telefonist (1979-1980) he visited the Higher Education for Nursing (HBOV) in Amsterdam for two years (1980-1982). In 1983 he started to study at the Faculty for Human Movement Sciences of the Vrije Universiteit in Amsterdam. Het specialised in Health Education and Epidemiology. During his study he worked for i) the Netherlands Institute for Sports and Healthcare (NISGZ) and ii) the Janus Jongbloed Research Center (JJRC) of the University of Utrecht. He did research on 1) "The incidence of insertion tendinopathy at the sports medical advisory centers (SMA) and the medical department of the KNVB and NOC\*NSF" (supervised by Willemien van Teeffelen, NISGZ, Hein Beijer, JJRC, and Willem van Mechelen, Vrije Universiteit Amsterdam), 2) "The application of braces in korfbal" (supervised by Frank Backx and Hein Beijer (JJRC), and he wrote two papers on 1) "The incidence, diagnosis and prevention of insertion tendinopathy" (supervised by Willemien van Teeffelen), and 2) "The preventive effect of ankle braces in comparison to tape-application in the prevention of ankle distorsions in sports participation" (supervised by Willem Van Mechelen). Publications on both research projects and both papers have been published in Geneeskunde en Sport in the period 1991-1993. Stiggelbout received his MSc degree in 1990. He then went to TUFTs University in Boston where he visited the post-doc course in Epidemiology (by Rothman & Lemeshaw).

After his university degree he worked for four organisations:

- The Dutch Ministry of Welfare, Public Health and Culture (WVC nowadays VWS) from 1990-1992: he carried out two freelance projects; 1) the organisation and reporting of an invitational expertmeeting "Sports, Physical Activity and Health", in Bilthoven, October 1990 (under supervision of Maarten Koornneef and Fons Kemper), and 2) the inventory of scientific research in sports in the Netherlands (under supervision of Henk Polling).
- The Netherlands Insitute of Sports and Health (NISG), from 1992-1995: as Consultant Physical Activity and Health, and project leader of the development of a database on exercise programs for elderly and people with chronic disaeses: the Bewegings Informatie Systeem (BIS).
- TNO Prevention and Health, Department of Physical Activity and Health, from July 1995 until july 2005. He is researcher in the field of physical activity, sports, and health:
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  - Development, evaluation and implementation of excercise programs;
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- The Netherlands Institute of Health Promotion and Diseases Prevention (het nationaal gezondheidsinstituut NIGZ), from July 2005 until now. Stiggelbout is Senior advisor with speciality Physical Activity and Health. He is involved in the development and implementation of exercise programs, i.e. Woerden Actief / Lokaal Actief, Scoren voor Gezondheid ('Scoring for Health'), and he is also advisor of the National Action Program Sports and Physical activity (NASB) for the NISB.

Appendices

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