

Physical Activity for People with a Disability

A Conceptual Model

Hidde P. van der Ploeg,¹ Allard J. van der Beek,^{1,2} Luc H.V. van der Woude³ and Willem van Mechelen^{1,2}

- 1 Department of Public and Occupational Health, Institute for Research in Extramural Medicine, VU University Medical Center, Amsterdam, The Netherlands
- 2 Body@Work, Research Center Physical Activity, Work and Health, TNO VUmc, Amsterdam, The Netherlands
- 3 Institute for Fundamental and Clinical Human Movement Sciences, Faculty of Human Movement Sciences, Vrije Universiteit, Amsterdam, The Netherlands

Abstract

The promotion of a physically active lifestyle has become an important issue in health policy in first-world countries. A physically active lifestyle is accompanied by several fitness and health benefits. Individuals with a disability can particularly benefit from an active lifestyle: not only does it reduce the risk for secondary health problems, but all levels of functioning can be influenced positively.

The objective of this article is to propose a conceptual model that describes the relationships between physical activity behaviour, its determinants and functioning of people with a disability. The literature was systematically searched for articles considering physical activity and disability, and models relating both topics were looked for in particular. No models were found relating physical activity behaviour, its determinants and functioning in people with a disability. Consequently, a new model, the Physical Activity for people with a Disability (PAD) model, was constructed based on existing models of disability and models of determinants of physical activity behaviour. The starting point was the new WHO Model of Functioning and Disability, part of the International Classification of Functioning, Disability and Health (ICF), which describes the multidimensional aspects of functioning and disability. Physical activity behaviour and its determinants were integrated into the ICF model. The factors determining physical activity were based mainly on those used in the Attitude, Social influence and self-Efficacy (ASE) model. The proposed model can be used as a theoretical framework for future interventions and research on physical activity promotion in the population of people with a disability. The model currently forms the theoretical basis for a large physical activity promotion trial in ten Dutch rehabilitation centres.

1. Physical Inactivity in People with a Disability

For the general population, the benefits of a physically active lifestyle are well known.^[1-5] Such a

lifestyle is accompanied by lower risks for morbidity and mortality of a great number of chronic diseases, such as coronary artery disease, diabetes mellitus and colon cancer.^[6] In the industrial world, physical inactivity has become more and more common and

the resulting health problems have become a serious burden for public health. These facts have made the promotion of physical activity behaviour in the general population an important public health policy issue.^[1,2,5] Consequently, several programmes for the stimulation of a physically active lifestyle have been designed and implemented into practice.^[7-11]

Until recently, not much attention has been paid to the physical activity behaviour of people with a disability in relation to their health and well-being. However, recent articles have emphasised the importance of a physically active lifestyle for people with a disability.^[12-17] It is believed that people with a disability can also benefit from a physically active lifestyle. People's health condition and secondary health problems can lead to problems with everyday functioning (disability). Such problems with functioning, and especially problems with mobility, can be influenced positively by a physically active lifestyle and thus reduce disability. Moreover, secondary health and functioning problems in people with a disability that could be prevented or reduced by a physically active lifestyle include coronary artery disease, type 2 diabetes, osteoporosis, osteoarthritis, colon cancer, high blood pressure, decreased balance, decreased strength, decreased endurance, decreased fitness, decreased flexibility, spasticity, weight problems including obesity, depression, urinary infections, diminished self-concept, reduced ability for normal societal interactions and greater dependence upon others.^[12-18] This shows that a physically active lifestyle for the health and well-being of people with a disability is probably even more important than for the general population.

However, the above-mentioned articles also showed that there is still a lack in scientific evidence and knowledge on this subject in this specific population.^[12-17]

There is a substantial group of people with a disability. It is estimated that 13–20% of the Western population has one or more disabilities.^[14,15,19-21] This percentage varies with the definition of disability, which is usually close to the legal definition in the US as formulated in the Americans with Disabilities Act of 1990. This definition states that “the term ‘disability’ means, with respect to an individual – (A) a physical or mental impairment that substantially limits one or more of the major life activities of such individual; (B) a record of such an impairment; or (C) being regarded as having such an impairment”.^[22] For the purposes of the proposed model introduced in this article, we use the WHO definition of disability, as discussed in section 3 and as formulated in table I.

The percentage of people with a disability increases with age and around 40% of people ≥ 65 years have a disability.^[20] The most common causes of disability are: musculoskeletal and connective tissue disorders (e.g. arthritis, back disorders); circulatory disorders (e.g. heart disease, stroke); respiratory disorders (e.g. chronic obstructive pulmonary disease, asthma); nervous and sensory disorders (e.g. multiple sclerosis, spinal cord injury); endocrine, nutritional, metabolic and immunity disorders (e.g. diabetes, cystic fibrosis, disorders of the thyroid gland); mental disorders (mental retardation,

Table I. The definitions of the levels of functioning based on the International Classification of Functioning, Disability and Health (ICF).^[23] The italic printed terms are the negative counterparts of the normal printed term(s) above them

Term	ICF definition
Body functions	The physiological functions of body systems (including psychological functions)
Body structures	Anatomical parts of the body, such as organs, limbs and their components
<i>Impairments</i>	Problems in body function or structure as a significant deviation or loss
Activities	The execution of a task or action by an individual
<i>Activity limitations</i>	Difficulties an individual may have in executing activities
Participation	Involvement in a life situation
<i>Participation restrictions</i>	Problems an individual may experience in involvement in life situations
Functioning	The umbrella term used for all three levels, namely body functions and structures, activity and participation
<i>Disability</i>	The umbrella term for the problems an individual may experience in functioning, namely impairments, activity limitations and participation restrictions

schizophrenia); and visual and hearing impairments.^[21]

People with a disability are on average even more inactive than the general population.^[13,14,24] The Healthy People 2010 report on adults aged ≥ 18 years, reported that in 1997 only 12% of people with a disability participated ≥ 5 days/week in moderate physical activity for at least 30 minutes per day, compared with 16% of people without a disability.^[24] When just looking at leisure time physical activity, the difference between people with and without a disability is even larger: 56% and 36%, respectively, in 1997 did not engage in leisure time physical activity.^[24] For people with a disability who have participated in a rehabilitation programme, such a sedentary lifestyle probably begins just after the rehabilitation period. Although most patients participate in numerous sports and other physical activities during their rehabilitation programme, this relatively high physical activity status is easily lost at the end of the rehabilitation period. Most people need a lot of time and energy to restart and reorganise their lives after rehabilitation and to get used to the new situation of having a disability. On top of this, most rehabilitation centres provide little to no after-care to keep their former patients physically active after the rehabilitation period. Consequently, the sudden lack of planned and structured activities after rehabilitation is not replaced by self-initiated activities.

In conclusion, promotion of a physically active lifestyle for people with a disability is needed. Although adjacent fields provide some theoretical framework, a model for this promotion could not be found. Therefore, the objective of this article is to propose a theoretical model that describes the relationships between physical activity behaviour, its determinants and functioning in people with a disability.

2. Literature Search

2.1 Methods of the Literature Search

Medline, PsycINFO and SPORTdiscus were systematically searched for relevant articles in May 2002. We specifically looked for studies describing the relationship between physical activity and disa-

bility. Additionally, we looked for models on disability and models on physical activity and its determinants.

The keywords used in the Medline search were 'sports', 'exercise', 'physical activity', 'walking/physiology', 'chronic disease', 'chronic disease/prevention and control', 'chronic disease/rehabilitation', 'rehabilitation', 'lifestyle', 'health promotion', 'health status', 'theoretical models', 'behavioural models' and 'psychological models'. PsycINFO was searched using 'physical activity', 'exercise', 'disability', 'chronic disease', 'rehabilitation', 'health promotion' and 'psychological models' as search terms. SPORTdiscus was searched using the following index words: 'exercise/physical activity', 'rehabilitation', 'chronic disease', 'health promotion' and 'theoretical model'.

In addition, authors of selected articles were checked in Medline, PsycINFO and SPORTdiscus for other relevant articles. Cited reference searches were performed for key articles. Finally, the references of relevant articles were checked for additional relevant articles.

2.2 Results of the Literature Search

The searches of the Medline, PsycINFO and SPORTdiscus databases resulted in 965 hits. Based on the titles and abstracts, 22 articles were selected. Of these 22 articles, four were directly relevant for the purpose of this review. The remaining 18 articles were only used to identify other articles directly relevant for this review. The search for other articles by the authors of these 22 selected articles and a cited reference search identified 13 additional relevant articles. After checking the references of these 35 articles, another 29 relevant articles were identified. In total, we identified 46 articles relevant for the construction of our model, including 18 reviews.

No model that integrated physical activity and its determinants with functioning and disability was found. Therefore, we decided to combine a model on functioning and disability with existing models of physical activity behaviour.

3. Models of Disability

Over the years, numerous models of disability have been presented in the literature.^[23,25-37] There

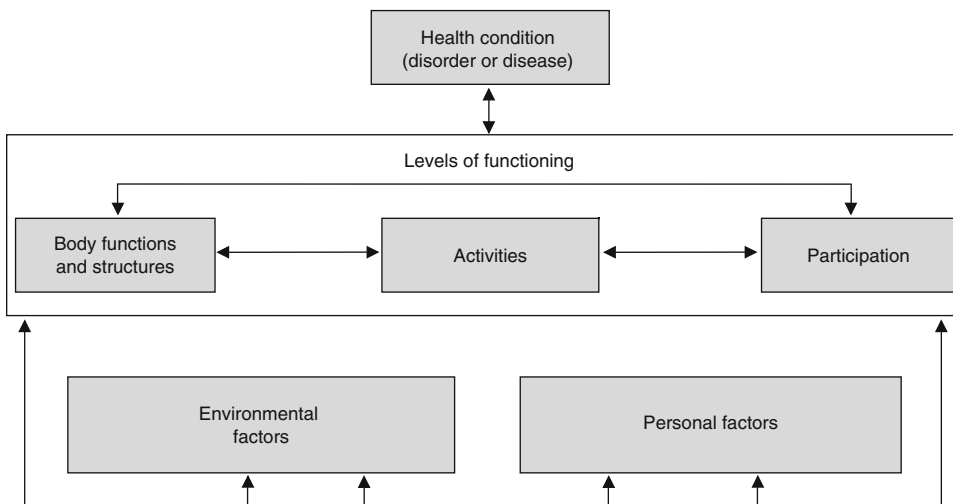


Fig. 1. The model of Functioning and Disability (ICF model) from the International Classification of Functioning, Disability and Health (reproduced from the World Health Organization,^[23] with permission).

are two major disability models, on which many of the other models are based: Nagi’s model^[25] and the WHO model associated with the International Classification of Impairment, Disability and Handicap (ICIDH).^[26] These two medically oriented models are quite similar and differ mainly in terminology. The disablement process is linear in both models, moving from pathology to impairment to disability (called functional limitations in Nagi’s model) and to handicap (called disability in Nagi’s model). The ICIDH definition of disability is, in the context of health experience, any restriction or lack (resulting from an impairment) of ability to perform an activity in the manner or within the range considered normal for a human being.^[26] Nagi defines disability as a pattern of behaviour that evolves in situations of long-term or continued impairments that are associated with functional limitations.^[25] However, two major problems of both original models are the insufficient attention paid to the environment and the lack of clarity in the nature of the relationship between the different components (all relations seem unidirectional and causal).^[38-40] As a result of these shortcomings and issues regarding the classification itself, the WHO decided to revise the ICIDH. This resulted in the International Classification of Functioning, Disability and Health (ICF),^[23] which also contains a new and more dynamic model of disability: the Model of Functioning and Disability.

3.1 The Model of Functioning and Disability

The ICF model (figure 1) describes an individual’s functioning in a specific domain as a dynamic interaction or complex relationship with environmental and personal factors, given certain health conditions. The ICF definitions of the different levels of functioning and their negative counterparts are given in table I.^[23] The umbrella term for problems an individual may experience with functioning (impairments, activity limitations and participation restrictions) is ‘disability’. Disabilities are the result of health conditions in the context of the person and environment. Health conditions are mainly diseases, disorders, injuries and traumas. Health conditions are classified primarily in the WHO *International Classification of Diseases* (10th revision; ICD-10),^[41] whereas functioning and disability associated with these health conditions are classified in the ICF. Consequently, the ICD-10 and ICF are complementary to each other.^[23]

According to the ICF, “environmental factors make up the physical, social and attitudinal environment in which people live and conduct their lives”.^[23] These factors are external to individuals and can be in the immediate physical and social environment of the individual, including settings such as the home, workplace and school. However, these factors can also be further away in society and

include formal and informal social structures, services and overarching approaches or systems in the community or society that have an impact on individuals. Examples are infrastructure, laws and regulations, climate, attitudes and ideologies.^[23]

Personal factors are the particular background of an individual's life and living and contribute to features of the individual. These factors include sex, race, age, health conditions, fitness, lifestyle, coping styles, social background, education, profession, past and current experience, overall behaviour pattern and other characteristics. All or any of these factors may play a role in disability at any level.^[23]

This multidimensional ICF model could be applied to all individuals, with or without a disability. The ICF model takes a broad perspective, so that the 'template' can integrate various personal and environmental factors that encompass all areas of participation. In any form of human behaviour, both personal and environmental factors play a role in the individual's capacity to perform and sustain the behaviour. We took the ICF model as the framework for our new conceptual model, focusing on people with a disability and physical activity as part of people's functioning.

4. Models on Determinants of Physical Activity Behaviour

Research in healthy subjects has shown that there are numerous determinants of physical activity. Many demographic, biological, cognitive, behavioural, social, cultural and environmental factors have been studied over the years for their relationship with physical activity behaviour.^[42-48] These determinants can be divided into immutable (age, sex, race, etc.) and modifiable (psychosocial behavioural factors, systems of support, etc.) determinants.^[49] The modifiable determinants are the most interesting in the context of physical activity promotion since these can be targeted in interventions.

Over the years, various models have been used that describe the ways in which physical activity behaviour is determined.^[44,45,49] The most frequently used theories concerning physical activity behaviour are the Social Learning/Cognitive theories,^[50] the Health Belief model,^[51] the Theory of Planned

behaviour,^[52] and the Transtheoretical model.^[53] De Vries et al.^[54,55] combined elements of the Social Learning theory and the Theory of Planned Behaviour into the Attitude, Social influence and self-Efficacy (ASE) model.

4.1 The Attitude, Social Influence and Self-Efficacy Model

The ASE model (figure 2) includes the three most important psychosocial determinants of physical activity behaviour: attitude, social influence and self-efficacy.^[42-45] Attitude towards physical activity is what an individual thinks and expresses about a physically active lifestyle for him- or herself. Social influence is what other people think about a physically active lifestyle for this individual. Self-efficacy is this individual's confidence of being able to successfully engage in a certain physical activity behaviour, given a range of different contexts, including different barriers.^[56] These three determinants are influenced by external variables that are similar to the 'personal factors' in the ICF model (e.g. sex, race, age and social economic status). External variables only influence physical activity through one or more of the three main determinants. Attitude, social influence and self-efficacy determine physical activity behaviour through the general concept intention towards physical activity. However, the behaviour is not only determined through intention, but depends also by a person's skills and barriers that could prevent the actual behaviour. The

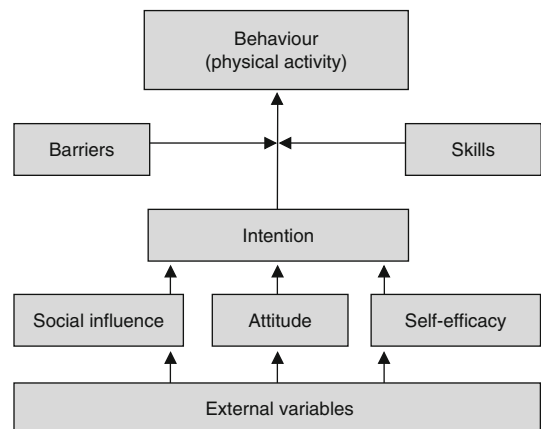


Fig. 2. The Attitude, Social influence and self-Efficacy (ASE) model (reproduced from De Vries et al.,^[54] with permission).

Table II. The different stages of change for physical activity behaviour^[57]

Stage of change	Definition
Precontemplation	Physically inactive and no intention to become more active in the next 6 months
Contemplation	Physically inactive, but intention to become more active in the next 6 months
Ready for action/preparation	Physically active, but not regularly ^a
Action	Regularly physically active, ^a but only started in the last 6 months
Maintenance	Regularly physically active ^a for at least 6 months
Relapse	Falling back to an earlier stage of change

a 'Regularly physically active' is defined as half an hour of moderate intensity physical activity at least 5 days a week.^[1]

ASE model forms the basis of the determinants of physical activity in our integrated model.

4.2 Stages of Change

The Transtheoretical model contains the stages of change concept, which describe the stages a person goes through when changing his or her health behaviour. Interventions focusing on the promotion of health behaviour should approach people in each stage of change in a different stage-specific way.^[53] Table II shows the stages of change for physical activity behaviour.^[57]

De Vries^[55] later integrated the stages of change into the ASE model. He placed 'precontemplator' and 'contemplator' in the intention box, 'action' in the behaviour box and after the behaviour box two extra boxes were placed containing maintenance and relapse. It seems the stages of change can actually be seen as a combination of physical activity status and intention towards physical activity behaviour.

5. The Integrated Model of Physical Activity and Disability

After making some adjustments to the ASE model, we integrated it with the ICF model to form the Physical Activity for people with a Disability (PAD) model (figure 3). We used the ICF model as the framework for the PAD model. Although important examples are given for each determinant of physical activity, there are more determinants of physical activity than are shown.^[42-48] If determinants that are not represented directly in the PAD model are important factors for physical activity behaviour (e.g. for a certain subgroup), they can act through the facilitator and barrier boxes. Thus, the PAD model does not rule out other possible determi-

nants, but for the sake of clarity the model focuses on the most important factors and on the relevant relations for determining physical activity behaviour.

5.1 Physical Activity and the Levels of Functioning

Physical activity is part of the levels of functioning. It can be considered at all three levels of functioning identified in the PAD model. For example, having legs and being able to move them is functioning at the level of body functions and structures. Walking is part of the activities level. Walking to the supermarket and buying groceries is at the level of participation, taking into account the social component. Of course, all three levels are closely interrelated and the border between them is sometimes vague. Consequently, the benefits of a more physically active lifestyle can be described at three levels as well. At the body functions and structures level, increased physical activity can, for example, lead to improvements in muscle power and cardiopulmonary function. At the activities level, it can lead to better and easier performance of actions, for example the ability to walk. At the participation level, a physically active lifestyle also improves functioning, meaning better performance in real-life situations and thus in society.

5.2 Environmental Factors

The main environmental determinants of physical activity are believed to be social influence and environmental facilitators and barriers.^[43,45-48] Social influence includes the opinion of family, friends, colleagues and health professionals, but also the general opinion in society. The social influence of family and friends, in particular, has been repeat-

edly shown to have a positive influence on physical activity behaviour in healthy subjects.^[45-48] In people with a disability, the influence of health professionals is likely to be more important than in the general population. Numerous environmental barriers have been identified for healthy subjects.^[43,45-48] Examples of environmental barriers for people with a disability could be poor transportation, poor availability and accessibility of equipment and built and natural facilities to become more physically active, lack of assistance to be physically active, not wanting to be physically active alone, discomfort with physical activity in the company of persons without a disability, climate and season. Rimmer et al.^[58] found that transportation was a barrier for physical activity behaviour in African American women with physical disabilities. The opposite of these barriers are usually seen as facilitators, such as having a

good accessible park nearby to go for a walk, having good transportation possibilities to a swimming group for people with rheumatoid arthritis, having access to a handbike to go for a ride and having good social contacts while being physically active.

5.3 Personal Factors

Research in healthy subjects has shown that many personal factors influence physical activity behaviour.^[44-47,49] These include demographic, biological, cognitive and behavioural factors.^[45,47] Only the factors that are considered the most important in determining physical activity in people with a disability are shown in the PAD model. For people with a disability, their health condition(s) is a very important determinant of physical activity behaviour. An Australian study in an urban-representative population showed that 20% of the survey population re-

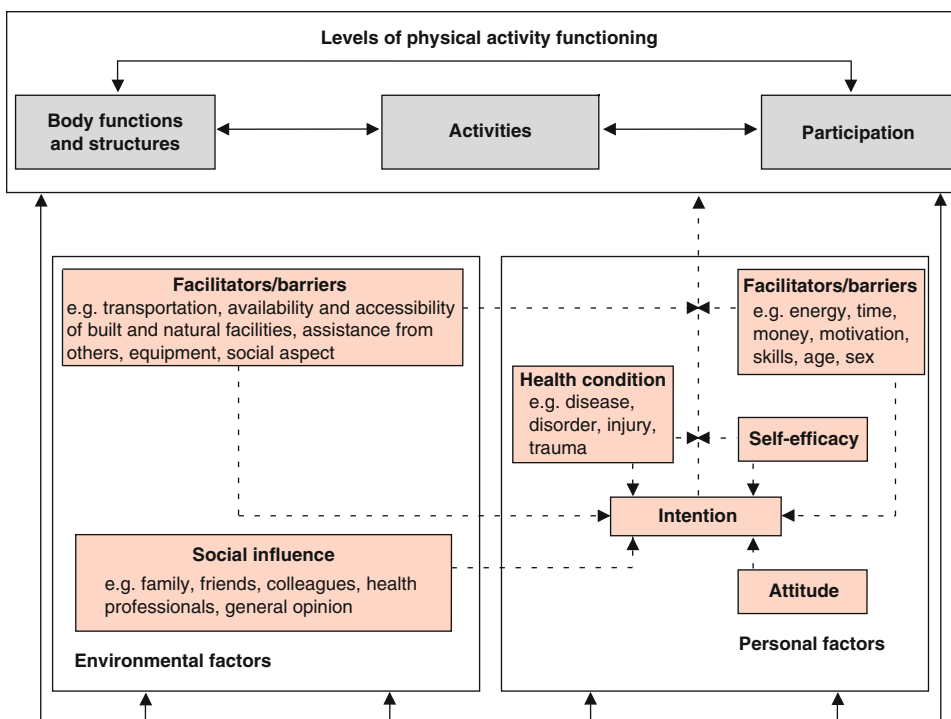


Fig. 3. The Physical Activity for people with a Disability (PAD) model, an integrated model of physical activity behaviour and its relation with functioning and disability. The framework of the International Classification of Functioning, Disability and Health (ICF) model is shown by the white and grey boxes and the solid arrows, while the determinants of physical activity behaviour are shown in the red boxes. The dashed arrows in the PAD model represent the pathway through which these factors determine physical activity, although not all possible pathways and relations are shown in the model. Most of the dashed arrows also work in the opposite direction and, as shown in the general framework, all components of the integrated model more or less interact with each other.

ported a current injury or disability as preventing them from being more physically active.^[59] In fact, it often happens that because of a health condition, a person's primary disability is having problems with physical activity. The severity of the health condition is of importance for the degree of disability and for the impact on physical activity behaviour. However, the degree of disability and physical activity behaviour is also determined by other factors. Thus, people with a similar health condition do not necessarily have the same degree of functioning and disability or the same physical activity behaviour.

Other important personal determinants of physical activity behaviour are the intention towards physical activity, the attitude towards physical activity, self-efficacy and personal facilitators and barriers. Kinne et al.^[60] found significant correlations for exercise maintenance with motivational barriers and self-efficacy but no significant correlations with environmental barriers and disability in 113 adults with mobility impairments. However, the subgroups of the different health conditions were small, which could be the reason that no statistically significant relation was found between disability and physical activity. Examples of important personal barriers are lack of energy, money, motivation, skills and time, and of course age and sex are also important.^[44-47,49] The opposites of these barriers are facilitators, for example having enough energy, money, motivation, skills and time. Rimmer et al.^[58] found that lack of energy and the cost of exercise programmes were personal barriers to physical activity participation in 50 African American women with disabilities. However, no significant effects were found on other expected barriers such as lack of time, boredom and laziness.

Intention is the central determinant of physical activity. The intention to participate in a physical activity can exist long before the actual activity, but can also emerge at the last moment when an opportunity to be active arises. Without the intention to participate in a certain structural behaviour, the actual behaviour will not take place. All other determinants influence a person's intention to remain or become physically active or inactive.^[52,54] However, the intention to be active does not necessarily lead to the actual performance of the physical activity behaviour. Environmental and personal facilitators and

barriers, self-efficacy and a person's health condition determine whether the intention will lead to the desired physical activity behaviour.

5.4 Stages of Change

Although not directly visible in the PAD model, the stages of change of the Transtheoretical model is compatible with the PAD model. The Transtheoretical model is linked to the PAD model in a similar way as it is to the ASE model.^[55] Stages of change can be helpful when applying the PAD model to interventions on the promotion of physical activity behaviour in people with a disability. Intention and actual physical activity status can be combined into 'stage of change',^[53] as was done in the ASE model.^[55] Given a certain definition of physical activity, individuals can be divided into being either physically active or physically inactive. As for intention, people can be divided into those who intend to change their behaviour and those who intend to maintain their current behaviour. Combining these two divisions leads to four groups of individuals. These groups in terms of stages of change are: (i) precontemplators; (ii) contemplators; (iii) those in action/maintenance; and (iv) those intending to terminate (relapse).^[53] These four stages can be extended easily to five or six stages by distinguishing between action and maintenance and/or adding the ready-for-action stage.^[53]

6. Recommendations for Future Research

The PAD model aims to show which variables determine the physical activity behaviour of people with a disability. Future research has to demonstrate how realistic and practically relevant this suggested integrated conceptual model is. Special attention should be paid to whether the model does indeed contain the correct combination of factors determining physical activity behaviour in people with a disability. The determinants of physical activity as proposed in the model are primarily based on research in healthy populations. It could be that not all determinants are as important as expected, or that important determinants are missing in the context of persons with a disability. It is also likely that the determinants have a different impact on groups with

different health conditions and disabilities. Special attention should also be paid to identifying the important personal and environmental facilitators and barriers of physical activity behaviour in people with a disability.

The PAD model could be used as a theoretical framework for future interventions and research on physical activity promotion in the population of people with a disability. The model could help future studies to identify which combinations of personal and environmental factors are important in the physical activity behaviour of different subgroups of people with a disability. Consequently, this would enhance the possibilities in designing tailored physical activity promotion interventions, in which the most important personal and environmental barriers should be minimised and the contribution of possible facilitators should be increased. Modifiable determinants are of course more interesting for interventions than immutable determinants. However, interventions should focus on the whole spectrum of determinants and their underlying relationships within the context of the person and environment to achieve an optimal result.

The PAD model already forms the theoretical basis of a large intervention study aimed at improving the physical activity behaviour of people with a disability. In 1997, half of the Dutch rehabilitation centres started a sport promotion programme to keep patients physically active after the end of their rehabilitation period. The effects of this programme and of a similar new intervention programme aimed at the promotion of general physical activity behaviour after rehabilitation are currently being evaluated in a multicentre controlled trial.^[61] Although the PAD model specifically focuses on physical activity for people with a disability, the general idea of the model can be applied much broader. For example it can be applied to other healthy lifestyle behaviours, such as smoking cessation and healthy nutrition. As mentioned in sections 3 and 5, this broad perspective originates in the ICF model. Thus, adapted versions of the PAD model could possibly be used in other lifestyle studies as well.

In the discussion on promotion of physical activity behaviour, the next question refers to the desired amount of physical activity for people with a disability in terms of duration, frequency and intensity in

order to improve functioning. This question is not easy to answer. The currently most frequently used recommendation for a healthy physically active lifestyle in the general population is half an hour of moderate intensity physical activity at least 5 days a week.^[1] This recommendation does not aim at improving physical fitness, but at improving health. An improvement in physical fitness is not necessarily needed for a positive effect on health. The advantage of focusing on health rather than fitness is that the physical activity intensity can be lower, making a physically active lifestyle easier to achieve. Focusing on improvements in functioning and health, rather than physical fitness, is also favourable for people with a disability.^[18] However, there are too few data to support whether the above recommendation is also applicable to people with a disability. The population of people with a disability is different from the general population in the amount of physical activity they can achieve and endure. For people with impaired mobility, a smaller amount of physical activity is probably already beneficial for their health. However, there is no evidence as to what amount of physical activity is beneficial for people with a disability. This absence of data could cause a problem when applying the stages of change model to people with a disability. If the recommendation does not translate to the population of people with a disability, differentiating between those who are sufficiently physically active and those who are inactive becomes difficult.

Another important issue concerning the amount of physical activity is that more physical activity is not always better for all types of disability. People can have contraindications for physical activity or for certain elements of physical activity. For every person with a disability there is probably a certain amount of physical activity beyond which a further increase is no longer beneficial or even harmful. For some disability types this amount will be quite low. Physical activity promotion for people with a disability should focus on finding the appropriate activity for the individual and on finding an optimum in the amount of physical activity rather than just focus on the promotion of more physical activity.^[13,14,18]

More research is needed concerning the amount and form of physical activity that is beneficial for the health of people with a disability. It should be

taken into account that the optimal amount and form of physical activity most likely differs between disability types and probably even between individuals with the same disability type.

7. Conclusion

The conceptual integrated model presented in this review describes the possible relationship between physical activity behaviour, its determinants and functioning in people with a disability. The PAD model was proposed to better understand physical activity behaviour and how it can be improved among people with a disability, which ultimately might improve their functioning and reduce their disability.

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Correspondence and offprints: Dr *Willem van Mechelen*, Department of Public and Occupational Health, VU University Medical Center, Institute for Research in Extramural Medicine, Van der Boeorchstraat 7, Amsterdam, 1081BT, The Netherlands.
E-mail: w.vanmechelen@vumc.nl