JOHANNA M. HUIJG

Towards the effective introduction of physical activity interventions in primary health care

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Voor mijn ouders, Jeroen,
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Contents

Chapter 1

General Introduction

The gap between science and practice

In the past decades, much research and funding have been invested into the development of effective prevention and health promotion interventions targeting behaviors such as smoking, healthy eating, alcohol use, and physical activity [1–3]. Health care is an important setting for the provision of population-level health behavior change interventions and health care professionals are an important means of delivering these interventions [2,3]. Unfortunately, often the transfer of such evidence-based interventions into routine health care practice does not happen as desired [1,4–8]. Specifically, interventions do not reach all of those who need them, and health care professionals do not deliver interventions as intended [4,9]. This gap between research and practice reduces the impact that effective interventions can ultimately have on public health [1,3,4,7,10–16]. That is, health behavior change interventions delivered by means of health care professionals can only improve population health outcomes when they are effectively introduced in health care practice.

The introduction process

The gap between our knowledge on health behavior change interventions and their delivery in routine health care may be explained by the complexity of the introduction of innovations in health care settings [5,15,17–22]. A multitude of theoretical frameworks describe the introduction of innovations in health care (for an overview of frameworks see Damschroder et al. [8], Tabak et al. [23], and Grol et al. [22]). Several of these frameworks indicate that the introduction process involves multiple stages and that the process is influenced by a variety of factors (e.g., [17,24–29]).

In an attempt to integrate a number of prominent theories and models regarding the introduction of innovations in health care, Fleuren et al. [17] developed a theoretical framework representing the main stages of the process and related categories of influencing factors. According to this framework, health care organizations and professionals move from being aware of the intervention (i.e., the dissemination stage), through the decision to start working with the intervention (i.e., the adoption stage), to delivery of the intervention as intended (i.e., the implementation stage), and finally, long term intervention delivery in which working with the intervention becomes routine practice (i.e., the continuation stage). Furthermore, the framework summarizes the main categories of factors that influence the process as factors related to characteristics of the innovation, socio-political context, organization, adopting person, and innovation strategy.

Health care professionals' behaviors

Health care professionals' behaviors and the factors that influence their behaviors play an important role in the effective introduction of innovations in health care. After all, health care professionals are the ones that need to adopt an intervention, deliver it as intended, and continue to use it over a longer period of time. Consequently, changing health care professionals' behaviors seems crucial for the improvement of the introduction process [6,30–32]. For this, it is important to understand the factors that influence health care professionals' behaviors, which can be guided by individual behavior change theories [6,30–32]. Based on a large number of behavior change theories, Michie et al. [31] developed a comprehensive set of theoretical construct domains covering the full range of current scientific explanations for human behavior. Following this so-called Theoretical Domains Framework (TDF) [31], factors potentially influencing health care professionals' behaviors include their knowledge, skills, social/professional role and identity, beliefs about capabilities, beliefs about

consequences, motivation and goals, memory, attention and decision processes, environmental context and resources, social influences, emotion, behavioral regulation, and the nature of the behaviors.

Improving the introduction process

Knowledge of the factors that determine the success of the introduction of innovations in health care is crucial for developing effective introduction strategies [1,6,7,17,22,33–39]. Taking into account the different stages of the process, various scholars suggest that different factors may be of critical importance within these stages [5,17,18,20] and, therefore, that specific strategies may be required for each stage [5,15,17,18,20,22]. In the first part of this thesis, Fleuren et al.'s [17] theoretical framework, representing both the different stages of the process and related categories of influencing factors, is used to identify factors influencing the introduction process. The framework has previously been proven successful for this purpose in studies using both qualitative and quantitative methods [40–42].

Using behavior change theory to investigate factors influencing health care professionals' behaviors can provide information on how to develop theory-based strategies to change their behaviors [30–32,35,37,43]. In the second part of this thesis, the TDF [30,31] is applied to identify factors associated with health care professionals' implementation behaviors. The TDF has been used in a number of studies in the past and was demonstrated to be useful for the development of qualitative [44,45] and quantitative [46–48] measurement tools to assess potential determinants of health care professionals' behaviors.

The introduction of physical activity interventions in primary health care

Different factors might play a role in different innovations, and they may vary across potential adopters, settings, and countries. Hence, it is important to identify the factors that influence the introduction of a specific innovation in a specific context in order to design an adequate introduction strategy [38,49]. The present thesis focuses on physical activity (PA) interventions and their introduction in primary health care (PHC) as a field of application. Similarly to the introduction of other evidence-based behavior change interventions in routine health care practice [1,4–8], the introduction of PA interventions in PHC does not always happen as desired. Specifically, rates of PA promotion by PHC professionals are far from optimal [50–52] and PA interventions are not delivered as intended by the intervention developers [1,9,53–57]. Based on a systematic literature review, VanWormer et al. [52] estimated that 30-50% of the US physicians regularly counsel their patients on PA. When delivering PA interventions, PHC professionals fail to accurately assess patients' motivation to change their PA behavior [53], set PA treatment goals [56], tailor PA advice to patients' goals and stage of behavior change, and provide follow up appointments [55]. Moreover, there is a lack of research on PA interventions' introduction in PHC and the factors that influence this process [12,58,59]. As a first step to bridge the gap between evidence-based PA interventions and their delivery in PHC practice, the main aim of this thesis is to investigate what factors influence the introduction of PA interventions in PHC.

Outline

The first part of the present thesis describes the factors that influence the introduction of PA interventions in PHC, including PHC organizations' and professionals' adoption, implementation, and

continuation of PA interventions. In *Chapter 2*, a systematic literature review on factors influencing PHC professionals' PA promotion practices is presented. The main aim is to identify factors described in the literature to be influencing PHC professionals' PA promotion practices (Figure 1). A secondary aim is to examine which methods are used to identify influencing factors and to take these methods into account when interpreting the results.

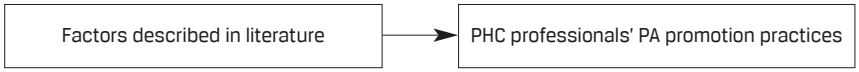

Figure 1. **Factors previously described in the literature to influence PHC professionals' PA promotion practices**

Following this literature review, a series of studies is conducted to further investigate factors influencing the introduction of PA interventions in PHC. *Chapter 3* presents a qualitative study to identify these factors. The main research questions in this study are: 1. which factors are perceived by stakeholders to be influencing the introduction of PA interventions in PHC, and 2. are factors perceived as specifically important to the distinct stages (i.e., adoption, implementation, and continuation) of the process (Figure 2)? Stakeholders' perceptions are investigated through 28 semi-structured interviews with intervention managers, PHC advisors, intervention providers, and referring general practitioners of five PA interventions delivered in PHC.

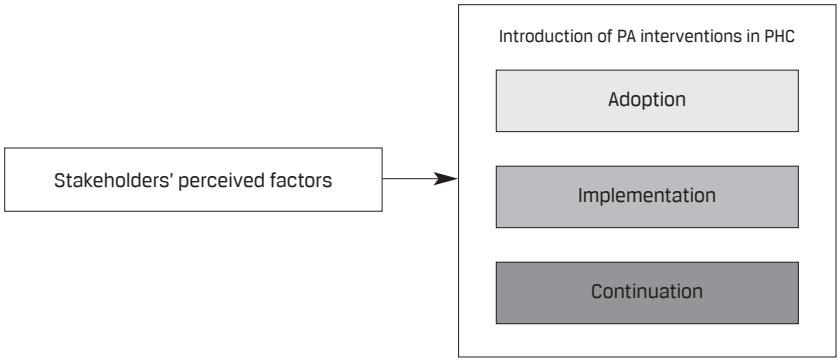

Figure 2. **Factors perceived by stakeholders to influence the introduction of PA interventions in PHC**

The systematic literature review and qualitative study resulted in an extensive list of factors potentially influencing the introduction of PA interventions in PHC. In *Chapter 4*, the relevance of these factors for each stage of the introduction process is investigated by a two-round Delphi study in which experts are asked to rate the importance and changeability of the factors. The research questions are: 1. which factors, as identified by the systematic literature review and qualitative study, are perceived by experts as most important for the adoption, implementation, and continuation of PA interventions in PHC, and 2. how changeable are these factors according to experts (Figure 3)?

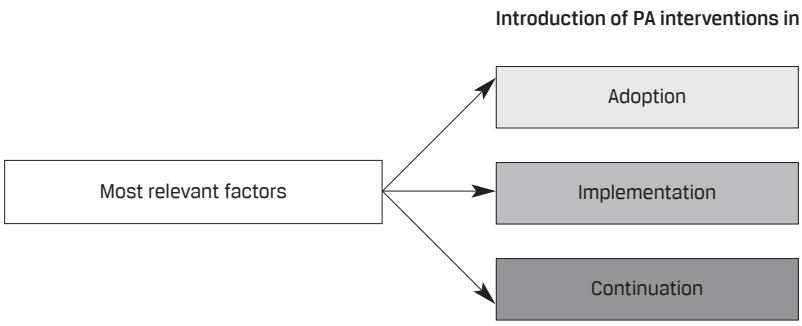

Figure 3. **Factors most relevant (i.e., important and changeable) to the adoption, implementation, and continuation of PA interventions in PHC**

The second part of the present thesis focuses on the implementation stage of the introduction process, as the extent to which interventions are implemented as intended is an important influence on intervention outcomes [21]. Specifically, the factors influencing PHC professionals' implementation of PA interventions (i.e., delivery as intended) are investigated. For this purpose, a questionnaire is developed to measure theory-based factors underlying health care professionals' implementation behaviors. The development of this questionnaire is based on the results of the previous studies (Chapter 3 and Chapter 4) and the TDF domains of potential behavioral determinants. *Chapter 5* describes the first step in the development of this questionnaire, including the investigation of questionnaire items' discriminant content validity based on judgments of a sample of experts on behavior change theory.

In *Chapter 6*, the development and initial validation of the Determinants of Implementation Behavior Questionnaire (DIBQ) are described. The psychometric properties of the DIBQ are tested in a health care professional sample. The aim is to answer the following research questions: 1. does confirmatory factor analysis support the pre-defined structure of the TDF-based questionnaire (i.e., construct validity), 2. is the questionnaire able to measure TDF domains in a reliable way (i.e., reliability), and 3. are the domains of the questionnaire discriminately measurable (i.e., discriminant validity)? Health care professionals' implementation of PA interventions is used as an example behavior to illustrate how such a questionnaire might be developed.

In *Chapter 7,* the DIBQ is used to examine which factors are associated with physical therapists' implementation of PA interventions. By means of a cross-sectional study, the following research questions are investigated: 1. to what extent do physical therapists deliver all PA intervention components to all of their patients (i.e., completeness), 2. how well do they deliver PA interventions (i.e., quality of delivery), and 3. which TDF domains are associated with physical therapists' completeness and quality of delivery of PA interventions (Figure 4)?

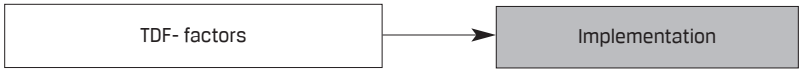

Figure 4. **TDF-based factors associated with physical therapists' implementation of PA interventions**

Finally, in *Chapter 8* the main findings of the thesis are summarized and discussed. Furthermore, the thesis' strengths and limitations are considered, in addition to its' main practical and scientific implications.

Chapter 2

Factors influencing primary health care professionals' physical activity promotion behaviors: a systematic review

This chapter is based on:
Huijg JM, Gebhardt WA, Verheijden MW, van der Zouwe N, de Vries JD, Middelkoop BJC, Crone MR.
Factors influencing primary health care professionals' physical activity promotion behaviors: a systematic review.
International Journal of Behavioral Medicine 2014; Epub ahead of print.

Abstract

Background

Despite the promising findings related to the efficacy of interventions aimed at promoting physical activity (PA) in primary health care (PHC), the translation of these interventions to PHC practice does not always happen as desired.

Purpose

To help understand why efficacious PHC-based PA interventions are not effectively translated to practice, this study systematically reviewed the literature on factors influencing PHC professionals' PA promotion practices.

Method

Literature searches were conducted in Web Of Science, PubMed, and PsycINFO for peer reviewed articles published in English from 1990 onwards. Studies were included that met the following criteria: 1. involving PHC-based PA interventions, and 2. reporting factors influencing PHC professionals' PA promotion behaviors. Two researchers independently screened studies and extracted data. A narrative synthesis using thematic analysis was conducted to identify factors.

Results

Of the 4469 identified articles, 59 were included in the review. Factors were identified by qualitative methods, barrier/facilitator ratings, and the examination of the relationship between factors and PA promotion, and the effectiveness of introduction strategies. Many factors related to the development, delivery, and effects of the innovation, the socio-political and organizational culture, resources, and support, patient and PHC professional characteristics, and innovation strategies were identified as potential influences on PHC professionals' PA promotion practices. However, the lack of evidence on the relationship between factors and PA promotion indicated insufficient evidence on PA promotion determinants.

Conclusion

This extensive overview of potential factors can inform intervention developers and implementers on which factors may play a role when introducing PA interventions in PHC. Future research should further investigate relationships between factors and PA promotion, which should be guided by qualitative in-depth knowledge on influencing factors.

Introduction

In the last decades many interventions have been developed aimed at promoting physical activity (PA) in primary health care (PHC) [60]. These PHC-based PA interventions, such as PA counseling, prescribing PA, and patient referral to PA programs, have been shown to be effective in research settings [61–63]. However, rates of PA promotion by PHC professionals are far from optimal [50–52] and PA interventions are not delivered as intended by the intervention developers [1,9,53,54].

This gap between research and practice reduces the impact that evidence-based PHC-based PA interventions can have on public health [1,10–13]. The gap may be at least partly due to the complexity of translating innovations to practice, which often requires changes in organizations and health care professionals' behavior [17,18,27,30]. Moreover, health care professionals' behaviors may be influenced by a multitude of factors related to the intervention, adopting person, patient, social setting, organizational context, and introduction strategies [5,7,17,24,27,30,64].

With the impact of efficacious interventions depending on their use in practice, it is critical to systematically investigate this process [1,5,7,17,21,24]. Furthermore, knowledge on which factors influence PHC professionals' PA promotion behaviors can inform intervention developers and implementers with regard to the design of appropriate strategies to introduce interventions in practice [1,7,17,34]. Possibly related to the complexity of the translation of innovations to practice, the factors that help and hinder the introduction of PA interventions in PHC are seldom studied in the PA literature [12,59]. This was also reported by Eakin et al. [58], who reviewed the PA intervention literature on the degree to which studies addressed interventions' introduction to practice. Furthermore, they reviewed eight studies on professionals' barriers to PA counseling in PHC, of which lack of time, perceived lack of patient receptiveness, lack of reimbursement, and perceived limitations in counseling skills were most reported. Recently, Hébert et al. [65] systematically reviewed the literature on PHC professionals' perceptions and attitudes towards PA counseling. They concluded that professionals perceive PA promotion as important and part of their role, but that they encounter numerous barriers to promote PA, such as lack of time, training, and reimbursement.

To date, no study has systematically reviewed the literature taking the comprehensive perspective of factors related to the intervention, adopting person, patient, social setting, organizational context, and introduction strategies influencing this subject. This might be due to the heterogeneity of theories and frameworks that guide implementation research, leading to challenges in measuring factors underlying health care professionals' behaviors [22,64]. To investigate factors influencing PHC professionals' PA promotion we used Fleuren et al.'s [17] theoretical framework describing the different categories of determinants of the introduction of innovations in health care (i.e., characteristics of the innovation, socio-political context, organization, adopting person, and innovation strategy). Moreover, we included characteristics of the patient as an additional category as proposed by Chaudoir et al. [64]. Fleuren et al.'s [17] framework has been successfully used for the identification of determinants of the introduction of innovations in health care in previous studies [40–42]. To the best of our knowledge, this study is the first to use this framework as a guide to study determinants of the introduction of PA interventions in PHC.

In short, the objective of this study was to systematically review the literature on factors influencing professionals' PA promotion. The main aim was to explore the factors described in the literature to be influencing PHC professionals' PA promotion practices. A secondary aim was to examine which methods are used to identify influencing factors and to take these methods into account when interpreting the results.

Method

Literature search

The literature search was performed between March and April 2012. Articles were retrieved via online databases and cross-checking reference lists. Three electronic databases, i.e., Web Of Science, PubMed, and PsycINFO, were systematically searched for the period of 1990 to 2012. A combination of the following keywords was used: physical activity, exercise, physician, clinician, nurse practitioner, practice nurse, professional, provider, family practice, general practice, health, primary care, primary health care, health care, promotion, and prevention. The full search strategy is described in Figure 1.

((physical activ* OR exerc*) AND (physician* OR clinician* OR nurse practi* OR professional* OR provider* OR family practi* OR general practi* OR practice nurse*) AND (health OR primary care OR primary health care OR healthcare OR health care) AND (promot* OR prevent*) NOT (child* OR school*))

Figure 1. **Search strategy**

Study selection

A study was eligible for inclusion in the review if: 1. it involved face-to-face interventions focusing on promoting PA in adults (e.g., PA counseling, prescribing PA, and patient referral to PA programs), 2. PA promotion was delivered in PHC or interventions were developed to be delivered in PHC, 3. outcomes included factors perceived to influence or associated with PHC professionals' PA promotion behaviors, 4. it was an original collection of data, and 5. it was written in English. All types of research designs were included.

Two researchers (JH and JdV) independently screened all titles to exclude clearly irrelevant articles. Consequently, they independently screened abstracts and full-texts to identify articles that were potentially relevant (Figure 2). The results of this process were discussed afterwards. Only slight disagreement occurred in this stage, which was discussed between the two researchers and resolved by consensus. A Kappa of .86 was calculated for the selection of articles based on full-texts, which reflects excellent agreement according to Orwin [66].

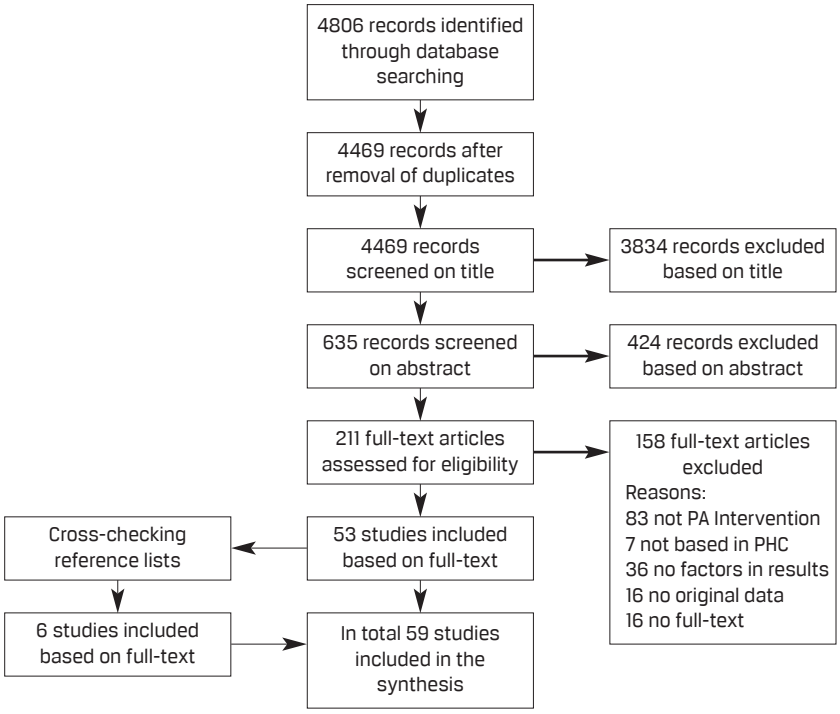

Figure 2. **Flow diagram of selection process**

Data collection and analyses

From the final set of studies that met the inclusion criteria, JH and JdV independently extracted the following study details: design, methods, objective, type of intervention, the intervention's target group, and study participants. A narrative synthesis using thematic analysis was conducted to identify influencing factors [67]. This included extracting all evidence regarding influences on PHC professionals' PA promotion from the literature. With regard to qualitative studies, a factor was created for everything that was reported to have a positive or negative influence on the introduction process. Regarding quantitative studies, all factors that were examined were included in the list of evidence. For each factor we registered the type of evidence (i.e., perceived influencing factors, relationship). Subsequently, factors were grouped into themes. This inductive approach to thematic analysis [68] was applied to detect factors and themes that were strongly linked to the data. A theoretical approach to thematic analysis [68] was used to structure the data by classifying the factors inductively derived from the data within the different categories of determinants of the introduction of innovations in health care (i.e., characteristics of the innovation, socio-political context, organization, adopting person, innovation strategy, and patient) as forwarded by Fleuren et al. [17] and Chaudoir et al. [64]. Every step of the process was done independently by the two researchers, and discussed afterwards. Cases of disagreement were resolved by consensus.

Results

The search strategy yielded 4469 potential articles after removal of duplicates (Figure 2). Following completion of screening, a total of 59 studies met the inclusion criteria and were included in the systematic review.

Characteristics of the included studies

Study characteristics are presented in Table 1. The final set of studies incorporated in the review encompassed a variety of methods to identify factors, including a. qualitative methods (e.g., interviews [69], focus groups [70]) investigating perceptions on barriers and facilitators of PA promotion, b. quantitative studies using questionnaire ratings of barriers and facilitators (e.g., indicating key factors from a list of barriers/facilitators [71]; rating barriers/facilitators on a 5-point Likert scale from very unlikely to act as a barrier to very likely to act as a barrier [72]), c. quantitative studies investigating the relationship between certain predetermined factors and PA promotion, and d. quantitative studies examining the effectiveness of introduction strategies. Some studies used a combination of these methods to identify factors (Table 2).

Factors for which qualitative evidence was found as well as factors that were rated a barrier or facilitator in questionnaire studies are considered in the present study as perceived influencing factors. Factors, including introduction strategies, for which their relationship with PA promotion has been investigated were described as either related to, unrelated to, or as having inconclusive relationships with PA promotion. For the latter factors, some studies found a relationship with PA promotion, while other studies did not or found opposite relationships with PA promotion.

Table 1. **Study characteristics**

	Study	Design	Methods	Objective	Type of intervention	Target group intervention	Study participants
1.	Abramson et al. [73]	Cross-sectional	Questionnaire	To investigate exercise habits and counseling practices	Exercise counseling	Sedentary PHC patients	298 PHC professionals
2.	Ackermann et al. [74]	RCT	Pretest and posttest questionnaires	To evaluate an intervention with the aim to promote referral of older adult patients to community exercise programs	Exercise advice	Sedentary older PHC patients	31 PHC professionals
3.	Allenspach et al. [75]	Qualitative	Interviews	To explore experiences with the 'Move for Health' project	PA counseling	PHC patients aged 16–65 years	40 physicians
4.	Almeida et al. [76]	Prospective trial	Referral rates record	To determine the effectiveness of a stimulus control strategy to increase referrals to an evidence-based PA program	Referral to PA intervention	PHC patients	11 physicians
5.	Al-Shahri and Al-Sameeh [77]	Cross-sectional	Questionnaire	To explore PA promotion practices	PA promotion	PHC patients	89 male physicians
6.	Bize et al. [78]	Qualitative	Interviews	To better understand the opinions, beliefs, and behavior regarding PA promotion	PA counseling	PHC patients	16 PHC professionals
7.	Bull et al. [72]	Cross-sectional	Questionnaire	To assess current practice, perceived desirable practice, and barriers related to PA promotion	Ask, assess, advice and PA promotion in general	PHC patients	908 GPs
8.	Bull & Milton [79]	Qualitative	Focus groups and interviews	To evaluate a systematic approach to integrating PA promotion into PHC	PA promotion	Patients aged 16-74 ranging from a low or high risk of chronic conditions	10 PHC professionals
9.	Burns et al. [80]	Cross-sectional	Questionnaire	To examine PA counseling practices and influencing factors	PA counseling (assessment and advice)	PHC patients	396 PHC NPs
10.	Croteau et al. [81]	Cross-sectional	Questionnaire	To determine the prevalence of PA advice and to identify characteristics of patients who receive such advice	PA advice and Green prescription	Sedentary PHC patients	8187 PHC patients
11.	Damush et al. [82]	Cross-sectional	Questionnaire	To describe the extent to which older adults receive recommendations to exercise	Exercise recommendations	Older adults	893 older adults
12.	Dauenhauer et al. [83]	Cross-sectional	Questionnaire	To better understand the prevalence of exercise prescriptions and related attitudes, barriers, and educational needs	Exercise prescriptions	Older adults	177 PHC professionals
13.	Douglas, Torrance et al. [84]	Cross-sectional	Questionnaire	To investigate attitudes, current practice, and knowledge related to PA advice	PA advice	PHC patients	757 PHC professionals

Table 1. **Study characteristics (continued)**

	Study	Design	Methods	Objective	Type of intervention	Target group intervention	Study participants
14.	Douglas, van Teijlingen et al. [85]	Cross-sectional	Questionnaire and interviews	To investigate attitudes, beliefs, and practice associated PA advice	PA advice	PHC patients	381 PHC professionals
15.	Eakin et al. [14]	Prospective trial	Pretest and posttest questionnaires	To evaluate efforts to increase PA promotion	PA counseling (incl. PA advice)	PHC patients	44 GPs pretest 37 GPs posttest and 2333 patients pretest and 2469 posttest
16.	Eakin et al. [86]	Cross-sectional	Questionnaire	To evaluate the prevalence of PA advice and characteristics of patients who receive it	PA advice	PHC patients	2478 PHC patients
17.	Eckstrom et al. [87]	Prospective controlled trial	Pretest and posttest questionnaires	To examine whether an educational intervention is effective in increasing PA counseling and whether this is associated with increased PA among patients	PA counseling	Elderly PHC patients with multiple chronic diseases	48 residents and 465 patients
18.	Epel and Regev [88]	Cross-sectional	Questionnaire	To investigate PA counseling and associated variable	PA counseling, PA assessment, PA advice, PA assistance	Older population	793 older adults
19.	Glasgow et al. [51]	Cross-sectional	Questionnaire	To examine relationships between PA counseling and patient characteristics	PA advice	PHC patients	1818 adults
20.	Goodman et al. [89]	Cross-sectional	Questionnaire	To investigate the feasibility of involving PHC nurses in PA promotion for older people	PA promotion	Community dwelling older people	515 PHC nurses
21.	Graham et al. [90]	Cross-sectional	Questionnaire and interviews	To investigate factors influencing referral to an exercise scheme	Exercise referral schemes	PHC patients	71 GPs (questionnaire) and 10 GPs and 2 PNs (interviews)
22.	Gribben et al. [91]	Cross-sectional	Questionnaire	To investigate Green Prescriptions practices and associated factors	Green prescription	Sedentary patients	316 GPs
23.	Harrison et al. [92]	Cross-sectional	Referral rates record	To examine the impact of exercise referral schemes at a population level and associated factors with uptake of the service	Exercise referral scheme	Sedentary patients	6610 referrals to the exercise referral scheme
24.	Hinrichs et al. [93]	Cross-sectional	Questionnaire	To evaluate the rate and characteristics of elderly patients receiving PA advice	PA advice	Older PHC patients	1,627 older PHC patients
25.	Huang et al. [94]	Prospective trial	Pretest and posttest GP questionnaires and interviews with patients '	To assess the success and cost effectiveness of the Active Script Program' in increasing PA advice	PA assessment, advice	PHC patients	338 GPs pretest, 332 GPs posttest, and 54 and 54 patients

Table 1. **Study characteristics (continued)**

	Study	Design	Methods	Objective	Type of intervention	Target group intervention	Study participants
26.	James et al. [95]	Longitudinal	Referral rates record	To examine scheme and participant characteristics in relation to access, uptake, and participation in PA referral schemes	PA referral schemes PHC patients	PHC patients	Referral data from 2958
27.	Johnson et al. [96]	Quasi experimental	Questionnaire	To examine the effectiveness of a workshop on PA promotion strategies	PA counseling and referral	RDs' patients	103 RDs
28.	Kennedy and Meeuwisse [97]	Cross-sectional	Questionnaire	To assess current and desired exercise counseling practices and related barriers	Exercise counseling	Family physicians patients	330 PHC professionals
29.	Lawlor et al. [98]	Cross-sectional	Questionnaire	To determine PA promotion practices and their impact	PA promotion (incl. PA advice)	PHC patients	174 GPs
30.	Leijon et al. [99]	Prospective trial	Referral rates record	To examine characteristics of the PA referrals' recipients and practitioners and to identify reasons for practitioners to use them	PA referrals	High-risk PHC patients.	PA referral rates: 3343 (2004) and 2955 (2005)
31.	Märki et al. [100]	Prospective trial	Patient pretest and patient and GPs posttest questionnaire and interview	To investigate how to promote daily PA of elderly patients through systematic counseling conducted by GPs	PA counseling	Elderly patients	2 GPs and 29 of their patients aged 65+
32.	McDowell et al. [101]	Cross-sectional	Questionnaire	To measure PA promotion and to identify related factors	PA promotion, PA advice, asking, assistance	PHC patients	169 PNs
33.	McKenna et al. [102]	Cross-sectional	Questionnaire	To examine PA promotion and related barriers	PA promotion	PHC patients	615 PHC professionals
34.	McKenna et al. [103]	Cross-sectional	Questionnaire	To investigate the prevalence and types of PA promotion and which patients receive it	PA promotion	RDs' patients	395 RDs
35.	McKenna and Vernon [104]	Cross-sectional	Questionnaire	To examine PA promotion practices and to identify how training has influenced delivery	PA counseling	PHC patients	234 GPs
36.	Morrato et al. [105]	Cross-sectional	Questionnaire	To evaluate the prevalence of received PA advice and to identify associated factors	PA advice	Adults with diabetes and who are at risk of developing diabetes	26.878 adults with diabetes or at risk of developing diabetes
37.	Patel et al. [69]	Qualitative	Interviews	To identify perceptions on green prescriptions use for the management of depression	Green prescription	Sedentary PHC patients	15 GPs
38.	Patel and Parchman [106]	Cross-sectional	Questionnaire, direct observation and and audio recordings	To study the relationship between exercise discussions and factors related to the organization	Exercise counseling	Diabetic patients	162 patients and 45 PHC physicians

Table 1. **Study characteristics (continued)**

Study	Design	Methods	Objective	Type of intervention	Target group intervention	Study participants
39. Petrella et al. [107]	RCT	Pretest and posttest questionnaires, telephone interview, and patient recordings	To investigate exercise counseling and acceptance and utilization of an exercise counseling instrument	Exercise counseling	Older adults	362 physicians pretest, 293 physicians posttest
40. Pinto et al. [108]	RCT	Pretest and posttest questionnaires	To examine perceptions on PA counseling, PA counseling training, and support materials, and patients' perceptions on PA counseling	PA counseling	Physicians' older adult patients	34 physicians and 355 patients
41. Podl et al. [109]	Cross-sectional	Direct observation checklist, and a patient exit questionnaire	To assess the prevalence of exercise counseling and to ascertain associated patient and visit characteristics	Exercise counseling (incl. advice	PHC patients	138 physicians, 4215 visits with direct observational data, and 3152 patients
42. Puig Ribera et al. [110]	Cross-sectional	Questionnaire, interviews, and focus groups	To investigate PA promotion practices	PA promotion	PHC patients	145 physicians and 92 nurses (questionnaire), 18 physicians and 15 nurses (interviews), and 5-12 participants (5 focus groups)
43. Puig Ribera et al. [111]	Case study	Focus groups and interviews with patients and key players	To generate explanations for the lack of integration of PA promotion in PHC	PA promotion	PHC patients	20 patients and 22 stakeholders
44. Robertson et al. [112]	Cross-sectional	Questionnaire	To investigate PA recommendations, characteristics of patientsreceiving recommendations, and patients' uptake of the recommendation	Recommending PA	PHC patients	1261 patients
45. Sassen et al. [113]	Prospective	Questionnaire	To explore the relationship between social cognitive variables and PA advice	PA advice	Cardiovascular risk patients	572 healthcare professionals (time 1) and 278 healthcare professionals (time 2)
46. Schmid et al. [114]	Cross-sectional	Focus Groups and a questionnaire	To develop a procedure and information material for PA promotion broadly applicable in the PHC setting	PA counseling	Patients older than 65 years old	12 GPs
47. Sherman et al. [115]	Cross-sectional	Questionnaire	To examine exercise counseling practices	Exercise counseling	Healthy patients	422 PHC physicians

Table 1. **Study characteristics (continued)**

Study	Design	Methods	Objective	Type of intervention	Target group intervention	Study participants
48. Shirley et al. [116]	Cross-sectional	Questionnaire	To determine knowledge, confidence, role perception, barriers, feasibility, and PA counseling practices	PA advice	Physical therapist patients	319 physical therapists and 279 physical therapist students
49. Smith et al. [117]	Qualitative	Focus groups	To identify attitudes toward exercise schemes	Prescription for exercise schemes	PHC patients	22 PHC professionals and 1 receptionist
50. Sowden et al. [118]	Cross-sectional	Referral rates record	To examine every stage of the implementation of the exercise referral scheme	Exercise referral schemes	People from disadvantaged socio-economic groups	6101 patients referred by general practices to exercise referral schemes
51. Swinburn et al. [70]	Qualitative	Focus groups	To assess attitudes and perceptions towards using green prescription and the feasibility of incorporating it into everyday practice	Green prescription	Sedentary patients	25 GPs
52. Tompkins et al. [71]	Cross-sectional	Questionnaire	To describe NP practice patterns for exercise counseling	PA counseling	Adults and older adults	398 NPs
53. van der Ploeg et al. [119]	Prospective trial	Pretest and posttest questionnaires	To examine PA promotion and associated factors	PA promotion	PHC patients	325 GPs (1997) and 397 GPs (2000)
54. van Sluijs et al. [120]	Qualitative	Interview	To conduct a process evaluation of a PA promotion program and investigate its effectiveness	PA promotion	General practice patients	17 PHC professionals and 12 practice assistants
55. Walsh et al. [121]	Cross-sectional	Questionnaire	To identify factors influencing exercise counseling and prescription	Exercise assessment, counseling and prescription	PHC patients	157 PHC professionals
56. Wee et al. [122]	Cross-sectional	Questionnaires	To examine physician counseling about exercise and to identify factors associated with counseling	PA counseling	PHC patients	9299 patients
57. Williford et al. [123]	Cross-sectional	Questionnaire	To determine physicians' attitudes and practices related to PA promotion and exercise prescriptions	PA advice and exercise prescriptions	Physicians' patients	168 physicians
58. Wilson et al. [124]	RCT	Patient exit questionnaires	To study the effect of a training on the frequency and quality of exercise prescriptions	Exercise prescription	Sedentary patients	22 physicians and 420 patients
59. Winzenberg et al. [125]	Qualitative	Interviews	To investigate GPs' perceptions of assessing PA, and to explore how GPs assess PA in their patients	Assessing PA	PHC patients	15 GPs

Note. PHC, primary health care; PA, physical activity; GPs, general practitioners; NPs, nurse practitioners; RDs, registered dieticians

Table 2. Methods to identify factors and categories and amount of factors

Type of method	Method to identify factors Source of data	Study
Qualitative	Perceptions on barriers/facilitators	Allenspach et al. [75]
	PHC professionals	Bize et al. [78]
		Bull & Milton [79]
		Patel et al. [69]
		Schmid et al. [114]
		Smith et al. [117]
		Swinburn et al. [70]
		Van Sluijs et al. [120]
		Winzenberg et al. [125]
	Multiple stakeholders	Puig Ribera et al. [111]
Quantitative	Ratings of barriers/facilitators	Bull et al. [72]
	PHC professionals	Goodman et al. [89]
		Gribben et al. [91]
		Kennedy and Meeuwisse [97]
		Lawlor et al. [98]
		Märki et al. [100]
		Tompkins et al. [71]
		Williford et al. [123]
	Analysis of relationship between factors and PA promotion	Al-Shari and Al-Almaei [77]
		McKenna et al. [103]
	PHC professionals	McKenna and Vernon [104]
		Sassen et al. [113]
	Patients	Croteau et al. [81]
		Damush et al. [82]
		Eakin et al. [86]
		Epel and Regev [88]
		Glasgow et al. [51]
		Hinrichs et al. [93]
		Morrato et al. [105]
		Robertson et al. [112]
		Wee et al. [122]
	Medical record data	Harrison et al. [92]
		James et al. [95]
		Leijon et al. [99]
		Sowden et al. [118]
	PHC professionals & medical record data	Patel and Parchman [106]
	Patients & medical record data	Podl et al. [109]

Table 2. **Methods to identify factors and categories and amount of factors (continued)**

Type of method	Method to identify factors Source of data	Study
	Ratings of barriers/facilitators + analysis of relationship between factors and PA promotion *PHC professionals*	Abramson et al. [73] Burns et al. [80] Dauenhauer et al. [83] Douglas, Torrance et al. [84] McDowell et al. [101] McKenna et al. [102] Sherman and Hershman [115] Shirley et al. [116] Walsh et al. [121]
	Effectiveness of introduction strategies *PHC professionals* *Patients* *PHC professionals & patients* *Medical record data*	Huang et al. [94] Johnson et al. [96] Ackermann et al. [74] Eakin et al. [14] Almeida et al. [76]
	Effectiveness of introduction strategies + analysis of relationship between additional factors and PA promotion *PHC professionals* *Patients* *PHC professionals & patients*	Pinto et al. [108] Van der Ploeg et al. [119] Eckstrom et al. [87] Wilson et al. [124]
Mixed	Perceptions + analysis of relationship between factors and PA promotion *PHC professionals*	Douglas, van Teijlingen et al. [85] Puig Ribera [110]
	Perceptions + ratings of given barriers/facilitators *PHC professionals*	Graham et al. [90] Petrella and Wight [107]

Note. PHC, primary health care; PA, physical activity

Factors influencing PA promotion

Factors influencing PHC professionals' PA promotion practices are shown in Table 3, 4, 5, 6, 7, and 8. The findings are presented in the different categories of determinants of the introduction of innovations in health care [17,64] and whether they were perceived influencing factors or their relationship with PA promotion was investigated.

Characteristics of the innovation

Factors related to characteristics of the innovation are shown in Table 3.

Table 3. **Factors related to characteristics of the innovation**

Theme	Factor	Perceived influencing factors		Relationship
		Qualitative evidence	Barriers/facilitators	
Development	Lack of (fully developed) protocol (-)	78,90,110,114, 120,125]	Barrier [71,102] to 54.6% - 55% [97,110]	Y: [101]
	Flexibility intervention (+) *Possibility to adapt to professionals' needs* *Possibility to adapt patients' needs*	[114] [78,110,125]		
	Fit with daily routine (+)	[75,79,110]		
	PA part of preventive intervention (+)	[114]		
	Use of waiting room (+)	[78,114]		
	Evidence-based (+)	[79,90]	Lack of is barrier to 3.1% - 12.9% [72,91,97]	
Delivery	Little time investment (+)	[110,114]		
	High delivery costs (-)		[71]	
	Administration work (-)	[100,120]	1.2 out of 5 on barrier score [108]	
	Intervention materials *Patient materials* (+)	[79,85,114]	Facilitator to 11.3% [71] Lack of is barrier to 39.3% - 43.4% [85]	
	Professional materials (+)	[70,75,78,107,114]	Lack of is barrier [83] to 5.4% - 29.2% [71,79]	
	Limited accessibility to target group (-) [110] [89]			
	Complex intervention organization (-) [75]			
Results/ effects	Effects (+)		Lack of is barrier [102]	Y: [115]
	Research on intervention (+)		[71]	
	Observable results (+)	[90]	[101]	

Note. PA, physical activity; Y, yes; N, no

Perceived influencing factors. Intervention materials for both patients [71,79,85,114] and professionals [70,71,75,78,79,83,107,114] were most often cited perceived influencing factors on PA promotion practices. Examples of facilitating materials were a PA booklet [114] and educational materials for patients [85] and an overview of all available regional resources for PA practice [78] and exercise prescription aids for professionals [107]. A (fully developed) intervention protocol, including core components that are essential to deliver, was also found to positively influence PA promotion in many studies [71,78,90,97,102,110,114,120,125], in addition to the intervention's flexibility to be adapted to professionals' [114] and patients' needs [78,110,125]. These factors indicate that a good balance between essential intervention components and the intervention's flexibility needs to be achieved to enhance PHC professionals' PA promotion. Next, multiple studies reported that PA is more often promoted when PA interventions are evidence-based [72,79,90,91,97].

Investigated relationships. The full development of an intervention protocol [101] and interventions' positive effects on patients' PA levels [115] were found to be significantly related to PHC professionals' increased PA promotion practices. No other innovation characteristics were studied for their association with PA promotion.

Characteristics of the socio-political context

Factors related to characteristics of the socio-political context are shown in Table 4.

Perceived influencing factors. The most often cited socio-political factor perceived to negatively influence PHC professionals' PA promotion practices was lack of formal education on PA promotion [72,84,85,89,97,107,110,111,123,124]. This barrier was reported by a variety of PHC professionals, including general practitioners, practice nurses, and health visitors. Moreover, lack of resources to promote PA was cited as a perceived barrier in four studies [85,101,102,110], while existing networks between PHC and PA and sport facilities in the community were often found to be facilitating [71,78,110,111].

Investigated relationships. PHC organizations' and professionals' support for the intervention was found to be significantly associated with higher PA promotion levels [113]. In addition, Leijon et al. [99] showed that PA interventions are delivered significantly more often during spring compared to

Table 4. Factors related to characteristics of the socio-political context

Theme	Factor	Perceived influencing factors		Relationship
		Qualitative evidence	Barriers/facilitators	
Culture/ climate	Curative medical culture (-)	[78,110]		
	Lack of formal education on PA promotion (-)	[85,107,110,111]	Barrier [83] to 21.4% - 78% [72,84,85,89,97,110,123,124]	N: [77]
Support	Political/official support for PA interventions (+)	[110,111]	Lack of is barrier [71] to 69% [110]	
	Support for PA interventions from PHC organizations and professionals (+)	[110]		Y: [113]
Resources	Lack of resources (-)	[85,110]	[101,102]	
	Lack of funding for PA research (-)	[78]		
	PA and sport facilities within community (+)	[78]	Lack of is barrier [71,80]	
Networks	Networks between PHC and PA and sport facilities in community (+)	[78,110,111]	Lack of is barrier [71]	
Time of the year	Seasonal changes (spring 〉 summer)			Y: [99]

Note. PA, physical activity; PHC, primary health care; N, no; Y, yes

summer. Lack of formal education was found to be unrelated to PA promotion in one study [77]. No other socio-political characteristics were studied for their association with PA promotion.

Characteristics of the organization
Factors related to characteristics of the organization are shown in Table 5.

Perceived influencing factors. Lack of time to promote PA was the most often cited perceived barrier [69,70,72,73,75,78–80,84,85,89–91,97,98,100–102,107,108,110,114–116,120,121,124,125]. In addition, short consultation time [71] and shortage of staff to promote PA [71,89] were perceived to negatively influence PA promotion. These factors may be related to the multitude of tasks PHC professionals' need to deliver, but also to lack of time provided by the management of the organization to promote PA. Managerial top-down decisions regarding PA promotion practices were perceived to negatively influence PHC professionals' PA promotion practices [71,89], which is linked to the perceived importance of support for the intervention from staff within the organization [110].

Table 5. Factors related to characteristics of the organization

Theme	Factor	Perceived influencing factors		Relationship
		Qualitative evidence	Barriers/facilitators	
Culture/ climate	Requirement in organization (top-down decision management) (-)		Barrier [89] to 5.9% [71]	
	Clarity on roles with regard to PA promotion (+)	[111]		
	Use of other preventive interventions (+)		Facilitator to 55.4% [71]	Y: [88]
Support	Support for PA interventions from staff (+)	[110]		Y: [106]
Resources	Lack of time (-)	[69,70,75,78,79, 85,90,91,100,107, 110,114,120,125]	Barrier [85,90] to 26.5% - 92.5% [72,73,80,84,89,97,98,101, 102,110,115,116,121,124] 2.3 out of 5 on barrier score [108]	
	Consultation time (long › short)		Long facilitator to 69.2% [71], short barrier to 68.1% [71]	Y: [102,106,109]
	Number of discussed problems (more › less)			Y: [106]
	Shortage of staff (-)		[71,89]	
	Number of GPs or PNs			N: [101,102]
	Number of patients			N: [101,102]

Note. PA, physical activity; GP, general practitioner; PN, practice nurse; Y, yes; N, no

Investigated relationships. Corresponding with the perceived importance of time to promote PA, longer consultation time was significantly related to higher levels of PA promotion [102,106,109]. Support for the intervention from staff within the organization [106] and the use of other preventive interventions within the organization, such as weight reduction counseling [88], were significantly associated with higher PA promotion levels. Also, a significant positive relationship was found between PA promotion and the number of problems discussed during consultations [106]. Two studies did not find a relationship between PA promotion and the number of staff and patients within the organization [101,102]. No other organization characteristics were studied for their association with PA promotion.

Characteristics of the patient
Factors related to characteristics of the patient are shown in Table 6.

Perceived influencing factors. Patients' negative attitudes towards prevention and PA was the most cited perceived barrier related to patient characteristics [71,72,91,97,110,114,115,121]. This may be related to other perceived inhibiting factors, such as patients' barriers to be physically active (e.g., not having time, busy lifestyles) [71,110] and patients' and professionals' competing agendas [78]. For example, a patient may prefer medication over lifestyle changes to enhance their health [78]. On the other hand, a good relationship between patients and professionals, causing amongst others increased knowledge on patients' personal lives and patients that accept professionals' advice, was reported to enhance PA promotion practices in multiple studies [70,71,110,125]. Finally, PA was perceived to be promoted most often in patients with a bad physical health [69,78,125] and patients with a condition that is linked to PA [98,110,125].

Investigated relationships. Multiple studies indicated that patients with a bad physical health (e.g. having one or multiple chronic diseases) receive significantly more PA promotion compared to patients with a good physical health [51,72,81,82,86,88,93,105,109,112,122]. Related to this, one study found that having a condition that is linked to PA was significantly associated with higher PA promotion levels [72]. In addition, PA was shown to be most often promoted in patients with a high socioeconomic status [118], patients with a general practitioner [51], and patients first visiting a PHC professional [101,103]. Factors unrelated to PA promotion were patients' employment status [112] and marital status [51,82,122].

Many inconclusive relationships were found. For instance, multiple studies reported that PA is most often promoted in middle-aged patients [92,99,105,112,118,122] and women [51,72,88,92,99,105,106,118,122], while evidence was also found for higher PA promotion in older patients [51,82,109], younger patients [81], and men [86,93,109] and some studies did not find a relationship for age [81,86,95,106] or gender [81,82,95,112]. Furthermore, two studies found that patients' negative attitude towards prevention and PA was significantly related to lower levels of PA promotion [72,82], while another study did not find an association [112]. Other factors for which inconclusive relationships were found were: patients' education level [51,82,86,88,93,105,112,122], income level [51,81,82,105,122], ethnic background [51,81,82,88,93,105,112,122], number of visits to PHC [51,86,88,93], physical limitations [93,105], mental health [72,82,95], PA level [81,82,93,105,122], and smoking behavior [88,93,105,112] (for details see Table 6).

Table 6. Factors related to characteristics of the patient

Theme	Factor	Perceived influencing factors		Relationship
		Qualitative evidence	Barriers/facilitators	
Demographic characteristics	Age			N: [86,95,106] (green prescription) [81]
	Young ⟨ in between ⟩ Old	[125]		Y: [92,99,105,112, 118,122]
	Old ⟩ Young			Y: [51,82,109]
	Young ⟩ Old			Y: (PA advice) [81]
	Gender			N: [81,82,95,112]
	Women ⟩ men			Y: [51,72,88,92,99, 105,106,118,122]
	Men ⟩ women			Y: [86,93,109]
	SES (high ⟩ low)		Low is barrier [71]	Y: [118]
	Education level			N: [51,82,86,88,93]
	High ⟩ low			Y: [105,112,122]
	Income level			N: [51,81,82]
	High ⟩ low		Low is barrier [71]	Y: [105,122]
	Employment status			N: [112]
	Language barriers (-)		Barrier [71] to 16.9% [80]	
	Ethnic background			N: [82,93,112,122]
	Maori & pacific ⟩ others			Y: (PA advice) [81]
	Maori ⟩ others			Y: (green prescription) [81]
	Nonwhites ⟩ whites (US)			Y: [51]
	Black and white ⟩ Hispanic or Asian Native or Western Europe (+) (Israel)			Y: [105] Y: [88]
	Lack of family support (-)		Barrier [71]	
	Marital status			N: [51,82,122]
Health care access	Number of visits			N: [93]
	More ⟩ less	[110]		Y: [51,86,88]
	Having a GP (+)			Y: [51]
	Type of insurance			N: [51]
	Insured ⟩ uninsured			Y: [122]
	Being a new patient (+)			Y: [101,103]

Table 6. **Factors related to characteristics of the patient (continued)**

Theme	Factor	Perceived influencing factors		Relationship
		Qualitative evidence	Barriers/facilitators	
Health	PA link with condition (+)	[110,125]	Lack of is barrier to 68.4% [98]	Y: [72]
	Physical health (bad › good)	[69,78,125]		Y: [51,72,81,82,86, 88,93,105,109,112, 122]
	Physical disability (-)	[125]	[71,89]	N: [93]
	Physical limitations (+)			Y: [105]
	Mental health			
	Good › bad		Bad mental health is barrier [71]	Y: [72,95]
	Bad › good			Y: [82]
Lifestyle	PA level			N: [93,122] (green prescription) [81]
	Low › high	[120]		Y: [82,105] (PA advice) [81]
	High › low			Y: [88,106]
	Smoking behavior			N: [93,112]
	Smoking › no smoking			Y: [88]
	No smoking › smoking			Y: [105]
Interest in prevention/ PA	Initiation of topic (+)	[125]	[71]	
	Patient barriers to be physically active (-)	[71,110]		
	Negative attitude towards prevention and PA (-)	[91,110,114]	Barrier to 21.1% - 87.3% [71,72,97,115,121] Positive attitude facilitator to 87.4% [71]	N: [112] Y: [72,82]
Patient/ professional interaction	Positive relationship between patient and professional (+)	[70,110,125]	[71]	
	Competing agendas patient and professional (-)	[78]		

Note. PA, physical activity; N, no; Y, yes

Characteristics of the adopting person
Factors related to characteristics of the adopting person are shown in Table 7.

Perceived influencing factors. PHC professionals' perception that patients lack motivation to be physically active was the most often cited perceived barrier to PA promotion [71,73,78–80,84,85, 90,97,98,107,110,120,125], followed by PHC professionals' priorities other than PA promotion [71,78, 80,85,90,97,110,111,115,121,125]. Tasks competing with PA promotion were, for example, other health promotion and preventive medicine activities [78], such as dealing with obesity and falls [125]. Moreover, one study forwarded that the extent to which the primary reason of the patient for visiting required immediate treatment was perceived to decrease the importance of discussing PA [90]. On the other hand, many studies found that PHC professionals' positive attitudes towards PA [69,71,110,115,124], the intervention [69–71,73,78,111,114,116,117,125], and the intervention's effectiveness [70,90,110,115–117,121,124] were perceived to enhance PA promotion. In addition, PHC professionals' knowledge [71,73,78,90,97,107,110,115] and skills [78,110,115,116,120,121,124] were often cited perceived facilitators.

Investigated relationships. PHC professionals' positive attitude towards the intervention's effectiveness was significantly and positively related to PA promotion practices [115,121]. Furthermore, PHC professionals' intentions [104,113] and habits regarding PA promotion were found to have a significant positive effect [113]. Studies could not find a relationship between PA promotion and PHC professionals' education level [80], smoking behavior [115], and perceived role/responsibility [83].

Many inconclusive relationships were found. For example, one study found that younger professionals and professionals with short practice experience promote PA significantly more often [73], while other studies found that this holds true for older professionals [115,121] and professionals with long practice experience [121]. Yet, two studies did not find associations between professionals' age, practice experience and PA promotion [101,102]. Likewise, multiple studies found that professionals' high PA levels are significantly related to higher levels of PA promotion [73,77,80,101, 102,110,115], whereas two studies did not find an association [91,103]. Other factors for which inconclusive relationships were found were: PHC professionals' profession [73,80,84,85,88,95,99,110, 121], physical health [115,121], received education on PA promotion [80,101,102], and self-efficacy [80,113,115,116]. Finally, inconclusive relationships were found for PHC professionals' knowledge [80,101,116,121] and positive attitudes towards PA [83,113,115] and the intervention [83,102,113,116]
(for details see Table 7).

Table 7. Factors related to characteristics of the adopting person

Theme	Factor	Perceived influencing factors		Relationship
		Qualitative evidence	Barriers/facilitators	
Demographic characteristics	Age			N: [101,102]
	Young › old			Y: [73]
	Old › young			Y: [115,121]
	Profession			N: (prescribing) [121]
	PNs › GPs			Y: [110] [84]
	Pediatricians › geriatricians › GPs and internists			Y: [73]
	Dietician, GPs and specialists › PNs			Y: [88]
	HVs › PNs			Y: [85]
	GPs › internists			Y: (asking and counseling) [121]
	GPs › PNs › PTs			Y: [95]
	PTs and behavioral scientists › physicians and dieticians			Y: [99]
	Education level (degree)			N: [80]
	Practice experience (+)			N: [101,102]
	Short › long			Y: [73]
	Long › short			Y: [121]
Health and lifestyle	Physical health			N: (asking and prescribing) [121]
	Good › bad			Y: [115] (counseling) [121]
	PA level			N: [91,103]
	Low › high	[78]		
	High › low	[110]		Y: [73,77,80,101,102, 110,115]
	Smoking behavior			N: [115]
Capability	Received education on PA promotion (+)	[70]		N: [102] Y: [80,101]
	Knowledge on PA, recommendations, and interventions (+)	[78,90,107,110]	Lack of is barrier [71,90] to 16% - 50.6% [73,97,115]	N: [101,116] Y: [80,121]
	Counseling skills (+)	[78,110,120]	Lack of is barrier [116,124] to 12% - 33% [115,121]	
	Self-efficacy (+)	[79,110,125]	Lack of is barrier to 7.4% [121]	N: [80] Y: [113,115,116]
	PA promotion is routine/habit (+)	[70]	Facilitator to 50.1% [124]	Y: [113]

Table 7. **Factors related to characteristics of the adopting person (continued)**

Theme	Factor	Perceived influencing factors		Relationship
		Qualitative evidence	Barriers/facilitators	
Motivation	Intention (+)	[70,110,125]		Y: [104,113]
	Perceived role/ responsibility (+)	[90,111]	Lack of is barrier to 7% [115]	N: [83]
	Beliefs about consequences			
	Positive attitude towards PA (+)	[69,110]	Negative attitude is barrier [71,124] to 11% [115]	N: [83] Y: [113,115]
	Positive attitude towards the intervention (+)	[69,70,78,111,114, 117,125]	Negative attitude is barrier [71,116] to 25% [73]	N: [83] Y: [102,113,116]
	Positive attitude towards the intervention's effectiveness (+)	[70,90,110,117]	Negative attitude is barrier [116,124] to 10.3% - 35% [115,121]	Y: [115,121]
	Perception of lack of patient motivation (-)	[78,79,85,90,107, 110,120,125]	Barrier [71,90] to 11% - 55.2% [73,80,84,85,97,98]	
	Perception of lack of patient compliance (-)	[91]	Barrier to 11% [73]	
	Competing priorities (-)	[78,85,90,110,111, 125]	Barrier to [71] 6.9% - 58.3% [80,90,97,115,121]	
	Emotions			
	Fear of undermining relationship with patients (-)	[78,91]		

Note. PN, practice nurse; GP, general practitioner; HV, health visitor; PT, physical therapist; N, no; Y, yes

Characteristics of the innovation strategy

Factors related to characteristics of the innovation strategy are shown in Table 8.

Perceived influencing factors. Most cited innovation strategies referred to PHC professionals' reinforcement. Specifically, adequate reimbursement for PA promotion practices was a frequently forwarded facilitator [71,78,80,97,107,114–116,124], in addition to other (financial) incentives [79,84,85,101,102]. Moreover, PHC professionals' PA promotion was perceived to be facilitated by providing information on PA and PA interventions [84,89,107,110], for instance during a workshop [91,103,110], and the inclusion of intervention reminders [78,114,125].

Investigated relationships. Seven studies investigated the effectiveness of combined innovation strategies, of which five were found to be effective [14,74,76,86,94,124]. The effective combined strategies involved some of the already described innovation characteristics (i.e., intervention materials, the intervention's evidence-base) and perceived influencing strategies (i.e., information, media attention, training, reminders) in combination with supervision [14], and stakeholder involvement in the development of PA interventions [94].

Inconclusive relationships with PA promotion were found for the provision of a workshop. Four studies reported a significant positive effect of the provision of a workshop [87,96,103,119], whereas two studies did not find such an effect [80,104].

Table 8. Factors related to characteristics of the innovation strategy

Theme	Factor	Perceived influencing factors		Relationship
		Qualitative evidence	Barriers/facilitators	
Information	Lack of information on PA and intervention (-)	[107,110]	Barrier to [89] 40 - 60% [84]	
	Media attention (+)	[78]	Facilitator to 30% [91]	
Training	Workshop (+)	[110]	Facilitator to 10% - 95.5% [91,103]	Y: [87,96,103,119] N:[80,104]
Reminders	Reminders (+)	[78,114,125]		
Assistance	Assistance (+)		Facilitator [71] to 5% [91]	
Reinforcement	(Financial) incentives (+)	[79]	Lack of is barrier [84,101,102] to 3.3% - 15% [79,85]	
	Adequate reimbursement (+)	[78,107,114]	Lack of is barrier [116] to 5.1% - 46.6% [71,80,97,115,124]	
Combined strategies	Media campaign, training, supervision, intervention materials professionals and patients (+)			Y: [14]
	Written information, intervention materials professionals, reminder, training (+)			Y: [74]
	Intervention material professional, reminder, instruction (+)			Y: [76]
	Training, written information, intervention materials professionals and patients (+)			Y: [124]
	Networks, stakeholder involvement in development, evidence-base, intervention materials professionals, media attention, training, audit (+)			Y: [94]
	Written information, reminder, poster, protocol, workshop			N: [108]
	Range of initiatives to increase attention to PA in PHC			N: [119]

Note. PA, physical activity; PHC, primary health care; Y, yes; N, no

Discussion

The aim of this study was to systematically review the literature on factors influencing PHC professionals' PA promotion. Based on 59 studies published in the last 20 years this review provides an overview of factors potentially influencing PHC-based PA promotion, taking into account the different methods used to identify these factors. Factors were organized following the different categories of determinants of the introduction of innovations in health care [17,64]. Prominent themes were the development, delivery, and effects of the innovation, the socio-political and organizational culture, resources, and support, patient and PHC professional characteristics, and innovation strategies.

Identified factors were foremost perceived influencing factors, as for only a minority of factors significant relationships with PA promotion were found. Most cited factors perceived to positively influence PA promotion referred to PHC professionals' knowledge [71,73,78,90,97,107,110,115], skills [78,110,115,116,120,121,124], and positive attitudes towards PA promotion [69–71,73,78,90,110,111,114–117,121,124,125], intervention materials [70,71,75,78,79,83,85,107,114], and strategies to reinforce PHC professionals' PA promotion practices [71,78–80,84,85,97,101,102,107,114–116,124]. Factors most cited to negatively influence PA promotion were lack of time [69,70,72,73,75,78–80,84,85,89–91,97,98, 100–102,107,108,110,114–116,120,121,124,125] and formal education [72,84,85,89,97,107,110,111, 123,124], PHC professionals' competing priorities [71,78,80,85,90,97,110,111,115,121,125] and their perception of patients' lack of motivation to be physically active [71,73,78–80,84,85,90,97,98,107,110,120,125]. For the majority of these factors their relationship with PA promotion was not investigated, which indicates that future research should examine the relationship between these important perceived influencing factors and PA promotion. Perceived influencing factors for which a significant positive relationship with PA promotion was found were: the full development of an intervention protocol [101], intervention's positive effects on patients' PA levels [115], support for the intervention from PHC organizations and professionals [113] and from staff within the organization [106], the use of other preventive interventions within the organization [88], and longer consultation time [102,106,109]. Furthermore, PA was most often promoted in patients with a high socioeconomic status [118], bad physical health [51,72,81,82,86,88,93,105,109,112,122], and a condition that is linked to PA [72] and PA was most often promoted by PHC professionals with positive attitudes towards the intervention's effectiveness [115,121], positive intentions [104,113], and habits regarding PA promotion [113].

Other factors for which significant relationships with PA promotion were reported lack qualitative evidence and were cited only once, indicating the need for further investigation. The same holds true for the majority of factors for which no relationship with PA promotion was found (i.e., lack of formal education [77], patients' employment status [112], and PHC professionals' education level [80], smoking behavior [115], and perceived role/responsibility [83]). For many other factors, particularly those related to characteristics of the patient and adopting person, we found inconclusive relationships with PA promotion. These findings might be explained by the variety in intervention type, intervention's target group, specific PHC practice, or country under study. This suggests that influencing factors with regard to these characteristics might be specific to each PA intervention and its context. Additional qualitative research on these factors might clarify their influence on PA promotion under a variety of circumstances.

In summary, included studies used a variety of methods to identify factors, leading to different categories of factors. Factors related to characteristics of the innovation, socio-political context, and simple innovation strategies were foremost identified by qualitative methods and barrier/facilitator ratings, whereas factors related to characteristics of the organization, patient, adopting person, and combined innovation strategies were foremost identified by quantitative methods (i.e., investigation of the relationship between factors and PA promotion and the effectiveness of introduction strategies). Many inconclusive relationships were found for the factors related to the characteristics of the patient and adopting person. These results might be explained by the variety in the type of intervention, the intervention's target group, specific PHC practice, or country under study. This suggests that influencing factors with regard to these characteristics might be specific to each PA intervention and its context. The results indicate a lack of studies on the relationship between PA promotion in general, and factors related to the innovation, socio-political context, and simple innovation strategies in particular. Furthermore, additional qualitative research may be necessary to examine factors related to the patient and adopting person. In line with Palinkas et al. [126], we therefore propose a combination of qualitative and quantitative methods to understand the effective introduction of innovations in practice. Moreover, the findings suggest that future research should investigate determinants of PA promotion by using a comprehensive theoretical framework taking into account all categories of factors affecting the introduction of innovations in health care, including factors related to the innovation, socio-political and organizational context, patient, adopting person, and innovation strategy [17,64]. Chaudoir et al. [64] provide an overview of measures that can be used to assess these categories of factors.

The factors identified in this review correspond with determinants discussed in the literature on the introduction of innovations in health care settings, such as Rogers' [24] characteristics of innovations (i.e., the innovation's compatibility, complexity, and observability), environmental factors and innovation strategies in Greenhalgh et al.'s [27] theoretical model on the translation of research in health care practice, and characteristics of the adopting person in Cane et al.'s [30] Theoretical Domains Framework. This suggests that the factors found might affect the implementation of evidence-based interventions in general, not merely PA interventions. Some factors are consistent with barriers related to PA promotion identified by Eakin et al. [58] and Hébert et al. [65], such as lack of time, lack of reimbursement, lack of resources, lack of patient receptiveness, and lack of knowledge, skills, and training, while others are an addition to these reviews. For example, a multitude of potential determinants related to the patient emerged from the data, suggesting the importance of taking these factors into account in implementation studies and frameworks, in which they are now often neglected [64].

Some limitations of the study should be noted here. Although the literature search was performed in both medical and psychological databases, broad search terms were used, and reference lists were cross-checked, articles may have been overlooked. Next, a discrepancy between perceived influencing factors and factors related to PA promotion was made based on the methods that were used to identify factors, yet the quality of these methods was not assessed or taken into account. With regard to the identified factors, relationships between factors, their relative importance, and their changeability could not be determined in this study. On the other hand, one of the strengths of this study is the inclusion of studies with a variety of methods and multiple sources of data to

identify factors, which allows for a broader examination than would qualitative or quantitative studies alone, as well as the inclusion of studies solely focusing on PHC professionals' as a source of data. In addition, the review investigated factors influencing PA promotion in general, without limitation to a specific intervention or target group, which makes our results applicable to a wide range of PHC-based PA interventions (e.g., PA promotion and counseling in general, exercise referral schemes).

Conclusion

This systematic literature review has identified many factors potentially influencing PHC professionals' PA promotion practices. These include factors related to the development, delivery, and effects of the innovation, the socio-political and organizational culture, resources, and support, patient and PHC professional characteristics, and innovation strategies. Knowledge on these factors can inform intervention developers and implementers on how to effectively introduce PA interventions in PHC [1,7,17,34]. Taking into account the methods that were used to identify these factors we can conclude that the findings are not unequivocal. First, for many factors their relationship with PA promotion was not examined and significant relationships with PA promotion were only found for a minority of factors. Overall, the findings emphasize the need for additional research on PA promotion determinants. Specifically, they suggest that a combination of qualitative and quantitative methods is desirable to investigate influencing factors. Finally, a further study into the relationships between factors, their relative importance, and changeability, and causal relationships between factors and the introduction process would lead to a better understanding of the exact role of all the potentially influencing factors that were distinguished through this literature review.

Chapter 3

Factors influencing the introduction of physical activity interventions in primary health care: a qualitative study

Huijg JM, van der Zouwe N, Crone MR, Verheijden MW, Middelkoop BJC, Gebhardt WA.
Factors influencing the introduction of physical activity interventions
in primary health care: a qualitative study.
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Abstract

Background

The introduction of efficacious physical activity (PA) interventions in routine primary health care (PHC) is a complex process. Understanding factors influencing the process can enhance the development of successful introduction strategies.

Purpose

The aim of this qualitative study was to explore stakeholders' perceptions on factors influencing the introduction, i.e., adoption, implementation, and continuation, of PA interventions in PHC.

Method

Twenty-eight semi-structured interviews were held with intervention managers, PHC advisors, intervention providers, and referring general practitioners of five PA interventions delivered in PHC. A theoretical framework on the introduction of innovations in health care was used to guide the data collection. Influencing factors were identified using thematic analysis.

Results

Stakeholders reported preconditions for the introduction of PA interventions in PHC (e.g., support, resources, networks and collaborations), in addition to characteristics of PA interventions (e.g., compatibility, flexibility, intervention materials) and characteristics of PHC professionals (e.g., knowledge, positive attitudes, beliefs about capabilities) perceived to enhance the introduction process. Furthermore, they proposed strategies for the development of PA interventions (e.g., involvement of future stakeholders, full development, refinement) and strategies to introduce PA interventions in PHC (e.g., training, assistance, reinforcement). The majority of the influencing factors was discussed specifically in relation to one or two stages.

Conclusion

This study presents an overview of factors that are perceived to influence the introduction of PA interventions in PHC. It underscores the importance of taking these factors into account when designing introduction strategies, and of giving special attention to the distinct stages of the process.

Introduction

In the last decades many interventions have been developed aimed at promoting physical activity (PA) in primary health care (PHC) [60]. These PHC-based PA interventions, such as PA counseling, prescribing PA, and patient referral to PA programs, have been shown to be effective in research settings [61–63]. However, rates of PA promotion by PHC professionals are far from optimal [50–52] and PA interventions are not delivered as intended by the intervention developers [1,9,53,54].

This gap between research and practice reduces the impact that evidence-based PHC-based PA interventions can have on public health [1,10–15]. It is likely to be due to the complexity of the introduction of innovations in health care settings [17,18,27,30]. Multiple parties are involved (e.g., health care organizations and professionals, insurance companies, governmental agencies) and the process consists of various stages: the adoption stage, in which the decision is made to start working with an intervention, the implementation stage, in which the intervention should be delivered as intended, and the continuation stage, which concerns long term delivery of the intervention [5,15,17–20]. Furthermore, the process may be influenced by a multitude of factors related to the innovation, PHC professional, patient, social setting, organizational context, and innovation methods and strategies [5,7,8,17,20,24,27,30,31,64].

Knowledge on which factors influence the introduction of PA interventions in PHC provides important information to apprise policy makers, intervention managers, and PHC advisors in the development of successful introduction strategies [7,12,17]. However, as yet, PA interventions' introduction to practice and the factors that influence this process are not often studied or reported on in the PA literature [12,58,59]. Huijg et al. [130] systematically reviewed the literature on factors influencing PHC professionals' PA promotion practices taking the comprehensive perspective of factors related to the innovation, PHC professional, patient, social setting, organizational context, and innovation methods and strategies [5,7,8,17,20,24,27,30,31,64]. In addition to the identification of a multitude of potential influencing factors, they concluded that different types of studies led to the identification of different categories of factors and that there is a lack of research on some categories of factors. In concordance with Chaudoir et al. [64], they suggest that research should take into account all categories of influencing factors and that qualitative research should inform quantitative research on the relationship between factors and PA promotion.

With regard to the different stages of the introduction process (i.e., adoption, implementation, and continuation), various scholars suggest that different factors may be of critical importance within these stages and, therefore, that specific innovation strategies may be required for each stage [5,15,17,18,20,22]. This emphasizes the importance of taking the different stages of the introduction process into account when exploring factors influencing the introduction of PA interventions in PHC. However, research that evaluates the influence of factors across the different stages of the introduction process is scarce [18]. Moreover, a very limited number of studies has investigated the adoption, implementation, and continuation of PHC-based PA interventions and the factors that influence the distinct stages [130].

To investigate factors influencing the introduction of PA interventions in PHC, we used a theoretical framework describing the different stages of the process (i.e., adoption, implementation, and continuation) and the different categories of determinants (i.e., innovation, socio-political context, organization, adopting person, and innovation strategy; Figure 1) [17,20]. The framework was developed for the identification of determinants of the introduction of innovations in health care and was successfully used for this purpose in various studies using both qualitative and quantitative methods [40–42,127]. Specifically, the framework was applied to prompt categories of determinants during focus group interviews [41,127] and to guide the development of questionnaire items which assess determinants of the introduction process [40,127]. In addition, the framework was applied to code answers to open-ended questions [40,127] and to structure the data into the different categories of determinants [40–42,127]. To the best of our knowledge, this study is the first to use this framework as a guide to study determinants of the introduction of PA interventions in PHC while taking into account the distinct stages of the process.

The aim of this study was to explore various stakeholders' perceptions on factors influencing the adoption, implementation, and continuation of PA interventions in PHC. Research questions that were addressed were: 1. which factors are perceived by stakeholders to be influencing the introduction of PA interventions in PHC, and 2. are factors perceived as specifically important to the distinct stages (i.e., adoption, implementation, and continuation) of the process?

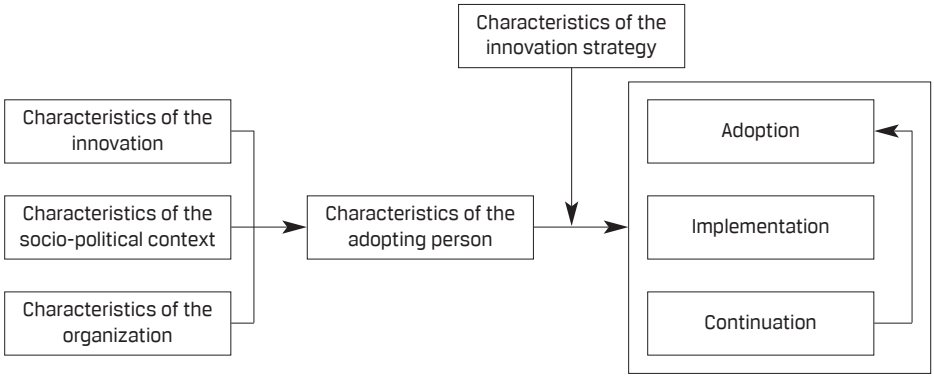

Figure. 1. **Framework representing the introduction process and related categories of determinants [20]**

Method

Design

This study was a qualitative study using semi-structured interviews with intervention managers, PHC advisors, intervention providers, and referring general practitioners (GPs) of five PA interventions delivered in PHC in the Netherlands.

Setting and participants

Three PA interventions and two interventions focusing on PA and dietary behavior delivered in PHC were purposively selected based on their differences in content and organization (see Table 1). This allowed for the identification of a variety of factors influencing PA interventions' introduction.

Table 1. Characteristics of interventions

Intervention & content	Procedure	Professionals involved
A. PA	GP referral (optional) A minimum of 2 (1 with lifestyle coach and 1 with PA coach) individual sessions	GP (optional) Lifestyle coach PA coach
B. PA	GP referral A minimum of 2 individual sessions with lifestyle coach 18 sessions (18 weeks) of PA in group under supervision of PA coach	GP Lifestyle coach PA coach
C. PA	GP referral A maximum of 3 months physical therapy (individual and group) A maximum of 3 months lifestyle courses A minimum of 6 months PA in community	GP Lifestyle coach Physical therapist
D. PA and dietary behavior	GP referral 10-15 group sessions over 3 months 1 year follow-up	GP Lifestyle coach Physical therapist Dietician Psychologist
E. PA and dietary behavior	GP referral A maximum of 1 year individual and group sessions PA based in PHC and the community	GP Lifestyle coach Physical therapist Dietician Psychologist

Note. PA, physical activity; GP, general practitioner; PHC, primary health care

From each intervention five or six stakeholders were interviewed. In total, six intervention managers (i.e., those who manage the organization of an intervention), four PHC advisors (i.e., those who advise and assist PHC organizations and professionals), eleven intervention providers (i.e., those who deliver an intervention), and seven referring GPs (i.e., those who refer patients to an intervention) were interviewed (see Table 2). This heterogeneous group of stakeholders was selected to gain information on influencing factors from different perspectives and to identify a great variety of potential factors.

In terms of recruitment, intervention managers were addressed first and with their support, PHC advisors, intervention providers, and referring GPs were contacted. Researcher JH contacted the stakeholders by e-mail and telephone, informed them about the aims of the study, and invited them to take part in an interview. All stakeholders invited to participate in the study agreed to take part.

Table 2. Characteristics of the study population

Intervention	Intervention managers	PHC advisors	Intervention providers	GPs	Total
A.	2	0	2	1	5
B.	1	1	2	2	6
C.	1	2	2	1	6
D.	1	0	2	2	5
E.	1	1	3	1	6
Total	6	4	11	7	28

Note. PHC, primary health care; GP, general practitioner

Data collection

Twenty-eight semi-structured face-to-face interviews, ranging from 50 to 90 minutes, were conducted by JH between April and November 2010. At the time of the interview all participants were provided with information about the aims, procedures and ethical aspects of the study, gave informed consent, and received a monetary incentive of 40 euro for their participation. As the last two interviews added no new information, it was concluded that data saturation had been reached. Therefore, no more stakeholders were invited at that point. All interviews were audio-recorded and transcribed verbatim.

The interview topic list (Table 3) was based on a theoretical framework describing the different stages (i.e., adoption, implementation, and continuation) and categories of determinants of the introduction of innovations in health care organizations (i.e., innovation, socio-political context, organization, adopting person, and innovation strategy; Figure 1) [17,20]. Stakeholders were asked about their experiences with the adoption, implementation, and continuation of the intervention they were involved in, and about barriers and facilitators to the introduction process. Every part of the interview initially started with open-ended questions to allow interviewees to talk about their experiences and to report on factors that they perceived as most important. Subsequently, interviewees were prompted with the categories of factors that may play a role in the introduction process, to encourage them to think about other influencing factors.

The topic list was developed collaboratively by the research team, and was pilot tested with a policy maker who had been involved in the introduction of a PA intervention in PHC. Piloting indicated that the interview structure and questions were clear and that they were suitable for the purpose of the study. Therefore, it could be concluded that the topic list was ready to use and no changes were necessary. In addition, no adaptations to the topic list were made during the interviewing phase.

Table 3. Interview topic list

General
• Could you tell me something about your experiences with the intervention?
• How did you get involved in the intervention?
Adoption
• Could you tell me about your* decision to work with the intervention?
• Which factors have influenced your* decision to work with the intervention? Prompts: did other factors related to the innovation, socio-political context, organization, patient, adopting person, and innovation strategy influence your* decision to work with the intervention?
Implementation
• Could you tell me about the way you* deliver the intervention?
• Which factors influence the way you* deliver the intervention? Prompts: did other factors related to the innovation, socio-political context, organization, patient, adopting person, and innovation strategy influence the way you* deliver the intervention?
Continuation
• Could you tell me about your* future plans with regard to the intervention?
• Which factors influence your* (dis)continuation of the intervention? Prompts: did other factors related to the innovation, socio-political context, organization, patient, adopting person, and innovation strategy influence your* (dis)continuation of the intervention?
Note. *, Intervention providers were asked about their adoption, implementation, and continuation of the intervention. Intervention managers and PHC advisors were asked about the adoption, implementation, and continuation by PHC organizations and intervention providers.

Ethics

The Medical Ethics Committee of the Leiden University Medical Centre granted ethical approval of this study (reference number NV/CME 09/081).

Data analysis

A thematic analysis was conducted on the transcribed interviews, using ATLAS.ti [128]. Thematic analysis was considered to be an appropriate technique as it can be used for "identifying, analyzing, and reporting patterns (themes) within the data" [68] (p.79). Furthermore, it can be used to organize and describe a data set in rich detail, by taking an inductive or theoretical approach [68]. In this study, we used an inductive approach of thematic analysis [68] to create codes, factors, and themes that were strongly linked to the data. A code was created for everything that was reported by the stakeholders to have a positive or negative influence on the introduction process. Codes on the same topic were brought together as a factor and factors were then grouped in themes.

Initially, two researchers (JH and NvdZ) with different perspectives on the introduction of PA interventions in PHC (theoretical versus practical) independently coded the data of six interviews. After coding the first three interviews, JH and NvdZ reflected on their results to determine if they formulated similar codes for stakeholders' quotations. Differences in codes were discussed. After coding the next three interviews, there was substantial overlap among the researchers' codes. Therefore, JH coded the other interviews individually. Next, JH and NvdZ independently developed factors and themes, organizing the multitude of codes. In cases of disagreement, consensus was achieved via discussion with a third researcher (WG). Finally, JH and a research assistant independently classified the factors according to the stage stakeholders mentioned the factors had an influence on. During the analyses, the researchers completed memos enabling them to keep track of their analytical thoughts and theoretical ideas. These memos were used as input during the discussions. Quotes to illustrate the results were translated from Dutch to English and as such are not presented here in the stakeholders' own language.

Results

Influencing factors

Factors perceived by stakeholders as influencing the introduction of PA interventions in PHC are shown in Table 4.

Preconditions for the introduction process

Many stakeholders talked about preconditions for the introduction of PA interventions in PHC. They reported that, before the actual development of an intervention, it is essential that the medical culture is prevention-oriented. In other words, authorities, PHC organizations, professionals, and patients need to believe that prevention is important. Stakeholders perceived that this may be facilitated by the existence of a public health problem that is related to a lack of PA, such as the increased incidence of cardiovascular disease and diabetes type 2. Furthermore, they found that a prevention-oriented medical culture may be enhanced by prevention and lifestyle behaviors being a part of PHC professionals' formal education. In addition to the popularity of prevention, the majority of stakeholders highlighted the relevance of support for the intervention. First, interventions need socio-political support, for example from the government, local authorities, and insurance companies. Specifically, it was reported to be helpful if PA interventions are part of national and/or local policies and that they are provided with financial support.

> *"Insurance companies, the municipal health service, and local authorities were involved, so we had a good basis."* (Intervention provider 7, male)

Second, PHC organizations and professionals should support PA interventions, as they are the ones that need to deliver the intervention to their patients. Higher levels of socio-political support appeared to be related to greater access to resources for the introduction of PA interventions in PHC. Perceived necessary resources included financial resources to introduce interventions, time to deliver PA interventions, and PA facilities within the community.

> *"Financial reasons. If the government will not provide resources to maintain the intervention and we do not receive any money from insurance companies, it will stop."*
> (PHC advisor 2, female)

In addition, networks and collaborations between key stakeholders were reported to facilitate the introduction process. Specifically, networks and collaborations between intervention managers, government, local authorities, and insurance companies were found to play an important role in collecting sufficient financial resources for the intervention's introduction and its future sustainability. Networks and collaborations between intervention managers, PHC advisors, and PHC organizations and professionals were stated to be relevant to the adoption, implementation, and continuation of PA interventions, and networks and collaborations between PHC professionals and PA facilities within the community were perceived to enhance intervention participants' maintenance of PA and, therefore, the interventions' effectiveness.

> *"It is important to contact GPs and convince them to refer patients and arrange sport locations. You need to talk to people to make it work."* (Intervention provider 2, female)

Intervention characteristics

Intervention's compatibility with the PHC setting was an important suggested intervention characteristic. Specifically, interventions should fit with professionals' knowledge, skills, and routines. In this way, interventions are easily integrated in daily practice and the delivery of PA interventions does not cost much extra time. For the same reason, stakeholders also stated that PA interventions should not be too complex to be delivered:

> *"I think it is very important that my colleagues realize referring patients is very simple and that it does not cost extra time."* (GP 6, male)

Often, different PHC professionals work together in delivering PA interventions. For instance, GPs refer, lifestyle coaches counsel, and physical therapists train intervention participants. To make sure that tasks and roles are clear, it was said to be desirable to develop an intervention with a standard protocol. On the other hand, stakeholders reported that interventions must be sufficiently flexible so that they can be tailored to intervention participants' needs (e.g., age, PA preferences, culture) and professionals' own time schedules. In addition, the introduction of PA interventions was found to be facilitated by providing professionals with intervention materials that they can use for intervention delivery (e.g., screening instruments, digital registration system, list with PA options) as well as material that can be provided to intervention participants (e.g., information packages, intervention booklet).

> *"We provide patients with a beautiful PA intervention booklet. It includes assignments, and a PA and nutrition diary. Working with this booklet works really well."* (Intervention provider 8, female)

Stakeholders discussed that changes in health care practice may occur when the innovation has relative advantages compared to old routines, for instance, when PA interventions reduce health care costs and GPs' workload (e.g., by improving patients' health) or when they enhance collaborations by facilitating networks.

> *"Physical activity level increased, health care consumption decreased, and psychosocial wellbeing improved. Furthermore, the GPs' work pressure decreased, because regular patients stayed away. (...) So at some point we knew we had something that worked."* (PHC advisor 4, male)

Furthermore, it was stated that PA intervention delivery needs to be financially feasible, i.e., professionals' work needs to be sufficiently reimbursed and financial benefits should outweigh organizational costs.

Strategies for intervention development

In addition to intervention characteristics, stakeholders mentioned strategies to develop interventions. At the time of the interview, many different PA interventions were being introduced in PHC in the Netherlands. To reduce overlap and 'reinvention of the wheel', stakeholders recommended that PA interventions should work together and/or that new interventions could be based on earlier examples. When aiming for the development of an intervention with the right characteristics, involving future stakeholders was a suggested strategy. For example, PHC professionals (i.e., future intervention providers and referring GPs) could be involved in discussions on intervention development and the process of introducing them in practice.

> *"We interviewed everybody that was involved in prevention, PHC, and wellbeing. (...) This provided us with a lot of information on how to develop the intervention."* (Intervention manager 6, female)

Furthermore, stakeholders described that some interventions are introduced when they are already fully developed (e.g., finances, collaborations between PHC professionals, and networks with community PA facilities are arranged), while others are introduced with many uncertainties and arrangements to be done by PHC organizations and professionals. A PHC advisor describes that the latter could be a barrier to the introduction process:

> *"It is not fully developed yet, still a lot of things need to be arranged. This is a very big task, which PHC professionals are often not equipped to do. They don't have the time, they need to run their practice, and often they don't have the capabilities to do it. Therefore, I believe this is way too much to ask."* (PHC advisor 3, male)

Finally, stakeholders stated that it is important that the intervention is refined when needed (e.g., based on formal evaluations, intervention providers' feedback).

PHC professionals' characteristics

PHC professionals play an important role in the introduction process, as they are the ones that need to deliver the intervention to their patients. Their characteristics were perceived as relevant influences. First, PHC professionals need to believe that prevention and delivering PA interventions are part of their role and responsibility. If they consider an active lifestyle to be their patients' own responsibility, this will decrease the chance that they will decide to work with a PA intervention.

> *"I don't feel responsible for patients' behavioral change, but I do feel responsible for motivating a person that is overweight and referring him or her to a PA intervention."* (GP 4, male)

Furthermore, they need to have positive attitudes towards PA intervention delivery and they need to be motivated. On the one hand, it was stated to be helpful when professionals believe that PA is important, when they are physically active themselves, and when they believe that the intervention is well-developed, evidence-based, relevant, and effective. On the other hand, PHC professionals' beliefs that intervention participants' are not motivated and that they lack the ability to maintain changes in PA behavior were perceived inhibitors. PHC professionals' motivation was said to be frequently related to having a passion for PA, for helping people, or for the target group, and to be related to enjoying working with the intervention and with the team of involved professionals. In addition to motivational factors, PHC professionals' knowledge and skills to deliver the intervention, and their experience with the intervention and the target group were also found to play an important role. Moreover, stakeholders reported that PHC professionals need to believe that they are capable to deliver the intervention.

"You need to constantly motivate and encourage these people. It appeared something I was not very good at." (Intervention provider 7, male)

Finally, stakeholders proposed that the introduction process is enhanced if delivering the intervention is considered a priority and the behavior is performed automatically.

"I know the project exists and it is prominent in my head. Therefore, in every consultation I think: would this be one to refer?" (GP 5, female)

Introduction strategies

Many stakeholders discussed strategies to introduce PA interventions in PHC. They reported that awareness of the intervention could be facilitated by media attention, such as announcements on the intervention in regional newspapers or medical journals.

"They have read or heard about the intervention, colleagues informed them, or they saw it on the internet. It has been discussed in the newspaper as well, which led to a lot of newly interested professionals." (Intervention manager 2, male)

Furthermore, stakeholders suggested that intervention champions can be deployed to encourage PHC organizations and professionals to adopt PA interventions, deliver them as intended, and continue doing this for a longer period of time. Providing PHC professionals with a training was found to be necessary to prepare them for intervention delivery, while assistance was suggested to be helpful during intervention delivery. Examples of assistance that were given were the option to call or send an email to the intervention manager or PHC advisor in case of uncertainties and the organization of meetings in which professionals' can share their experiences (i.e., peer supervision).

"I think assistance is really important, because delivering the intervention is not that easy." (Intervention provider 3, male)

Reminders were put forward as a strategy to prompt GPs with the intervention as an option to refer their patients to. Moreover, stakeholders stated that it is important to reinforce PA intervention delivery, which could be actively done by giving PHC organizations and professionals money (i.e., reimbursement) and recognition.

"Getting recognition for what I am doing works very rewarding." (Intervention provider 6, female)

Furthermore, the introduction's success was perceived to be an important facilitator. PHC professionals' experience with a large amount of colleagues delivering the intervention, the intervention's high reach of the target group, intervention participants' positive feedback, and the intervention's effectiveness were perceived to enhance the introduction process. Therefore, it was found to be important to evaluate the introduction's success and make results observable.

Stages

The majority of the influencing factors was discussed specifically in relation to one or two stages (Table 4). Preconditions for the introduction process were mostly discussed with regard to the adoption and the implementation stage, while support, financial resources, and networks and collaborations remained important during the continuation stage. Intervention characteristics were foremost perceived to influence the implementation stage, yet some intervention characteristics were found to be important for the whole process (i.e., compatibility, relative advantages, financial feasibility) or for both the implementation and the continuation stage (i.e., little time investment, complexity). Strategies for intervention development were perceived most important for either the adoption and implementation stage (i.e., involvement of future stakeholders, full development) or

PA interventions' implementation and continuation (i.e., collaborations between interventions, the use of other interventions as examples, refinement). PHC professionals' characteristics were foremost perceived to influence the implementation stage, while professionals' attitudes and motivation were also perceived to influence the adoption and continuation stage and their perceived role and responsibility was found to be specifically important for the PA intervention adoption. Introduction strategies were mainly discussed with regard to the implementation and continuation stage, yet intervention champions were also found to be important for the adoption stage and media attention was specifically reported with regard to the adoption of PA interventions.

Table 4. Factors influencing the introduction of PA interventions in PHC and the different stages

Themes & factors	Stages		
	A	I	C
Preconditions for the introduction process			
Prevention-oriented medical culture	x	x	
Public health problem related to PA	x		
Formal education on prevention and lifestyle behaviors	x	x	
Support for the intervention (policy, financial, PHC)	x	x	x
Financial resources to introduce interventions	x	x	x
Time to deliver interventions	x	x	
PA facilities within the community		x	
Networks and collaboration	x	x	x
Intervention characteristics			
Compatibility	x	x	x
Little time investment		x	x
Complexity		x	x
Standard protocol		x	
Flexibility		x	
Intervention materials		x	
Relative advantages	x	x	x
Financial feasibility	x	x	x
Strategies for intervention development			
Work together with other interventions		x	x
Use example interventions		x	x
Involvement of future stakeholders	x	x	
Full development	x	x	
Refinement		x	x

Table 4. **Factors influencing the introduction of PA interventions in PHC and the different stages (continued)**

Themes & factors	Stages		
	A	I	C
PHC professionals' characteristics			
Perceived role and responsibility	x		
Attitudes	x	x	x
Motivation	x	x	x
Knowledge		x	
Skills		x	
Experience		x	
Beliefs about capabilities		x	
Priority		x	
Automaticity		x	
Introduction strategies			
Media attention	x		
Intervention champions	x	x	x
Training		x	
Assistance		x	x
Reminders		x	
Reinforcement		x	x
Introduction's success		x	x
Evaluation		x	x
Observable results		x	x

Note. A, adoption; I, implementation; C, continuation; PA, physical activity, PHC, primary health care

Discussion

The aim of this qualitative study was to explore stakeholders' perceptions on factors influencing the introduction of PA interventions in PHC and to examine to what extent factors are perceived as specifically important to one of the distinct stages of the process (i.e., adoption, implementation, and continuation stage).

In line with the literature on the introduction of innovations in health care [5,7,8,17,20,24,27,30,64], many factors were reported as potential influences on the introduction of PA interventions in PHC. Important themes of factors were preconditions for the introduction process, characteristics of interventions and PHC professionals that enhance the adoption, implementation, and continuation of PA interventions, in addition to strategies to develop PA interventions and to introduce them in PHC.

The majority of the factors were previously reported as influencing factors in qualitative studies on PA promotion in PHC. Other factors are an addition to the existing literature. With regard to preconditions for the introduction process, time to deliver the intervention was the most often

cited factor [69,70,75,78,79,85,90,91,100,107,110,114,120,125], while existence of a public health problem related to PA was the only precondition that was not previously reported. In addition, Sassen et al. [113] found that PHC professionals' support is a significant predictor of PA promotion. Most often cited intervention characteristics were intervention materials [70,75,78,79,85,107,114] and intervention's flexibility [78,110,114,125]. Intervention's complexity, relative advantages, and standard protocol were not reported earlier in the PA intervention literature. Stakeholders' perceived strategies for intervention development were not previously reported, except for the strategy to fully develop a PA intervention before introducing it in PHC [78,90,110,114,120,125]. Stakeholders' perception that interventions should work together and use other interventions as examples might be related to the period in which the interviews were held, as at that time a great variety of PA interventions were being introduced in Dutch PHC. Most often cited PHC professionals' characteristics that may enhance the adoption, implementation, and continuation of PA interventions were professionals' attitudes, including their attitudes towards PA and the intervention [69,70,78,90,110,111,114,117,125] and towards intervention participants [78,79,85,90,91,107,110,120,125]. Furthermore, Walsh et al. [121] found that attitudes and PA promotion were positively associated and Sassen et al. [113] found that attitudes significantly predict PA promotion. Reinforcement [78,79,107,114] and reminders [78,114,125] were most cited introduction strategies, while intervention champions, assistance, and evaluation were not previously reported with regard to the introduction of PA interventions.

Factors found are consistent with leading theoretical models on the introduction of innovations in health care (e.g., [8,24,27,30,31]). This suggests that they might affect the introduction of evidence-based interventions in health care in general, not merely PA interventions. For instance, preconditions related to the socio-political culture, support, resources, and networks are central determinants in Greenhalgh et al.'s [27] and Damschroder et al.'s [8] models, in addition to some of the reported strategies (e.g., involvement of future stakeholders, intervention champions, assistance, reinforcement, evaluation). Furthermore, the intervention's compatibility, complexity, and relative advantages, in addition to the observability of the results correspond with four out of five (i.e., compatibility, relative advantage, complexity, observability, and trialability) of Rogers' [24] described characteristics of innovations influencing the introduction process. Factors related to characteristics of the PHC professional are prominent in Damschroder et al.'s model [8] and central in the Theoretical Domains Framework on determinants of implementation behaviors [30,31].

The majority of influencing factors was discussed specifically in relation to one or two stages of the introduction process. Many stakeholders reported important preconditions for the introduction process. This implies that the medical culture, support, resources, and networks and collaborations should be taken into account before the actual development of an intervention. Furthermore, preconditions were perceived to influence the distinct stages of the introduction process; they were mostly reported with regard to the adoption and the implementation stage. This is in line with Fixsen et al. [18] who previously described the importance of political and financial support for the adoption stage. Intervention characteristics and PHC professionals' characteristics were foremost perceived to influence the implementation stage. The importance of PHC professionals' characteristics for the implementation of PA interventions corresponds with Bartholomew et al. [15] who stated that behavioral capability, skills, and self-efficacy become more important when evolving from the adoption to the implementation of health promotion interventions. Finally,

strategies for intervention development were either reported to influence the early or the later stages of the introduction process, and introduction strategies were mainly discussed with regard to the implementation and continuation stage. This suggests that indeed different factors play a role in the adoption, implementation, and continuation of PA interventions in PHC. However, these findings should be further investigated using longitudinal designs. If replicated in future research, they will suggest that special attention should be given to the distinct stages of the process when doing research and designing introduction strategies [5,15,17,18,20,22].

Some limitations need to be taken into consideration when interpreting the results. The sampling strategy may have introduced a positive bias with regard to the factors mentioned, since the majority of participants was actively involved in the introduction process at the moment of the interview. This has potentially increased the identification of factors considered important from a more positive view. It is possible that if more people had been interviewed who had decided not to adopt the intervention, or who had discontinued working with the intervention after some time, more knowledge would have been gathered on barriers to the introduction process. The explorative approach of this study served the study's primary aim to identify as many factors as possible. However, the open character of the interviews decreased the focus on the distinct stages of the process. Therefore, it made it difficult to differentiate between the distinct stages from the interview transcripts. Possibly as a result, many factors were related to multiple stages of the introduction process. Consequently, we mostly described the importance of themes of factors for the distinct stages, while we were cautious with linking individual factors to a specific stage. Next, identification of themes or factors does not provide evidence for the relative importance of factors nor for the relationship between factors and the adoption, implementation, and continuation of PA interventions in practice. These are merely intervention managers', PHC advisors', intervention providers' and referring GPs' perceptions on what might influence the introduction process. Although interviews are required in exploratory research, other research designs are needed to establish which of these factors are most important to use as a foundation for the development of introduction strategies. Next steps to increase further knowledge on the introduction of PA interventions in PHC may include the development of a questionnaire to investigate influencing factors in a quantitative way. In addition, future studies should focus on examining causal relationships between factors and PHC organizations' and professionals' adoption, implementation, and continuation of PA interventions. For this purpose, we suggest conducting longitudinal studies in which the introduction of newly developed evidence-based PA interventions in PHC is closely monitored. Finally, the effectiveness of strategies targeting these introduction determinants should be investigated in randomized controlled trials.

Conclusion

To our best knowledge, this study is one of the first attempts to explore factors influencing the introduction of PA interventions in PHC, including the distinct stages of the process and taking into account various stakeholders' perceptions. The study provides an overview of preconditions for the introduction of PA interventions in PHC, characteristics of interventions and PHC professionals that enhance the process, and strategies to develop PA interventions and to introduce them in PHC. Policy makers, intervention managers, PHC advisors, and intervention developers could take these factors into account when planning the introduction of PA interventions in PHC and developing effective introduction strategies. Furthermore, the findings suggest that different factors may be important for the adoption, implementation, and continuation of PA interventions, which, if replicated in future research, implies that special attention should be given to the distinct stages of the process when designing strategies and doing research. Finally, the present findings can guide future research on factors' influence on the adoption, implementation, and continuation of PA interventions in PHC, including research on factors' relative importance and changeability, causal relationships between factors and the introduction process, and effective introduction strategies.

Chapter 4

Factors influencing the adoption, implementation, and continuation of physical activity interventions in primary health care: a Delphi study

Huijg JM, Crone MR, Verheijden MW, van der Zouwe N, Middelkoop BJC, Gebhardt WA.
Factors influencing the adoption, implementation, and continuation of physical activity interventions in primary health care: a Delphi study.
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Abstract

Background

The introduction of efficacious physical activity interventions in primary health care is a complex process. Understanding factors influencing the process can enhance the development of effective introduction strategies. This Delphi study aimed to identify factors most relevant for the adoption, implementation, and continuation of physical activity interventions in primary health care by examining experts' opinions on the importance and changeability of factors previously identified as potentially relevant for the process.

Method

In the first round, 44 experts scored factors on their importance for each stage of the introduction process, as well as on their changeability. In the second round, the same experts received a questionnaire containing a reduced list of factors, based on the first-round results. They were asked to indicate their top-10 most important factors for each stage, and to re-rate factors' changeability. Thirty-seven experts completed this round.

Results

Most important factors could be identified for each stage. Some factors were found important for a specific stage, e.g., the presence of intervention champions within the organization (adoption), provider knowledge (implementation), and the intervention's sustainability (continuation), while others were perceived important for all stages, i.e., the intervention's financial feasibility, the intervention's accessibility to the target group, and time to deliver the intervention. The majority of most important factors was perceived changeable. However, for some factors no consensus could be reached regarding their changeability.

Conclusion

This study identified general and stage-specific factors relevant for the introduction of physical activity interventions in primary health care. It emphasizes the importance of taking these factors into account when designing introduction strategies, and of giving special attention to the distinct stages of the process. Due to lack of consensus on the changeability of most important factors, the extent to which these factors can be influenced by introduction strategies remains unclear.

Introduction

In the last decades many interventions to promote physical activity (PA) in primary health care (PHC) have been proven to be effective in research settings [60,62,63]. However, within PHC practice, rates of PA promotion are suboptimal [50,51] and interventions are often not delivered as intended by the intervention developers [21,53,54,129].

To have an impact on public health, efficacious PHC-based PA interventions need to be effectively introduced in practice. This process involves several stages which often require changes in organizations and professionals' behavior. In short, organizations and professionals need to make the decision to work with an intervention (i.e., adoption), deliver it as intended (i.e., implementation), and continue to use it over a longer period of time (i.e., continuation) [1,7,21]. Furthermore, the

process, and each of the stages within it, may be influenced by a multitude of factors related to the innovation, adopting person, patient, social setting, organizational context, and innovation methods and strategies [5,17,18,27,30,64].

Reviews on the introduction of PA interventions in PHC have identified factors influencing professionals' PA counseling behavior. Barriers that were often mentioned were lack of time, perceived lack of patient receptiveness, and lack of reimbursement [58,65]. Perceived success and sufficient knowledge and skills were reported as facilitating [65]. Taking the comprehensive perspective of factors related to the innovation, adopting person, patient, social setting, organizational context, and innovation methods and strategies [5,17,18,27,30,64], Huijg et al. systematically reviewed the literature [130] and interviewed intervention stakeholders [131] on factors influencing the introduction of PA interventions in PHC. Both studies resulted in an extensive list of potential influencing factors with some factors similar to determinants discussed in the literature on the introduction of innovations in health care settings [24,27,30] and other factors being an addition to the previous PA intervention literature.

In concordance with Grol et al. [5] and Fixsen et al. [18], Huijg et al. [131] also found that the influence of factors may vary across the distinct stages of the introduction process (i.e., adoption, implementation, and continuation). Various scholars [5,18] already emphasized the importance of studying these distinct stages and taking their specific determinants into account when designing introduction strategies. However, the relevance of factors for the distinct stages of the introduction of PA interventions in PHC has not been previously studied.

Although an overview of potential influencing factors can be helpful when designing strategies to introduce PA interventions in PHC practice, policy makers, intervention managers, and PHC advisors cannot take into account all of the identified factors in this process. Furthermore, in order to investigate the relationship between factors and PA interventions' adoption, implementation, and continuation in PHC, it might be helpful to identify most relevant factors and refine the list based on factors importance and changeability [15]. The present paper describes a Delphi study designed to reach consensus among experts on the relevance (i.e., importance and changeability) of these factors. The research questions were: 1. which factors, as identified by a systematic literature review [130] and qualitative study [131] are perceived by experts as most important for the adoption, implementation, and continuation of PA interventions in PHC, and 2. how changeable are these factors according to experts?

Method

A two-round Delphi study was conducted through the Internet by the use of Qualtrics software, version 45433 [132] and within a 4-month time frame (July – October 2011). A flow diagram of the methods is shown in Figure 1. The Delphi method is a systematic approach that can be used to derive consensus among experts on a topic where scientific knowledge is scarce [133]. Its main characteristics, i.e., anonymity of experts, iteration, controlled feedback, and statistical group response, allow participants to give their opinion freely, change it after having received feedback, and assure that the opinion of every expert is equally represented in the results [133,134].

First round

Procedures and participants

The first round was conducted to facilitate consensus among experts on the importance of factors for the specific stages of the introduction process, i.e., adoption, implementation, and continuation, and on their changeability. Therefore, a variety of people with research and/or practice experience in the field of the introduction of PA interventions in PHC was recruited via research and practice networks (e.g., participants of the qualitative study, LinkedIn groups) and invited to participate by email and telephone. Participating experts were sent an email including the link to the first questionnaire. After two weeks, four weeks, and five weeks, non-respondents received a reminder. In total, 44 experts (response rate of 65%) completed the questionnaire. Completing the questionnaire indicated consent, so no separate consent from participants was obtained. All experts were Dutch and had experience with the introduction of PA interventions in PHC within the following functions: researcher (*n* = 12), policy maker (*n* = 7), intervention manager (*n* = 4), PHC advisor (*n* = 12), and PHC professional (*n* = 9).

Questionnaire

The questionnaire consisted of two parts. Part one encompassed 267 structured questions (89 factors x 3 stages) on factors' importance. Questions were based on the factors identified in the systematic literature review [130] and qualitative study [131] (see Appendix 1) and divided into six categories of factors that may influence the introduction process, i.e., innovation, socio-political context, organization, patient, adopting person, and innovation strategy [17,64]. The experts were asked to rate on a 10-point Likert scale (1 = not at all important, 10 = essential) the importance of each factor for, respectively, the adoption, implementation, and continuation of PA interventions in PHC. For each category of factors an open-ended question was added on whether factors were missing in the list. Part two included 89 structured questions on factors' changeability. The experts were asked to rate on a 10-point Likert scale (1 = no influence at all, 10 = a lot of influence) the amount of influence they had on each factor during their involvement in the introduction of PA interventions in PHC. Piloting of the questionnaire among health promotion researchers and employees of health promotion institutes indicated that the questionnaire was well received.

Data analysis

Median scores were calculated as indicators of factors' importance for each stage of the introduction process. In concordance with van Stralen et al. [135] factors with a median score of 8 or higher were considered important. Based on median scores, many factors were found to be important. To avoid burdening experts with too many items to decide on their top-10s in the second-round questionnaire, mean scores were calculated to identify most important factors for each stage. Based on stages' grand mean scores of important factors, *most important factors* were factors with a median score of 8 or higher *and* a mean score of 7.64 or higher for the adoption stage, a mean score of 7.70 or higher for the implementation stage, and mean score of 7.76 or higher for the continuation stage.

Median scores were also calculated for factors' changeability. Factors were indicated as changeable if they scored a median of 6 or higher. This cut-off value was chosen to be able to include all factors that are considered to be at least somewhat changeable. The interquartile range (IQR) scores were calculated to assess the extent of agreement between the experts on the

changeability of each factor [134]. The IQR represents the distance between the 25th and 75th percentile values, with smaller values indicating higher degree of consensus. An IQR score of 1 means that 50% of all the scores given by experts fall within one point on the scale. According to Linstone and Turoff [133] an IQR of 2 or smaller can be considered as good consensus on a 10-point Likert scale.

Differences between expert groups (i.e., researchers, policy makers, intervention managers, PHC advisors, and PHC professionals) with regard to their ratings of factors' importance and changeability were explored with one-way independent ANOVAs. IBM SPSS Statistics version 19.0 [136] was used for the analyses. The qualitative data on potentially missing factors were scored as 'new' or 'already in the list'.

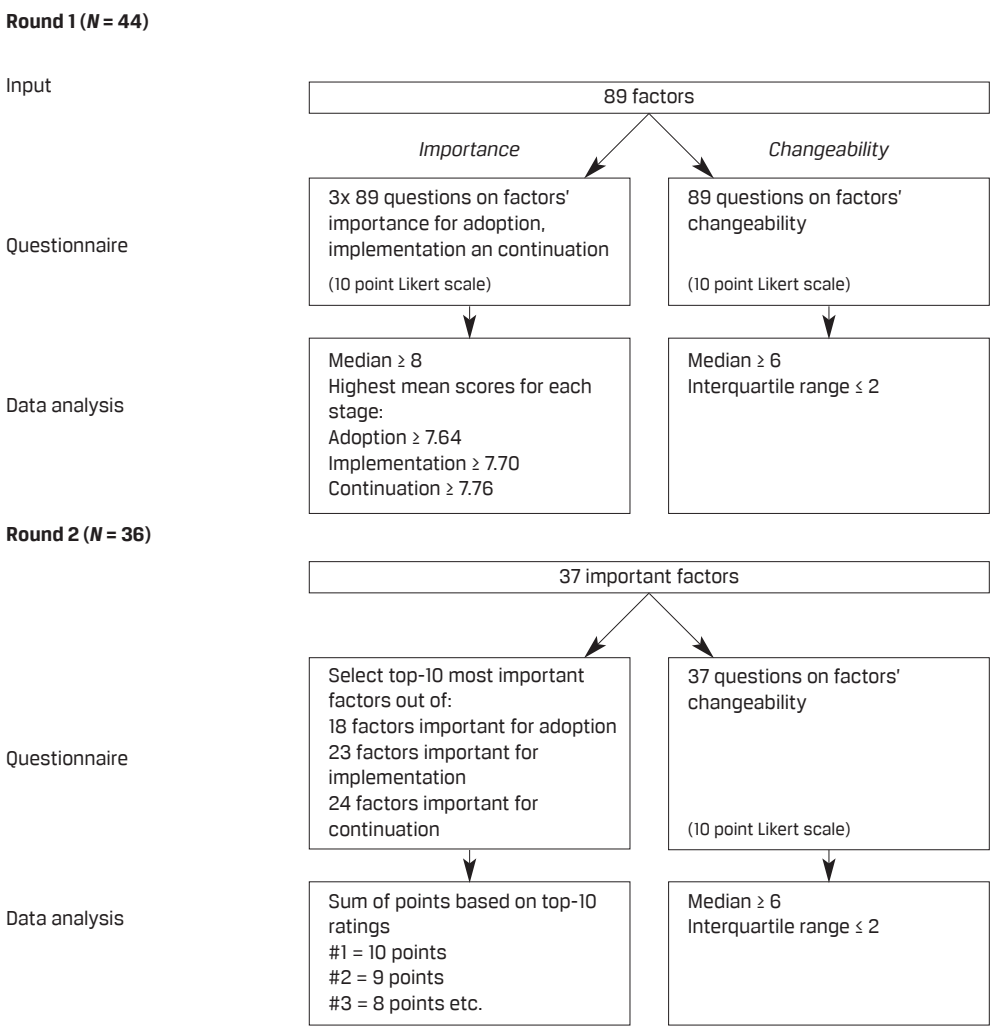


Figure 1. **Flow diagram of methods**

Second round

Procedures and participants

All experts who completed the first-round questionnaire (*N* = 44) were sent an invitation by email to participate in the second round including the link to the second questionnaire. After one week and two weeks, non-respondents received a reminder. In total, 37 experts (response rate 84%) completed the questionnaire. Of them, 11 were researchers, six were policy makers, three were intervention managers, nine were PHC advisors, and eight were PHC professionals.

Questionnaire

The second round was conducted to identify the top-10 most important factors for the specific stages (i.e., adoption, implementation, and continuation) of the introduction process, and their changeability. The questionnaire included the factors that were scored as most important by the experts in the first round (median ≥ 8 and mean ≥ 7.64 for the adoption stage; median ≥ 8 and mean ≥ 7.70 for the implementation stage; median ≥ 8 and mean ≥ 7.76 for the continuation stage). This resulted in a list of 18 factors for the adoption stage, 23 factors for the implementation stage, and 24 factors for the continuation stage; in total 37 different factors (see Table 1). For each stage, the experts were asked to indicate their top-10 of most important factors. Again, open-ended questions were added on whether any factors were missing. For the same set of factors, experts were asked to rate their changeability on a 10-point Likert scale (1 = not changeable at all, 10 = very changeable). In contrast to the first questionnaire, which concerned their own personal influence, experts were asked to rate factors' changeability in general. This alteration was made because we felt that the group of experts was too heterogeneous for consensus to occur if their own personal influence was taken into account. Again, piloting indicated that the questionnaire was well received.

Data analysis

For changeability, again, the median scores and IQR scores were calculated. Importance was calculated based on the sum of points allocated to the factors based on the experts' top-10 ranking. For each expert, factors ranked first in the top-10 were allocated ten points, factors ranked second were allocated nine points, and so on. When a factor was not assigned to a top-10, it did not get any points. Differences between expert groups (i.e., researchers, policy makers, intervention managers, PHC advisors, and PHC professionals) with regard to their top-10 rankings and ratings of factors' changeability were explored with one-way independent ANOVAs. The qualitative data on potentially missing factors were scored as 'a factor not in the list' or 'in depth information on top-10'.

Ethics

The Medical Ethics Committee of the Leiden University Medical Centre had granted ethical approval of this study (reference number NV/CME 09/081).

Results

The items and results are shown in Appendix 1. Table 1 shows the most important factors for the different stages of the introduction process and their changeability.

First round

Experts rated 41 factors as important for the adoption stage (median ≥ 8; M = 7.64), 50 factors as important to the implementation stage (median ≥ 8; M = 7.70), and 56 factors as important to the

continuation stage (median ≥ 8; M = 7.76). Intervention's financial feasibility for PHC organizations and professionals and support for the intervention from insurance companies had the highest median scores regarding all stages (median ≥ 8.5). In addition, related to the continuation stage, several other factors had a median above 8.5: intervention's accessibility to the target group, evidence for intervention effectiveness, network between PHC and local PA or sport facilities, participants' feedback, time to deliver the intervention, provider skills, attitudes towards intervention effectiveness, experience with the intervention's effectiveness, and financial resources for the introduction. The lowest importance ratings (median ≤ 5) were given to delivering the intervention being a fulltime job, competition between PA interventions, routine intervention delivery, and coordination of the intervention in one place. Most important factors that were included in the second round questionnaire (median ≥ 8 and mean ≥ 7.64 for the adoption stage; median ≥ 8 and mean ≥ 7.70 for the implementation stage; median ≥ 8 and mean ≥ 7.76 for the continuation stage) are shown in Table 1. Two out of 89 factors were found to be changeable by the majority of experts (median ≥ 6; IQR ≤ 2): provider knowledge and provider attitudes towards the intervention's effectiveness.

Exploratory one-way independent ANOVAs suggested that the groups of experts differed from one another primarily with regard to how they rated factors' changeability; significant differences between the groups on changeability ratings were found for around half of the factors. Furthermore, significant differences between the groups were found for 21 out of 267 importance ratings. Groups of experts differed mostly from one another with regard to how they rated factors' importance for the adoption stage (i.e., 16 out of 21 ratings). In general, PHC professionals rated factors more important and changeable compared to other experts. When experts replied to the open-ended questions on possible missing factors, they provided no 'new' factors, but gave a more detailed description of factors already in the list or commented on the complexity of the introduction of PA interventions in PHC.

Second round

With regard to the top-10s of most important factors, intervention's financial feasibility, intervention's accessibility to the target group, and time to deliver the intervention were rated as most important factors for all three stages. Other factors indicated as most important for the adoption stage were: presence of a public health problem, support for the intervention from insurance companies, support for the intervention from professionals within the organization, presence of intervention champions within the organization, and provider attitudes towards PA, the intervention, and its effectiveness. Other factors important to the implementation stage were: participants' feedback, presence of the target group within the organization, provider knowledge, skills, motivation to deliver the intervention, and experience with the intervention's effectiveness, and introduction's success. For the continuation stage additional important factors were: intervention's sustainability, network between PHC and local PA or sport facilities, participants' feedback, presence of the target group within the organization, provider motivation to deliver the intervention, introduction's success, and availability of a list of local PA or sport facilities.

From the 37 factors identified as most important from the first round, there was consensus on the changeability of 24 factors (IQR ≤ 2). Among these factors, 23 factors were indicated as changeable (median ≥ 6) and one factor was perceived as unchangeable (i.e., financial resources for the

introduction process). With regard to the top-10 most important factors for the distinct stages of the process, there was consensus on the changeability of more than half of the factors. From the three factors important for all three stages, only intervention's financial feasibility was rated as changeable by the majority of experts (median = 6; IQR = 2). There was no consensus on the changeability of intervention's accessibility to the target group and time to deliver the intervention. Except for presence of a public health problem, all other most important factors for the adoption stage were considered changeable by the majority of experts. For the most important factors for the implementation stage, participants' feedback, provider knowledge, skills, and motivation to deliver the intervention were commonly perceived as changeable. There was no consensus on the changeability of the other three factors. For the factors in the top-10 of most important factors for the continuation stage, there was consensus on the changeability of network between PHC and local PA or sport facilities, participants' feedback, provider motivation to deliver the intervention, and availability of a list of local PA or sport facilities. There was no consensus on the changeability of the other three factors.

Exploratory one-way independent ANOVAs suggested that the groups of experts differed on how they ranked four out of 37 factors and on how they rated the changeability of eight out of 37 factors. In general, PHC professionals rated factors more changeable compared to other experts. Similarly to the first-round questionnaire, experts did not indicate factors were missing in the list.

Table 1. **Most important factors, stages, and changeability (including consensus)**

Round 1	Round 2 Stage	Stage & changeability
Factors related to the innovation		
Sustainability	A & C	Continuation
Time investment	Implementation	
Financial feasibility for PHC organizations and professionals	A, I, & C	A, I, & C[c]
Accessibility to the target group	A, I, & C	A, I, & C
Fit with PHC organizations' and professionals' objectives	Adoption	
Possibility to tailor intervention to participants' needs	Implementation	
Complexity of organization intervention	Continuation	
Evidence for intervention effectiveness	Continuation	
Factors related to the socio-political context		
Presence of a public health problem	Adoption	Adoption
Support for intervention from government	A, I, & C	
Support for intervention from insurance companies	A, I, & C	Adoption[c]
Support for intervention from local authorities	I & C	
Support for intervention from PHC professionals	A, I, & C	
Presence of intervention champions within community	Adoption	
Availability of PA or sport facilities within community	Continuation	
Network between intervention developer and external parties	Continuation	
Network between PHC and local PA or sport facilities	Continuation	Continuation[c]

Table 1. **Most important factors, stages, and changeability (including consensus) (continued)**

Round 1	Round 2 Stage	Stage & changeability
Factors related to the organization		
Time to deliver the intervention	A, I, & C	A, I, & C
Presence of the target group within the organization	I & C	I & C
Support for intervention from management	Adoption	
Support for the intervention from professionals within the organization	A & I	Adoption[C]
Presence of intervention champions within the organization	Adoption	Adoption[C]
Factors related to the patient		
Participants' feedback	I & C	I & C[C]
Relationship between provider and participant	Continuation	
Potential participants' enthusiasm	I & C	
Factors related to the adopting person		
Provider knowledge	Implementation	Implementation[C]
Provider skills	I & C	Implementation[C]
Provider motivation to deliver the intervention	I & C	I & C[C]
Provider attitudes towards PA	Adoption	Adoption[C]
Provider attitudes towards the intervention	A & I	Adoption[C]
Provider attitudes towards intervention effectiveness	A, I & C	Adoption[C]
Provider experience with intervention effectiveness	I & C	Implementation
Factors related to the innovation strategy		
Introduction's success	I & C	I & C
Time to introduce intervention	A & I	
Intervention materials (participants)	Implementation	
Availability of list of local PA or sport facilities	Continuation	Continuation[C]
Financial resources for introduction	A, I, & C	

Note. A, adoption; I, implementation; C, continuation; [C], consensus on changeability + changeable

Discussion

The objective of this study was to identify factors most relevant for the adoption, implementation, and continuation of PA interventions in PHC by examining experts' opinions on the importance and changeability of an extensive set of potentially influencing factors based on previous research [130,131].

Factors related to time and money, i.e., time to deliver the intervention within the organization, intervention's financial feasibility for PHC organizations and professionals, and intervention's accessibility to the target group, which is most optimal when the intervention is free-of-charge,

were found to be important to all three stages. This is not such an unexpected finding, since time and money are important factors in any kind of process and they are frequently mentioned in the leading theoretical models on the introduction of innovations in health care [17,27] and empirical studies [58,130,131]. With regard to the changeability of these factors, there was only consensus on intervention's financial feasibility, which was rated as changeable, and thus a potentially relevant factor to take into account when introducing PA interventions in PHC. Experts' rating of intervention's financial feasibility as changeable and availability of financial resources for the introduction process as unchangeable, might be explained by the fact that financial resources for the introduction process are often dependent on external funding, whereas intervention's financial feasibility (i.e., the balance between time investment and reimbursement) is mostly within the intervention developers' own control.

In line with Grol et al. [5] and Fixsen et al. [18] who suggested that different factors may be of critical importance within the distinct stages of the introduction process, the majority of factors were found to be stage specific. With regard to PHC organizations' and professionals' adoption of PA interventions, results suggest that it is important that there is a public health problem that can be solved by delivering PA interventions and that interventions obtain socio-political support. Furthermore, PHC professionals' support for the intervention is important for adoption, which is also illustrated by the importance of professionals' positive attitudes towards PA, the intervention, and the intervention's effectiveness in this stage. In addition, intervention champions were found to facilitate PHC organizations' and professionals' decision to start working with an intervention. The importance of political and financial support for the adoption process has been previously described by Fixsen et al. [18] and is associated with the presence of a public health problem. Furthermore, the importance of the presence of intervention champions within the adoption stage has been confirmed by Carlfjord et al. [137] and Huijg et al. [131] and might reflect the idea that the adoption of PA interventions requires some degree of awareness [18]. Support for the intervention from professionals within PHC organizations can be seen as an important social influence during the adoption process, which together with provider attitudes is a key construct in behavior change theory [138,139]. Except for presence of a public health problem, all factors rated as most important for the adoption stage were found to be changeable, and are thus relevant when designing introduction strategies. For example, attitudes might be changed by arguments and direct experience [15] and intervention champions can be identified and given more emphasis. For the implementation of PA interventions it appears to be important that PHC professionals are capable (i.e., have sufficient knowledge and skills) to deliver the intervention and that they experience the intervention's effectiveness. These results are in line with Bartholomew et al. [15] who state that behavioral capability, skills, self-efficacy, and reinforcement become more important when evolving from the adoption to the implementation of health promotion interventions. Only capability was found to changeable, which can be targeted by the provision of a workshop, which increased PA promotion in previous studies [87,96,103,119]. Factors specifically important for the continuation stage were the intervention's sustainability and factors related to participants' maintenance of PA within the community, i.e., the presence of a network between PHC and local PA or sport facilities, and availability of a list of local PA or sport facilities. Experts agreed that the latter two factors may be targeted in innovation strategies to facilitate long term delivery of PA interventions. The presence of the target group within the organization and the introduction's success both facilitate the implementation and continuation of PA interventions in PHC. Furthermore, providers must be

motivated and receive participants' feedback to deliver the intervention in the right way and for a longer period of time, which were found to be changeable following the majority of experts.

Although based on exploratory analysis and no final conclusions can be drawn due to the small sample sizes for all groups, the findings suggest that experts vary with regard to how they rate factors' importance and changeability depending on the function they have. In general, PHC professionals rated factors more important and changeable than other experts. Differences in changeability ratings might be explained by the fact that experts were asked to rate their personal influence on factors, which is likely to be influenced by the experts' function. Indeed, in the second round, when general (and not personal) changeability of factors was assessed, a decrease in differences between the expert groups was found.

Some limitations of the study should be noted here. First, by using factors identified through a systematic literature review and a qualitative study as a basis for the first-round questionnaire, we adapted the traditional Delphi method, which usually begins with an open-ended questionnaire to explore experts' opinions. Advantages of this modification are that it reduces experts' workload and that the study has a solid ground in previous empirical work [140]. Disadvantages might be that experts do not recognize the factors, since they have not forwarded these themselves, and that they perceive factors missing in the predesigned questionnaire. However, the latter appeared not the case from our analysis of the response to the open-ended questions. Second, only factors with the highest mean scores on importance were included in the second questionnaire, instead of including all factors rated as important (i.e., median scores ≥ 8). This method of selecting factors was chosen to avoid burdening experts with too many items to decide on their top-10s or with another questionnaire round. Third, using the top-10 ranking of factors as a cut-off point to define most important factors for each stage might be an arbitrary choice, since factors rated 11th, 12th, and so on, could also be important for the introduction process. On the other hand, the method of the study allowed for prioritization of factors. For instance, support for the intervention from insurance companies was rated as important for all three stages in the first round, whereas the results of the second round indicated that this factor was perceived as specifically important for the adoption stage. Fourth, in the first round, where experts rated their personal influence on factors, the lack of consensus might be explained by experts' different experiences with the introduction of PA interventions in PHC. Although rates on general changeability increased consensus, round two was insufficient in reaching consensus on all factors' changeability.

Conclusion

To our knowledge, this was the first study that identified general and stage-specific factors relevant and most important for the adoption, implementation, and continuation of PA interventions in PHC. The results confirm the importance of taking into account the distinct stages and their specific determinants when designing introduction strategies as previously suggested by Grol et al. [5] and Fixsen et al. [18]. Knowledge on which factors are most important for the distinct stages and how changeable they are, can inform policy makers, intervention managers, and PHC advisors in the development of successful introduction strategies. Since consensus could not be reached on the changeability of all most important factors, the extent to which these factors can be influenced by introduction strategies needs further investigation. Finally, researchers can use this

explorative study as a basis to further investigate the relationship between these potentially important factors and PHC organizations' and professionals' decisions to work with PA interventions, the way they deliver them to the target group, and the continuation of PA interventions in PHC over a longer period of time.

Appendix 1. **Items and results**

	Round 1								Round 2				
	Importance						Changeability		Importance			Changeability	
	A		I		C				A	I	C		
	Mdn	M (≥7.64)	Mdn	M (≥7.70)	Mdn	M (≥7.76)	Mdn	IQR	Sum of points			Mdn	IQR
Factors related to the innovation													
Evidence-base	7	6.77	7	6.23	7	6.43	7	4	-	-	-	-	-
Extent to which intervention is known	8	7.20	7	6.61	7	6.50	7	3	-	-	-	-	-
Sustainability	8	**8.05**	8	7.61	8	**8.18**	6	4	99	-	104	5	4
Time investment	8	7.27	8	**7.77**	8	7.64	5	5	-	73	-	6	2
Financial feasibility for PHC organizations and professionals	8.5	**8.45**	9	**8.52**	9.5	**8.98**	5	5	186	141	157	6	2
Intervention's accessibility to the target group	8	**7.75**	8	**8.20**	8.5	**8.36**	5	4	158	123	113	5	3
Delivering intervention is fulltime job	5	5.18	5	5.32	6	5.61	4	6	-	-	-	-	-
Balance between tasks	7	7.00	8	7.36	8	7.73	5.5	5	-	-	-	-	-
Fit with socio-political context	7	6.95	7	7.27	8	7.48	6	5	-	-	-	-	-
Fit with organizational logistics	7	6.66	7	6.82	7	7.05	6	5	-	-	-	-	-
Fit with PHC organizations' and professionals' objectives	8	**7.68**	7	7.05	7	7.16	6	3	82	-	-	7	2
Fit with PHC professionals' knowledge	7	7.09	8	7.43	8	7.32	7	4	-	-	-	-	-
Fit with PHC professionals' routines	7	6.66	7	6.98	7	7.36	6	3	-	-	-	-	-
Relative advantages for socio-political context	7	6.73	7	6.55	7	7.25	6	4	-	-	-	-	-
Relative advantages for PHC organizations	7	7.16	7.5	6.93	7	7.14	5	4	-	-	-	-	-
Relative advantages for PHC professionals	8	7.30	7.5	7.07	8	7.52	5	4	-	-	-	-	-
Possibility to tailor intervention to participants' needs	8	7.34	8	**7.86**	8	7.70	7	4	-	80	-	7	2
Possibility to tailor to PHC organizations' and professionals' needs	8	7.41	8	7.52	8	7.55	6	5	-	-	-	-	-
Complexity of organization intervention	7.5	7.36	8	7.64	8	**7.86**	6	4	-	-	87	7	2
Evidence for intervention effectiveness	8	7.48	8	7.30	8.5	**7.91**	5	5	-	-	35	5	3
Factors related to the socio-political context													
Presence of a public health problem	8	**8.09**	7	6.98	7	6.68	2.5	5	113	-	-	3	4
Media attention	7.5	7.09	6.5	6.18	6	5.93	5	4	-	-	-	-	-
Socio-political medical culture (preventive)	7	6.77	7.5	7.00	7	6.80	4.5	4	-	-	-	-	-
Formal education on PA and interventions	7	7.05	7	6.75	7	6.30	5	5	-	-	-	-	-
Support for intervention from government	8	**8.14**	8	**7.70**	8	**7.77**	4.5	5	65	22	52	5	3
Support for intervention from insurance companies	9	**8.59**	9	**8.73**	9	**8.66**	5	4	107	67	85	6	2

Appendix 1. **Items and results (continued)**

	Round 1								Round 2				
	Importance						Changeability		Importance			Changeability	
	A		I		C				A	I	C		
	Mdn	M (≥7.64)	Mdn	M (≥7.70)	Mdn	M (≥7.76)	Mdn	IQR	Sum of points			Mdn	IQR
Support for intervention from local authorities	8	7.61	8	**7.84**	8	**8.07**	5	4	-	61	65	6	1
Support for intervention from PHC professionals	8	**7.84**	8	**7.75**	8	**8.09**	7	3	77	34	27	7	2
Support for intervention from PHC organizations	8	7.45	8	7.50	8	7.59	6.5	4	-	-	-	-	-
Presence of intervention champions within community	8	**8.16**	7.5	7.34	7	7.07	6	4	50	-	-	6	3
Availability of PA or sport facilities within community	6	5.91	7	7.25	8	**7.84**	3.5	6	-	-	90	7	3
Network between intervention developer and external parties	7	7.18	8	7.52	8	**7.89**	7	4	-	-	59	7	2
Network between intervention developer and PHC organizations and professionals	7	7.36	7	7.41	7	7.36	7	3	-	-	-	-	-
Network between intervention providers	7	7.00	8	7.34	8	7.59	6	5	-	-	-	-	-
Network between PHC and local PA or sport facilities	7	6.39	8	7.36	9	**8.00**	6	4	-	-	129	7	2
Collaboration between intervention developer and intervention partners	7.5	7.34	8	7.52	8	7.61	7	3	-	-	-	-	-
Collaboration between different PA interventions	5.5	5.52	6	5.50	7	6.45	6	4	-	-	-	-	-
Collaboration between intervention providers	7	6.57	8	7.14	8	7.39	6	4	-	-	-	-	-
Socio-political medical culture (curative)	8	7.55	8	7.25	8	7.36	3.5	4	-	-	-	-	-
Competition between PA interventions	6	6.09	5.5	5.61	5	5.52	3	3	-	-	-	-	-
Factors related to the organization													
Time to deliver the intervention	8	**7.86**	8	**8.39**	9	**8.64**	4	6	120	148	92	6	4
Presence of the target group within organization	8	7.50	8	**7.91**	8	**7.82**	3	5	-	114	120	5	4
Support for intervention from management	8	**7.70**	8	7.50	8	7.57	5	6	82	-	-	7	2
Routine of intervention tasks within organization	7	6.50	8	7.36	8	7.45	5	4	-	-	-	-	-
Support for intervention from professionals within organization	8	**7.86**	8	**7.82**	8	7.75	7	4	164	56	-	7	2
Presence of intervention champions within organization	8	**8.00**	7	7.30	7	6.82	6	5	162	-	-	6	2
Collaboration within organization	7	6.98	8	7.55	8	7.59	6	5	-	-	-	-	-
Presence of PA or sport facilities within organization	6	6.20	7	6.61	7	6.45	4	5	-	-	-	-	-
Organizational medical culture (curative)	8	7.34	7	7.00	7	6.98	4	5	-	-	-	-	-

Appendix 1. **Items and results (continued)**

	Round 1								Round 2				
	Importance						Changeability		Importance			Changeability	
	A		I		C				A	I	C		
	Mdn	M (≥7.64)	Mdn	M (≥7.70)	Mdn	M (≥7.76)	Mdn	IQR	Sum of points			Mdn	IQR
Factors related to the patient													
Participants' feedback	8	7.18	8	**8.07**	9	**8.48**	5	5	-	105	93	7	2
Relationship between provider and participant	7	6.82	8	7.61	8	**7.86**	4.5	6	-	-	66	7	2
Potential participants' enthusiasm	7	7.07	8	**7.98**	8	**8.05**	5	5	-	53	21	7	3
Potential participants have other aims for consultation	7	6.59	7	6.52	7	6.66	5	5	-	-	-	-	-
Potential participants' medical culture (curative)	7	6.93	6.5	6.66	6.5	6.75	4	5	-	-	-	-	-
Factors related to the adopting person													
Knowledge	7	7.14	8	**7.80**	8	7.45	7	2	-	82	-	8	0
Skills	7	7.25	8	**8.11**	9	**8.05**	7	3	-	166	53	8	1
Experience with PA intervention	6.5	6.00	6	6.20	7	6.55	4	4	-	-	-	-	-
Experience with target group	7	6.64	8	7.43	7	7.02	4	6	-	-	-	-	-
Motivation to deliver intervention	8	7.45	8	8.14	8	8.16	7	3	-	171	94	7	2
Self-efficacy	7	7.14	8	7.43	8	7.36	6	5	-	-	-	-	-
Perception that he or she plays an important role in the intervention's effectiveness	8	7.48	8	7.55	8	7.68	7	3	-	-	-	-	-
Attitudes towards PA	8	**7.73**	8	7.32	7.5	7.20	6	5	158	-	-	7	2
Attitudes towards the intervention	8	**7.70**	8	**7.82**	8	7.73	7	5	131	67	-	7	2
Attitudes towards prevention	8	7.48	7.5	7.09	8	7.14	6	4	-	-	-	-	-
Perception on role or responsibilities with regard to prevention and PA interventions	8	7.43	7	7.18	7	7.14	6	3	-	-	-	-	-
Attitudes towards intervention effectiveness	8	**8.07**	8	**7.95**	9	**8.20**	7	2	151	52	56	8	2
Experience with intervention effectiveness	8	7.09	8	**8.30**	9	**8.75**	7	4	-	119	83	6	3
Priority of intervention delivery	7	6.80	8	7.32	8	7.41	4	4	-	-	-	-	-
Routine of intervention delivery	5	5.73	7	6.70	7	7.09	5	4	-	-	-	-	-
Attitudes towards the target group (motivation)	7	7.00	8	7.27	8	7.45	5	3	-	-	-	-	-
Attitudes towards the target group (maintenance of behavior change)	7	6.66	7	7.09	8	7.30	**5**	**4**	-	-	-	-	-
Perception on effect of intervention on relationship with patients	6	5.86	6	6.07	6	5.98	5	4	-	-	-	-	-

Appendix 1. **Items and results**

	Round 1								Round 2				
	Importance						Changeability		Importance			Changeability	
	A		I		C				A	I	C		
	Mdn	M (≥7.64)	Mdn	M (≥7.70)	Mdn	M (≥7.76)	Mdn	IQR	Sum of points			Mdn	IQR
Factors related to the innovation strategy													
Introduction success	8	7.18	8	**7.84**	8	**8.50**	6	4	-	139	181	6	3
Coordination of intervention in one place	5	5.30	6	5.86	6	5.80	5	5	-	-	-	-	-
Stakeholder involvement in development of intervention	8	7.52	7	7.14	7	7.02	6	4	-	-	-	-	-
Time to introduce intervention	8	**7.73**	8	**7.89**	8	7.32	6	3	70	55	-	7	2
Clarity on tasks	8	7.48	8	7.39	8	6.82	6.5	4	-	-	-	-	-
Clarity on roles	8	7.34	7.5	7.34	7.5	7.07	7	4	-	-	-	-	-
Materials (participants)	7	7.23	8	**7.75**	8	7.20	7	4	-	53	-	8	2
Materials (providers)	7.5	7.18	8	7.41	8	7.20	7	3	-	-	-	-	-
Availability of list of local PA or sport facilities	7	6.77	8	7.45	8	**7.93**	6.5	4	-	-	94	8	2
Reminders	6	5.55	6.5	6.11	7	6.23	5.5	5	-	-	-	-	-
Refinement	6	5.93	7	6.80	8	7.30	7	4	-	-	-	-	-
Research	7	6.84	7	6.45	7	6.95	8	3	-	-	-	-	-
Assistance	8	7.34	8	7.48	7.5	7.18	7	4	-	-	-	-	-
Training	8	7.57	8	7.59	8	7.30	8	5	-	-	-	-	-
Intervision	7	6.80	7	7.20	8	7.30	7.5	3	-	-	-	-	-
Financial resources for introduction	8	**8.02**	8	**8.39**	9	**8.64**	5	5	60	54	79	5	2
Intervention readiness	7	6.59	7	6.86	8	7.27	6	4	-	-	-	-	-

Note. A, adoption; I, implementation; C, continuation; Mdn, median; M, mean; IQR, interquartile range

Bold mean scores indicate most important factors for each stage as scored in the first round, which was based on factors' median score (≥ 8) and mean score (mean ≥ 7.64 for the adoption stage; mean ≥ 7.70 for the implementation stage; mean ≥ 7.76 for the continuation stage). These factors were included in the second round questionnaire.

Underlined sum of points indicate the top-10 of most important factors for each stage as rated in the second round.

Chapter 5

Discriminant content validity of a Theoretical Domains Framework questionnaire for use in implementation research

Huijg JM, Gebhardt WA, Crone MR, Dusseldorp E, Presseau J.
Discriminant content validity of a Theoretical Domains Framework Questionnaire for use in implementation research.
Implementation Science 2013;9:11.

Abstract

Background

To improve the implementation of innovations in health care settings it is important to understand factors influencing health care professionals' behaviors. We aimed to develop a generic questionnaire in English and in Dutch assessing the 14 domains of behavioral determinants from the revised TDF (Cane et al., 2012) that can be tailored to suit different targets, actions, contexts, and times of interest, and to investigate questionnaire items' discriminant content validity.

Method

We identified existing questionnaires including items assessing constructs within TDF domains and developed new items where needed. Nineteen judges allocated 79 items to one or more TDF domains. One-sample *t*-tests were used to examine the discriminant content validity of each item, i.e., whether items measured intended domains or whether items measured a combination of domains.

Results

We identified items judged to discriminately measure 11 out of 14 domains. Items measuring the domains *Reinforcement, Goals*, and *Behavioral regulation* were judged to measure a combination of domains.

Conclusion

We have developed a questionnaire in English and in Dutch able to discriminately assess the majority of TDF domains. The results partly support Cane et al.'s (2012) 14-domain validation of the TDF and suggest that Michie et al.'s (2005) 12-domain original version might be more applicable in developing a TDF-based questionnaire. The identified items provide a robust basis for developing a questionnaire to measure TDF-based determinants of health care professionals' implementation behaviors to suit different targets, actions, contexts, and times. Future research should investigate the concurrent and predictive validity and reliability of such a questionnaire in practice.

Background

Health care professionals routinely deliver pharmacological and behavior change interventions to their patients to promote health and prevent disease. However, as the evidence-base for effective interventions is continuously developing, the transfer of such evidence into routine practice often does not happen as desired [1,4,141]. For example, primary care-based interventions for increasing physical activity (PA) are effective [61–63,142], yet rates of PA counseling by health care professionals are suboptimal [50,51], as is the fidelity of delivery of PA interventions [1,53,54]. This gap between research and practice reduces the impact that effective behavior change interventions can have on public health [10,15]. Implementation research aims to bridge this gap by investigating methods to promote health care professionals' uptake of research findings, including the study of factors influencing health care professional behavior [6,34].

Improving the adoption and implementation of evidence-based interventions into routine practice involves changes in health care professionals' behaviors that may be influenced by a range of individual, organizational, and social factors [5,7,17,24,27]. Identifying the key factors associated with health care professional behavior can provide a basis for developing interventions to help health care professionals to use research findings more effectively [34]. Given the range of potential factors associated with behavior, many advocate the use of theory to guide the selection of factors to investigate [6,22,36,43]. In addition, the UK Medical Research Council guidance on developing and evaluating complex interventions recommends the use of theory in the intervention development phase [143]. The advantages of a theory-based approach are numerous: theory allows for a shared understanding, for the development of a cumulative science that limits the re-invention of existing concepts, and importantly is based on constructs which have been investigated, for which measures can be validated and standardized and have been shown to provide a useful account of behavior [144]. Furthermore, investigating the relationship between theory-based factors and health care professional behavior provides an opportunity to identify factors that can be targeted by implementation interventions to change health care professional behavior [6,35–37].

The number and heterogeneity of potential theories that might be used to guide implementation research poses a challenge to researchers wanting to assess and identify theory-based factors underlying health care professional behavior [22,32,64,145]. The Theoretical Domains Framework (TDF) [31] was developed as an integrative framework of theories of behavior change to overcome these challenges. The framework includes 12 theoretical domains of potential behavioral determinants and provides exemplar questions for the theoretical assessment of implementation problems. The framework has been used in a number of studies and was demonstrated to be useful for the development of qualitative [44,45] and quantitative [46–48] measurement tools to assess potential implementation behavior determinants. However, factor analysis implied that only one out of these three questionnaires was able to measure the theoretical domains independently [48]. Furthermore, the questionnaires were developed to assess determinants of specific implementation behaviors in specific settings (i.e., tobacco use prevention and smoking cessation in dental health care [46], smoking cessation in maternal care [47], and different types of patient safety behaviors in hospitals [48]) and internal consistency reliability was low [46] or could be improved [47,48].

Since its original development, the consensus study that produced the TDF [31] has been validated, leading to Cane et al.'s [30] refined TDF. It extends the original TDF to include the following 14 domains: *Knowledge; Skills; Social/professional role and identity; Beliefs about capabilities; Optimism; Beliefs about consequences; Reinforcement; Intentions; Goals; Memory, attention and decision processes; Environmental context and resources; Social influences; Emotions;* and *Behavioral regulation.* Main differences between the original and the revised framework include the separation of the domain *Optimism* from the domain *Beliefs about capabilities* and the domain *Reinforcement* from the domain *Beliefs about consequences.* In addition, the domain *Motivation and goals* was divided into two separate domains, i.e., *Intentions* and *Goals*, and the domain *Nature of the behaviors* was omitted in the revised framework. Although the framework is suggested to be useful for the development of theory-based questionnaires for use in implementation research, the content of the TDF has not yet been validated on item level. Therefore, it is not clear whether questionnaire items based on this recent version of the framework will be able to measure the 14 domains independently.

In the present study we aimed to develop a questionnaire assessing the 14 TDF domains, worded in such a way to provide researchers the capacity to tailor the items to the targets, actions, contexts and times of interest [146], whilst retaining the essential theoretical content in each item. Furthermore, we aimed to test the discriminant content validity of each item within the questionnaire.

Method

Participants

Fifty-eight academics from the Netherlands were approached with details of the study and nineteen agreed to participate (response rate of 33%). They were either involved as experts in the field of behavior change, development of health behavior change interventions, or implementation of interventions in health care settings. They were recruited via the authors' networks. The sample size was based on estimates of between 3 and 20 participants as adequate for judgment tasks [147,148]. We included academics (instead of health care professionals) in this study, because the discriminant content validation (DCV) exercise of allocating items to TDF domains requires theoretical knowledge and experience with the specific domains.

Materials

We developed a questionnaire that initially included 79 items assessing each of the domains through their related key constructs (see Additional file 1). Constructs within domains were selected based on conceptual relatedness to the content of the domain (i.e., Knowledge, Procedural knowledge, Skills, Professional role, and Memory); inclusion in relevant theories frequently used in the field of behavior change (and thus ready access to existing items): the Theory of Planned Behavior [138] (i.e., Perceived behavioral control, Attitudes, Subjective norm, and Intention) and Social Cognitive Theory [139] (i.e., Self-efficacy, Outcome expectancies, and Social support); existence of validated scales (i.e., Optimism, Pessimism, Action planning, Attention, Affect, Stress, Automaticity, and Self-monitoring); and/or relevance to the implementation of PA interventions in routine health care by mapping factors resulting from previous research [131,149] onto the TDF

domains. JP and JMH independently identified that the constructs Reinforcement, Priority, Resources/materials, and Descriptive norm were salient in the previous PA-based research and thus these constructs were also included as construct-indicators of their respective domains.

Items measuring constructs within the domains *Knowledge, Beliefs about capabilities, Optimism, Beliefs about consequences, Intentions, Social influences, Emotion,* and *Behavioral regulation* were adapted from previously published questionnaires (i.e., [46,47,138,139,150–158]). Given lack of available questionnaires in the literature for some domains, new items were created for the domains *Skills, Social/professional role and identity, Reinforcement,* and *Environmental context and resources*. With regard to the domain *Goals*, items were newly developed for the construct Priority (as none could be located in the literature), while items measuring the construct Action planning were adapted from a previously published questionnaire [151]. With regard to the domain *Memory, attention, and decision making*, items measuring the construct Attention were adapted from a previously published questionnaire [156] and items measuring the construct Memory were newly developed. New items were developed based on discussions between JP and JMH. These discussions were informed by the academic literature on the concept and definition of specific domains and constructs, questions to identify behavior change processes as formulated by Michie et al. [31], and themes emerging from interviews on the implementation of PA interventions [131]. WAG and MRC supervised the development of the questionnaire and reviewed items' face validity.

To develop a questionnaire which could be used by researchers in different fields of implementation research, items were formulated in a generic way using a '[action] in [context, time] with [target]' construction based on the 'TACT principle' [146], whereby researchers can specify the target, action, context, and time relevant to their research. The questionnaire was developed in English, then translated to Dutch and back-translated to English by an independent translator. The small amount of differences between the original and back-translated version of the questionnaire were discussed and adaptations were made.

Procedure

In May and June 2012 participants were sent an email including the link to the online DCV exercise [159,160]. After one and two weeks non-respondents received a reminder. Participants were provided with the aim of the study and an explanation of the DCV exercise. Then, they were asked to report their expertise on each of the 14 TDF domains on a 7-point Likert scale (1 = I am a layman with regard to this domain; 7 = I am an expert with regard to this domain).

We used Cane et al.'s [30] definitions of the 14 TDF domains (see Table 1), which were presented at the top of each rating page. The items of the questionnaire were listed below the definitions, in a random order. Participants were asked to consider carefully the meaning of each item and allocate it to the domain they perceived the item measures using the domain definitions provided. To determine whether items were deemed to discriminately measure domains or if they measure a combination of domains, participants were asked to allocate each of the 79 items to up to three domains. Upon allocating items, judges were asked to rate their confidence in each allocation between 0% and 100% (0% = not at all confident; 100% = extremely confident). For example, a judge could allocate an item to the domain *Knowledge* and rate their confidence 60% and allocate the same item to the domain *Skills* and rate their confidence 20%.

Table 1. **Definitions of the domains of the TDF [30]**[1]

Domain		Definition
D1	Knowledge	An awareness of the existence of something
D2	Skills	An ability or proficiency acquired through practice
D3	Social/professional role and identity	A coherent set of behaviors and displayed personal qualities of an individual in a social or work setting
D4	Beliefs about capabilities	Acceptance of the truth, reality, or validity about an ability, talent, or facility that a person can put to constructive us
D5	Optimism	The confidence that things will happen for the best or that desired goals will be attained
D6	Beliefs about consequences	Acceptance of the truth, reality, or validity about outcomes of a behavior a given situation
D7	Reinforcement	Increasing the probability of a response by arranging a dependent relationship, or contingency, between the response and a given stimulus
D8	Intentions	A conscious decision to perform a behavior or a resolve to act in a certain way
D9	Goals	Mental representations of outcomes or end states that an individual wants to achieve
D10	Memory, attention and decision processes	The ability to retain information, focus selectively on aspects of the environment and choose between two or more alternatives
D11	Environmental context and resources	Any circumstance of a person's situation or environment that discourages or encourages the development of skills and abilities, independence, social competence, and adaptive behavior
D12	Social influences	Those interpersonal processes that can cause individuals to change their thoughts, feelings, or behaviors
D13	Emotion	A complex reaction pattern, involving experiential, behavioral, and physiological elements, by which the individual attempts to deal with a personally significant matter or event
D14	Behavioral regulation	Anything aimed at managing or changing objectively observed or measured actions

[1]As described in Cane et al. [30] definitions are based on definitions from the American Psychological Associations' Dictionary of Psychology [161]

Data analysis

Classification of items

Ratings for matching items and domains (i.e., items judged to assess the domain they were designed to assess) were coded 1 (a 'match'), whereas items judged to assess a different domain were coded -1 (a 'no match'); missing variables were scored 0. Each judgment was multiplied by its accompanied confidence rating (e.g., .20, .40, .80). As a consequence, the weighted judgments ranged from -1 to 1.

DCV analysis

Following Dixon et al. [159,160], we used one-sample one-tailed *t*-tests to investigate whether each item was classified by the judges to represent the domain that the item aimed to measure. Judges were provided with three possibilities to allocate an item to a domain, therefore, the sum of the three weighted judgments was used for the one-sample *t*-tests. An item was classified as measuring a domain if its weighted judgment against that domain was significantly greater than

zero ($p < .05$) [159]. The false discovery rate controlling procedure [162] was used to correct for multiple tests. Items that were classified to the correct (i.e., intended) domain were included in the final questionnaire, whereas items that were allocated to more than one domain or that were classified to a domain other than the intended domain were not included. Analyses were performed in IBM SPSS Statistics version 19.0 [136].

Inter-rater agreement

A generalization of Cohen's Kappa (i.e., Light's Kappa [163]) was calculated to assess agreement between judges across their allocation of all items to domains. For this calculation, we used the first domain that judges selected to represent the item. This was justified as the data indicated that judges used the first selected domain as the most preferable domain (i.e., domain with the highest confidence ratings) to allocate an item to. As a consequence, the 79 items were scored between 1 and 14 (representing the domain it was allocated to) for each judge separately. This resulted in a data matrix composed of 79 rows (i.e., the items) and 19 columns (i.e., the judges). We also assessed inter-rater agreement for allocation of items to each domain. For this calculation, the 79 items were scored between 1 and 0 for each domain separately (representing if it was selected to the specific domain or not) and for each judge separately. This resulted in 14 data matrices, one for each domain, consisting of 79 rows and 19 columns. These analyses were repeated for the final set of items that was selected based on the DCV analysis. In line with previous research, κ-values of between .00 and .20 were labeled as slight agreement, values from .21 to .40 as fair agreement, values from .41 to .60 as moderate agreement, values from .61 to .80 as substantial, and values from .81 to 1.00 as almost perfect [164]. Analyses were performed in the R software environment [165], using the R-package 'Psy' [166].

Ethics

The Medical Ethics Committee of the Leiden University Medical Centre gave ethics approval for this study (reference number NV/CME 09/081).

Results

Judges' expertise in the use of domains

Descriptive statistics of judges' expertise in the use of each domain are shown in Table 2. Mean scores indicated that judges had at least some expertise on each domain. On average, judges rated that they had most expertise on the domains *Intentions* and *Goals*, whereas lowest expertise ratings were given to the domains *Social/professional role and identity*, and *Memory, attention, and decision processes*. Only three judges indicated to be a layman on, respectively, one, two, and seven domains.

Neither judges' expertise with TDF domains nor their academic level (i.e., PhD student, PhD, Professor) was related to their performance on the classification of items to domains calculated as the number of 'matches'. Pearson's correlations were respectively $r = -.35$ ($p = .14$) and $r = -.16$ ($p = .52$).

Table 2. **Judges' expertise on domains**

Domains		Mean	(SD)
D1	Knowledge	4.63	(1.01)
D2	Skills	5.21	(0.71)
D3	Social/professional role and identity	3.47	(1.81)
D4	Beliefs about capabilities	5.26	(1.45)
D5	Optimism	3.68	(1.70)
D6	Beliefs about consequences	4.68	(1.49)
D7	Reinforcement	4.63	(1.50)
D8	Intentions	5.53	(1.31)
D9	Goals	5.47	(1.02)
D10	Memory, attention, and decision processes	3.58	(1.68)
D11	Environmental context and resources	4.11	(2.08)
D12	Social influences	5.32	(1.20)
D13	Emotion	4.11	(1.60)
D14	Behavioral regulation	5.26	(1.45)

Note. 1 = I am a layman with regard to this domain; 7 = I am an expert with regard to this domain

DCV results

Table 3 shows the results of the DCV analysis. Of 79 items, 32 were classified as measuring the intended domain and therefore included in the final questionnaire. Forty-seven items were allocated to more than one domain, of which 39 items were allocated to the intended domain as well as additional domains, while eight items were classified as measuring a domain other than the item aimed to measure. Table 4 shows Kappa values for the agreement between judges based on all 79 items of the initial questionnaire and the 32 items included in the final questionnaire. The final lists of items measuring TDF domains are shown in Table 5 (English) and Table 6 (Dutch).

Knowledge

The domain *Knowledge* was defined as "An awareness of the existence of something" [30]. Of the six *Knowledge* items included in the DCV exercise, four items were classified as measuring the domain *Knowledge* (Table 4) and were included in the final questionnaire. Two items were allocated to more than one domain. In addition to the domain *Knowledge*, these items were amongst others allocated to the domain *Skills*. The extent to which judges agreed on which items measured the domain was substantial when including all items (κ = .76; 95% C.I. .63-.87; Table 4) and almost perfect for the 32 final items (κ = .88; 95% C.I. .77-.96; Table 4).

Skills

The domain *Skills* was defined as "An ability or proficiency acquired through practice" [30]. Three out of four *Skills* items included in the DCV were classified as measuring the intended domain (Table 3) and were included in the final questionnaire. In addition to the domain *Skills*, nine judges allocated the item 'I have the proficiency to…' to the domain *Beliefs about capabilities*. With all items included, moderate agreement between judges was found for their allocation of items to the domain (κ = .58; 95% C.I. .35-.71; Table 4), while substantial agreement was found for the 32 final items (κ = .80; 95% C.I. .73-.87; Table 4).

Social/professional role and identity

The domain *Social/professional role and identity* was defined as "A coherent set of behaviors and displayed personal qualities of an individual in a social or work setting" [30]. All four *Social/professional role and identity* items included in the DCV were classified as measuring the intended domain (Table 3) and were included in the final questionnaire. The extent to which judges agreed on which items measured the domain was moderate with all items included (κ = .59; 95% C.I. .37-.75; Table 4) and almost perfect for the 32 final items (κ = .86; 95% C.I. .72-.93; Table 4).

Table 3. **DCV analysis of the questionnaire**

Domain		Construct	Item	Mean	*t*-value	Domain allocation if not classified to right domain (› 1)
D1	Knowledge	Knowledge (6)	I am aware of the content and objectives of [innovation/guideline]	.82	9.99*	-
			I know the content and objectives of [innovation/guideline]	.88	17.58*	-
			I am familiar with the content and objectives of [innovation/guideline]	.82	8.76*	-
			I am aware of how to [A] in [C, T] with [Ta]	.74	5.51*	-
			I know how to [A] in [C, T] with [Ta]	.20	1.03	*D1*, D2, D4, D14
			I am familiar with how to [A] in [C, T] with [Ta]	.44	2.63	*D1*, D2
D2	Skills	Skills (4)	I have been trained how to [A] in [C, T] with [Ta]	.86	16.42*	-
			I have the proficiency to [A] in [C, T] with [Ta]	-.01	-0.05	*D2*, D4
			I have the skills to [A] in [C, T] with [Ta]	.53	3.84*	-
			I have practiced [A] in [C, T] with [Ta]	.67	5.28*	-
D3	Social/professional role and identity	Professional role (4)	[A] in [C, T] with [Ta] is part of my work as a [profession]	.85	9.62*	
			As a [profession], it is my job to [A] in [C, T] with [Ta]	.89	29.74*	-
			It is my responsibility as a [profession] to [A] in [C, T] with [Ta]	.82	7.90*	-
			Doing [A] in [C, T] with [Ta] is consistent with my [profession]	.81	8.70*	-
D4	Beliefs about capabilities	Self-efficacy (2)	I am confident that I can [A] in [C, T] with [Ta] even when [Ta] is not motivated	.71	5.80*	-
			I am confident that I can [A] in [C, T] with [Ta] even when there is little time	.67	5.31*	-
		Perceived behavioral control (4)	I am confident that if I wanted I could [A] in [C, T] with [Ta]	.78	7.07*	-
			How much control do you have over [A] in [C, T] with [Ta]?	.02	0.11	*D4*, D2, D14
			For me, [A] in [C, T] with [Ta] is (Very difficult – very easy)	.40	2.17	*D4*, D2, D5
			For me, [A] in [C, T] with [Ta] is (Impossible – possible)	.33	2.21	*D4*, D2, D5, D6
D5	Optimism	Optimism (3)	With regard to [A] in [C, T] with [Ta] in uncertain times, I usually expect the best	.64	5.01*	-
			With regard to [A] in [C, T] with [Ta] I'm always optimistic about the future	.65	4.35*	-
			With regard to [A] in [C, T] with [Ta] overall, I expect more good things to happen than bad	.13	0.65	*D5*, D6
		Pessimism (3)	With regard to [A] in [C, T] with [Ta] if something can go wrong, it will	.43	3.13	*D5*, D4, D6
			With regard to [A] in [C, T] with [Ta] I hardly ever expect things to go my way	.03	0.14	*D5*, D4, D6
			With regard to [A] in [C, T] with [Ta] I rarely count on good things happening to me	.44	2.60	*D5*, D6
D6	Beliefs about consequences	Attitudes (2)	For me, [A] in [C, T] with [Ta] is (Useless – useful)	.45	2.71	*D6*, D5
			For me, [A] in [C, T] with [Ta] is (bad – good)	.42	2.82	*D6*, D1, D3
		Outcome expectancies (2)	If I [A] in [C, T] with [Ta] it will benefit public health	.60	4.44*	-
			If I [A] in [C, T] with [Ta] it will have disadvantages for my relationship with [Ta]	.58	4.14*	-

Table 3. **DCV analysis of the questionnaire (continued)**

Domain		Construct	Item	Mean	*t*-value	Domain allocation if not classified to right domain (⟩ 1)
D7	Reinforcement	Reinforcement (3)	Whenever I [A] in [C, T] with [Ta], I get financial reimbursement	.42	2.38	*D7*, D6
			Whenever I [A] in [C, T] with [Ta], I get recognition from professionals who are important to me	-.51	-3.77*	*D7*, D3, D6, **D12**
			Whenever I [A] in [C, T] with [Ta, I feel like I am making a difference	-.68	-7.14*	*D7*, D4, **D6**, D13
D8	Intentions	Intention (4)	For how many of the next 10 [Ta] do you intend to [A] in [C]?	.73	6.92*	-
			I will definitely [A] in [C] with [Ta] in the next [T]	.63	3.89*	-
			I intend to [A] in [C] with [Ta] in the next [T]	.66	5.83*	-
			How strong is your intention to [A] with [Ta] in [C] in the next [T]?	.89	20.60*	-
D9	Goals	Action planning (4)	I have a clear plan of how I will [A] in [C, T] with [Ta]	.47	2.75	*D14*, D8, *D9*
			I have a clear plan under what circumstances I will [A] in [C, T] with [Ta]	.26	1.22	*D14*, D8, *D9*
			I have a clear plan when I will [A] in [C, T] with [Ta]	.43	2.26	*D14*, D8, *D9*
			I have a clear plan how often I will [A] in [C, T] with [Ta]	-.18	-0.83	*D14*, D8, *D9*
		Priority (4)	Generally, in [C, T] with [Ta], how often is covering something else on your agenda a higher priority than [A]	-.58	-4.10*	*D9*, D3, **D10**, D11
			Generally, in [C, T] with [Ta], how often does covering something else on your agenda take precedence over [A]	-.58	-4.30*	*D9*, D3, **D10**, D11
			Generally, in [C, T] with [Ta], how often is covering something else on your agenda more urgent than [A]	-.49	-4.32*	*D9*, D3, **D10**, **D11**, *D14*
			Generally, in [C, T] with [Ta], how often is covering something else on your agenda more pressing than [A]	-.63	-4.82*	*D9*, D3, **D10**, D11
D10	Memory, attention and decision processes	Memory (4)	[A] in [C, T] with [Ta] is easy to remember	.32	1.64	*D10*, D1, **D4**
			How often do you forget [A] in [C, T] with [Ta]?	.63	4.55*	-
			How often do you have to check the [innovation/guideline] before [A] in [C, T] with [Ta]?	-.66	-5.52*	*D10*, **D1**, D4
			To what extent do you know [innovation/guideline] by heart to [A] in [C, T] with [Ta]?	-.91	-30.09*	**D1**
		Attention (4)	When I need to concentrate to [A] in [C, T] with [Ta], I have no trouble focusing my attention	.77	7.10*	-
			When I am working hard on [A] in [C, T] with [Ta], I still get distracted by events around me	.52	3.24	-
			When trying to focus my attention on [A] in [C, T] with [Ta], I have difficulty blocking out distracting thoughts	.68	5.06*	-

Table 3. **DCV analysis of the questionnaire (continued)**

Domain		Construct	Item	Mean	*t*-value	Domain allocation if not classified to right domain (⟩ 1)
			When concentrating on [A] in [C, T] with [Ta], I can focus my attention so that I become unaware of what's going on around me	.68	6.03*	-
D11	Environmental context and resources	Environmental context and resources (8)	[Innovation/guideline] has a good fit with routine practice	.22	1.44	*D11*, D1, D3
			[Innovation/guideline] provides the possibility to adapt it to the [Ta]'s needs (e.g., culture)	.25	1.55	*D11*, D3, D6, D12
			In the organization I work [A] in [C, T] with [Ta] is routine	-.02	-0.11	*D11*, D2, D3, D12, D14
			In the organization I work there is enough time to [A] in [C, T] with [Ta]	.42	2.24	*D11*, D3
			Within the socio-political context there is sufficient financial support (e.g., from local authorities, insurance companies, the government) for [innovation/guideline]	.86	13.48*	-
			Within the socio-political context there are good networks between parties involved in [innovation/guideline]	.74	9.35*	-
			Prior to delivery of [innovation/guideline] professionals are provided with a training to [A] in [C, T] with [Ta]	-.51	-3.29	*D11*, D2
			During the delivery of [innovation/guideline] professionals are provided with sufficient financial reimbursement to [A] in [C, T] with [Ta]	.13	0.69	*D11*, D7
D12	Social influences	Social support (4)	I can rely on the team of professionals with whom I deliver [innovation] when things get tough on [A] in [C, T] with [Ta]	-.35	-1.96	*D12*, D3, D11
			My colleagues are willing to listen to my problems related to [A] in [C, T] with [Ta]	.22	1.30	*D12*, D3, D11
			The team of professionals with whom I deliver [innovation] is helpful in getting [A] in [C, T] with [Ta] done	.14	0.74	*D12*, D11
			I can rely on my colleagues when things get tough on [A] in [C, T] with [Ta]	.07	0.38	*D12*, D3, D11
		Subjective norm (2)	Most people who are important to me think that I should [A] in [C, T] with [Ta]	.84	9.04*	-
			Most people whose opinion I value would approve me of [A] in [C, T] with [Ta]	.61	3.97*	-
		Descriptive norm (2)	The team of professionals with whom I deliver [innovation/guideline] [A] in [C, T] with [Ta]	.35	2.13	*D12*, D3, D11
			Respected colleagues [A] in [C, T] with [Ta]	.24	1.26	*D12*, D3, D11

Table 3. **DCV analysis of the questionnaire (continued)**

Domain	Construct	Item	Mean	*t*-value	Domain allocation if not classified to right domain (⟩ 1)
D13 Emotion	Affect (2)	Thinking about yourself and how you normally feel as a professional that delivers [innovation/guideline], to what extent do you generally feel inspired with regard to [A] in [C, T] with [Ta]	-.09	-0.49	*D13*, D3, D14
		Thinking about yourself and how you normally feel as a professional that delivers [innovation/guideline], to what extent do you generally feel nervous with regard to [A] in [C, T] with [Ta]	-.01	-0.05	*D13*, D3, D4
	Stress (2)	Have you recently, during the past two weeks been able to enjoy your normal day-to-day activities?	.55	3.55*	-
		Have you recently, during the past two weeks been feeling unhappy and depressed?	.78	6.95*	-
D14 Behavioral regulation	Automaticity (2)	[A] in [C, T] with [Ta] is something I do automatically	-.31	-0.20	*D14*, D2, D10
		[A] in [C, T] with [Ta] is something I do without thinking	-.45	-3.29	D2, D10
	Self-monitoring (4)	I keep track of my overall progress towards [A] in [C, T] with [Ta]	.27	1.57	*D14*, D7, *D9*, D13
		I tend to notice my successes while working towards [A] in [C, T] with [Ta]	-.39	-2.53	*D14*, *D9*
		I am aware of my day-to-day behavior as I work towards [A] in [C, T] with [Ta]	-.09	-0.49	*D14*, D8, *D9*, D10
		I check regularly whether I am getting closer to attaining [A] in [C, T] with [Ta]	.49	3.45	*D14*, *D9*
	Action planning (4)	I have a clear plan of how I will [A] in [C, T] with [Ta]	.47	2.75	*D14*, D8, *D9*
		I have a clear plan under what circumstances I will [A] in [C, T] with [Ta]	.26	1.22	*D14*, D8, *D9*
		I have a clear plan when I will [A] in [C, T] with [Ta]	.43	2.26	*D14*, D8, *D9*
		I have a clear plan how often I will [A] in [C, T] with [Ta]	-.18	-0.83	*D14*, D8, *D9*

Note. [A], action; [C], context; [T], time; [Ta], target; *, significant at 0.05 level, after false discovery rate controlling procedure for multiple tests; D1, Knowledge; D2, Skills; D3, Social/professional role and identity; D4, Beliefs about capabilities; D5, Optimism; D6, Beliefs about consequences; D7, Reinforcement; D8, Intentions; D9, Goals; D10, Memory, attention, and decision processes; D11, Environmental context and resources; D12, Social influences; D13, Emotion; D14, Behavioral regulation; *D*, domain the item intended to measure; **D**, domain the item is systematically allocated to other than the item intended to measure

Beliefs about capabilities

The domain *Beliefs about capabilities* was defined as "Acceptance of the truth, reality, or validity about an ability, talent, or facility that a person can put to constructive use" [30]. Six *Beliefs about capabilities* items were included in the DCV exercise. The three items containing the word 'confident' were classified as measuring the intended domain (Table 3) and were included in the final questionnaire. The items measuring the difficulty and possibility of [action] in [context, time] with [target] were allocated to more than one domain. In addition to the domain *Beliefs about capabilities*, they were often allocated to the domain *Skills*. The item 'How much control do you have over ' was allocated to the intended domain, but also to the domains *Skills* and *Behavioral regulation*. With all items included, moderate agreement between judges was found for their allocation of items to the domain (κ = .55; 95% C.I. .41-.71; Table 4), while substantial agreement was found for the 32 final items (κ = .73; 95% C.I. .60-.81; Table 4).

Optimism

The domain *Optimism* was defined as "The confidence that things will happen for the best or that desired goals will be attained" [30]. Two out of six *Optimism* items included in the DCV were classified as measuring the domain *Optimism* (Table 3). These were included in the final questionnaire. Four items were allocated to more than one domain, including the domains *Beliefs about capabilities* and *Beliefs about consequences*. The extent to which judges agreed on which items measured the domain was moderate with all items included (κ = .60; 95% C.I. .49-.69; Table 4) and substantial for the final 32 items (κ = .68; 95% C.I. .63-.72; Table 4).

Beliefs about consequences

The domain *Beliefs about consequences* was defined as "Acceptance of the truth, reality, or validity about outcomes of a behavior in a given situation" [30]. Of the four *Beliefs about consequences* items included in the DCV, only two items were classified as measuring the intended domain (Table 3) and included in the questionnaire. These were the items measuring the construct Outcome expectancies. The two items measuring the construct Attitudes were allocated to a variety of domains, including *Social/professional role and identity and Optimism*. With all items included, moderate agreement between judges was found for their allocation of items to the domain (κ = .49; 95% C.I. .34-.62; Table 4), while substantial agreement was found for the final 32 items (κ = .70; 95% C.I. .67-.73; Table 4).

Reinforcement

The domain *Reinforcement* was defined as "Increasing the probability of a response by arranging a dependent relationship, or contingency, between the response and a given stimulus" [30]. The DCV exercise included three items intended to measure *Reinforcement*, but none of them was classified as measuring the domain (Table 3) and so none of them was included in the final questionnaire. The item ' I get financial reimbursement' was, in addition to the intended domain, allocated to the domain *Beliefs about consequences*. Two items were classified as measuring domains they were not intended to measure. The item ' I get recognition from professionals who are important to me' was classified as measuring the domain *Social influences* and the item ' I feel like I am making a difference' was classified as measuring the domain *Beliefs about consequences*. Five judges did not allocate any item to the domain. Without these judges taken into account Cohen's Kappa indicated moderate agreement (κ = .59; 95% C.I. .50-.68; Table 4).

Intentions

The domain *Intentions* was defined as "A conscious decision to perform a behavior or a resolve to act in a certain way" [30]. All four items included in the DCV to measure *Intentions* were classified as measuring the domain (Table 3) and included in the final questionnaire. The extent to which judges agreed on which items measured the domain was substantial with all items included (κ = .75; 95% C.I. .56-.87; Table 4) and almost perfect for the final 32 items (κ = .93; 95% C.I. .89-1.00; Table 4).

Goals

The domain *Goals* was defined as "Mental representations of outcomes or end states that an individual wants to achieve" [30]. Eight *Goals* items were included in the DCV exercise. None of them were classified to the right domain (Table 3) and thus *Goals* items were not included in the final questionnaire. Items measuring the construct Priority were classified as measuring the domain *Memory, attention, and decision processes*. The four items measuring the construct Action planning were included in the DCV as measuring both the domain *Goals* and *Behavioral regulation*. They were not classified as measuring these two domains, because they were also often allocated to the domain *Intentions*. Three judges did not allocate items to the domain. Without these judges taken into account Kappa indicated slight agreement (κ = .11; 95% C.I. .07-.14; Table 4).

Memory, attention, and decision processes

The domain *Memory, attention, and decision processes* was defined as "The ability to retain information, focus selectively on aspects of the environment and choose between two or more alternatives" [30]. Eight items were included in the DCV exercise to measure the domain *Memory, attention, and decision processes*. Four of these items were classified to measure the intended domain (Table 3) and were included in the final questionnaire. Two items were allocated to more than one domain and two items measuring the construct Memory were classified as measuring a domain other than they were intended to measure (i.e., *Knowledge* and *Beliefs about capabilities*). The extent to which judges agreed on which items measured the domain was substantial with all items included (κ = .63; 95% C.I. .48-.75; Table 4) and almost perfect for the final 32 items (κ = .85; 95% C.I. .79-.90; Table 4).

Environmental context and resources

The domain *Environmental context and resources* was defined as "Any circumstance of a person's situation or environment that discourages or encourages the development of skills and abilities, independence, social competence, and adaptive behavior" [30]. Eight items were included in the DCV to measure this domain, while only two items were classified as measuring the domain (Table 3) and therefore could be included in the final questionnaire. Other items, not including the word 'socio-political context' were, in addition to the intended domain, foremost allocated to the domains *Skills, Social/professional role and identity, and Social influences*. With all items included, moderate agreement between judges was found for their allocation of items to the domain (κ = .48; 95% C.I. .34-.65; Table 4), while almost perfect agreement was found for the final 32 items (κ = .82; 95% C.I. .73-.87; Table 4).

Social influences

The domain *Social influences* was defined as "Those interpersonal processes that can cause individuals to change their thoughts, feelings, or behaviors" [30]. Two out of eight *Social influences* items included in the DCV, were classified as measuring the intended domain (Table 3) and therefore included in the final questionnaire. These were the items measuring the construct Subjective norm. In addition to the domain *Social influences*, the other six items were mostly allocated to the domains *Social/professional role* and identity and *Environmental context and resources*. The extent to which judges agreed on which items measured the domain was moderate with all items included (κ = .53; 95% C.I. .43-.67; Table 4) and substantial for the final 32 items (κ = .78; 95% C.I. .69-.86; Table 4).

Emotion

The domain *Emotion* was defined as "A complex reaction pattern, involving experiential, behavioral, and physiological elements, by which the individual attempts to deal with a personally significant matter or event" [30]. Of the four *Emotion* items included in the DCV exercise, the two items measuring the construct Stress were classified as measuring the intended domain (Table 3). These items were included in the final questionnaire. The two items measuring the construct Affect were allocated to more than one domain, including *Emotion, Social/professional role and identity,* and *Beliefs about capabilities*. With all items included, moderate agreement between judges was found for their allocation of items to the domain (κ = .58; 95% C.I. .44-.70; Table 4), while almost perfect agreement was found for the final 32 items (κ = .90; 95% C.I., .83-.96; Table 4).

Behavioral regulation

The domain *Behavioral regulation* was defined as "Anything aimed at managing or changing objectively observed or measured actions" [30]. Ten items, including Action planning items also aimed to measure the domain *Goals*, were included in the DCV to measure *Behavioral regulation*. None of them were classified to the right domain (Table 3) and therefore *Behavioral regulation* items were not included in the final questionnaire. The six items measuring the constructs Automaticity and Self-monitoring were allocated to more than one domain including *Behavioral regulation, Skills, Goals,* and *Memory attention, and decision processes*. Two judges did not allocate any of the 79 items to the domain. Without these judges taken into account kappa indicated fair agreement (κ = .36; 95% C.I. .20-.52; Table 4).

Table 4. Light's K-values for all items and the items included in the final questionnaire

Domains		All 79 items	(95% C.I.) K	32 final items K	(95% C.I.)
All items and domains		.56	(.50-.62)	.82	(.79-.85)
D1	Knowledge	.76	(.63-.87)	.88	(.77-.96)
D2	Skills	.58	(.35-.71)	.80	(.73-.87)
D3	Social/professional role and identity	.59	(.37-.75)	.86	(.72-.93)
D4	Beliefs about capabilities	.55	(.41-.71)	.73	(.60-.81)
D5	Optimism	.60	(.49-.69)	.68	(.63-.72)
D6	Beliefs about consequences	.49	(.34-.62)	.70	(.67-.73)
D7	Reinforcement	.59	(.50-.68)	-	
D8	Intentions	.75	(.56-.87)	.93	(.89-1.00)
D9	Goals	.11	(.07-.14)	-	
D10	Memory, attention, and decision processes	.63	(.48-.75)	.85	(.79-.90)
D11	Environmental context and resources	.48	(.34-.65)	.82	(.73-.87)
D12	Social influences	.53	(.43-.67)	.78	(.69-.86)
D13	Emotion	.58	(.44-.70)	.90	(.83-.96)
D14	Behavioral regulation	.36	(.20-.52)	-	

Note. C.I., biased-corrected bootstrapped confidence interval of Light's Kappa (based on 200 bootstrap samples)

With regard to the 32 final items, κ-values could not be calculated for the domains *Reinforcement, Goals,* and *Behavioral regulation*, because none of the items measuring these domains was included in the final questionnaire

All items and domains

Overall, moderate agreement was found for the allocation of all 79 items to the 14 domains (κ = .56; 95% C.I. .50-.62; Table 4), while almost perfect agreement was found for the allocation of the final 32 items to the 14 domains (κ = .82; 95% C.I. .79-.85; Table 4).

Table 5. Final list of items measuring TDF domains (English)

Domain		Item
D1	Knowledge (4)	I am aware of the content and objectives of [innovation/guideline]
		I know the content and objectives of [innovation/guideline]
		I am familiar with the content and objectives of [innovation/guideline]
		I am aware of how to [A] in [C, T] with [Ta]
D2	Skills (3)	I have been trained how to [A] in [C, T] with [Ta]
		I have the skills to [A] in [C, T] with [Ta]
		I have practiced [A] in [C, T] with [Ta]
D3	Social/professional role and identity (4)	[A] in [C, T] with [Ta] is part of my work as a [profession]
		As a [profession], it is my job to [A] in [C, T] with [Ta]
		It is my responsibility as a [profession] to [A] in [C, T] with [Ta]
		Doing [A] in [C, T] with [Ta] is consistent with my [profession]
D4	Beliefs about capabilities (3)	I am confident that I can [A] in [C, T] with [Ta] even when [Ta] is not motivated
		I am confident that I can [A] in [C, T] with [Ta] even when there is little time
		I am confident that if I wanted I could [A] in [C, T] with [Ta]
D5	Optimism (2)	With regard to [A] in [C, T] with [Ta] in uncertain times, I usually expect the best
		With regard to [A] in [C, time] with [Ta] I'm always optimistic about the future
D6	Beliefs about consequences (2)	If I [A] in [C, T] with [Ta] it will benefit public health
		If I [A] in [C, T] with [Ta] it will have disadvantages for my relationship with [Ta]
D7	Reinforcement (0)	**
D8	Intentions (4)	For how many of the next 10 [Ta] do you intend to [A] in [C]?
		I will definitely [A] in [C] with [Ta] in the next [T]
		I intend to [A] in [C] with [Ta] in the next [T]
		How strong is your intention to [A] with [Ta] in [C] in the next [T]?
D9	Goals (0)	**
D10	Memory, attention and decision processes (4)	How often do you forget [A] in [C, T] with [Ta]?
		When I need to concentrate to [A] in [C, T] with [Ta], I have no trouble focusing my attention
		When trying to focus my attention on [A] in [C, T] with [Ta], I have difficulty blocking out distracting thoughts
		When concentrating on [A] in [C, T] with [Ta], I can focus my attention so that I become unaware of what's going on around me
D11	Environmental context and resources (2)	Within the socio-political context there is sufficient financial support (e.g., from local authorities, insurance companies, the government) for [innovation/guideline]
		Within the socio-political context there are good networks between parties involved in [innovation/guideline]
D12	Social influences (2)	Most people who are important to me think that I should [A] in [C, T] with [Ta]
		Most people whose opinion I value would approve me of [A] in [C, T] with [Ta]
D13	Emotion (2)	Have you recently, during the past two weeks been able to enjoy your normal day-to-day activities?
		Have you recently, during the past two weeks been feeling unhappy and depressed?
D14	Behavioral regulation (0)	**

Note. [A], action; [C], context; [T], time; [Ta], target; **, discriminant content validity of the items measuring these domains was not demonstrated

Table 6. Final list of items measuring TDF domains (Dutch)

Domain		Item
D1	Knowledge (4)	Ik ben op de hoogte van de inhoud en doelstellingen van [innovatie/richtlijn]
		Ik ken de inhoud en doelstellingen van [innovatie/richtlijn]
		Ik ben bekend met de inhoud en doelstellingen van [innovatie/richtlijn]
		Ik ben op de hoogte van hoe ik [A] in [C, T] met [Ta]
D2	Skills (3)	Ik ben getraind hoe ik [A] in [C, T] met [Ta]
		Ik heb de vaardigheden om [A] in [C, T] met [Ta]
		Ik heb [A in [C, T] met [Ta] in [C, T] met [Ta] geoefend
D3	Social/professional role and identity (4)	[A] in [C, T] met [Ta] hoort bij mijn werk als [beroep]
		Als [beroep] is het mijn taak om [A] in [C, T] met [Ta]
		Het is mijn verantwoordelijkheid als [beroep] om [A] in [C, T] met [Ta]
		Het doen van [A] in [C, T] met [Ta] is overeenkomend met mijn [beroep]
D4	Beliefs about capabilities (3)	Ik heb er vertrouwen in dat ik in staat ben om [A] in [C, T] met [Ta], zelfs wanneer [Ta] niet gemotiveerd is
		Ik heb er vertrouwen in dat ik in staat ben om [A] in [C, T] met [Ta], zelfs wanneer er weinig tijd is
		Ik heb er vertrouwen in dat als ik het wil, ik in staat ben om [A] in [C, T] met [Ta]
D5	Optimism (2)	Als het gaat om [A] in [C, T] met [Ta] dan verwacht ik in onzekere tijden, toch meestal het beste
		Als het gaat om [A] in [C, T] met [Ta] dan ben ik altijd optimistisch over de toekomst
D6	Beliefs about consequences (2)	Als ik [A] in [C, T] met [Ta], dan zal dit voordelig zijn voor de publieke gezondheid
		Als ik [A] in [C, T] met [Ta], dan zal het nadelig zijn voor mijn relatie met [Ta]
D7	Reinforcement (0)	**
D8	Intentions (4)	Voor hoeveel van de komende 10 [Ta] heb je de intentie om [A] in [C]?
		Ik zal zeker [A] in [C] met [Ta] in de komende [T]
		Ik ben van plan om [A] in [C] met [Ta] in de komende [T]
		Hoe sterk is uw intentie om [A] in [C] met [Ta] in de komende [T]?
D9	Goals (0)	**
D10	Memory, attention and decision processes (4)	Hoe vaak vergeet u [A] in [C, T] met [Ta]?
		Als ik me moet concentreren om [A] in [C, T] met [Ta], lukt het mij gemakkelijk om mijn aandacht hierop te richten.
		Als ik mijn aandacht probeer te richten op [A] in [C, T] met [Ta], vind ik het moeilijk afleidende gedachten uit te schakelen
		Als ik me concentreer op [A] in [C, T] met [Ta], kan ik mijn aandacht zo richten dat ik niet merk wat er om me heen gebeurt
D11	Environmental context and resources (2)	Binnen de sociaal-politieke context is er voldoende financiële ondersteuning (bijv. van gemeente, zorgverzekeraars, de overheid) voor [innovatie/richtlijn]
		Binnen de sociaal politieke context zijn er goede netwerken tussen partijen betrokken bij [innovatie/richtlijn]

Table 6. **Final list of items measuring TDF domains (Dutch) (continued)**

Domain	Item
D12 Social influences (2)	De meeste mensen die belangrijk voor mij zijn vinden dat ik [A] in [C, T] met [Ta] zou moeten doen De meeste mensen van wie ik hun mening waardeer, zouden [A] in [C, T] met [Ta] goedkeuren
D13 Emotion (2)	Heeft u de laatste tijd (de afgelopen twee weken) plezier kunnen beleven aan gewone, dagelijkse bezigheden? Heeft u zich de laatste tijd (de afgelopen twee weken) ongelukkig en neerslachtig gevoeld?
D14 Behavioral regulation (0)	**

Note. [A], actie; [C], context; [T], tijd; [Ta], target; **, discriminant content validity of the items measuring these domains could was not demonstrated

Discussion

We have developed a TDF-based questionnaire in both English and Dutch able to discriminately assess the majority of domains. For the first time, items have been operationalized to assess TDF domains using theoretical constructs within each domain *and* these items were judged to be either pure measures of the domain, or else also measuring other domains. Our findings provide an additional level of validation for the content of the TDF: not only do judges agree about the constructs within each domain and the domain structure as demonstrated by Cane et al. [30], but the majority of TDF domains have now been shown to be largely discriminately measurable. These results correspond with Taylor et al. [48,167] who found good discriminant validity of TDF domains in a questionnaire measuring influences on patient safety behaviors [48] and in the Determinants of Physical Activity Questionnaire [167]. While Taylor et al. [48,167] used specific items (i.e., related to a specific application), our items are generic and allow for application within a range of different contexts in which implementation research takes place. In summary, the development of our questionnaire provides important evidence of content validity and is a first step towards the development of a valid and reliable questionnaire to measure TDF-based factors underlying health care professionals' specific implementation behaviors.

Of the 79 items assessed, 32 items were able to discriminately measure the following 11 domains: *Knowledge, Skills, Social/professional role and identity, Beliefs about capabilities, Optimism, Beliefs about consequences, Intentions, Memory, attention and decision processes, Environmental context and resources, Social influences*, and *Emotion*. For each of these domains at least two items were identified that can be used in the development of a TDF-based questionnaire.

Following judges' allocations, items were not able to measure the domains *Reinforcement, Goals,* and *Behavioral regulation*. Items intended to measure these domains were allocated to multiple domains or classified to a domain other than the item intended to measure. This may be due to a few reasons. First, it is possible that the items used to operationalize the constructs within these domains were not appropriate, which might be related to the fact that some of *Reinforcement and*

Goals items were newly developed by the researchers rather than previously-validated items. Nevertheless, items intended to measure the domain *Behavioral regulation* through the constructs Automaticity, Self-monitoring, and Action planning were adapted from previously published questionnaires, and thus it is unlikely that the existing level of validation of items is responsible for challenges in allocating items to particular domains. Second, it might be that items could not be classified to measure these three domains, because the domain definitions were not fit for purpose. This is associated with the finding that five, three, and two judges did not allocate any of the items to, respectively, the domains *Reinforcement, Goals,* and *Behavioral regulation*. The findings may also be explained by the use of domain definitions instead of construct definitions to allocate items, while items were previously developed to target individual constructs rather than broader domains. The allocation of items to domain definitions might therefore be influenced by the closeness of the definition of the domain to the definition of its constituent constructs. Finally, it could be that the remaining domains themselves cannot be discriminately measured. This seems a plausible explanation, as the domain *Reinforcement* is a refinement of the *Beliefs about consequences* domain and was originally included within the latter domain in the original TDF [31]. It is then perhaps not surprising that the *Reinforcement* items were judged to be assessing *Beliefs about consequences*, and arguably, such assignment is theoretically appropriate. Furthermore, the refinement of the domain *Motivation and goals* of the original TDF [31] into the domains *Goals* and *Intentions* in the recent version of the TDF and the classification of multiple goal-related constructs to the domains *Goals, Intentions*, and *Behavioral regulation* imply overlap between these domains. Therefore, it is perhaps also not surprising that the items measuring these domains were allocated to all three domains, and thus are not able to discriminately measure them. From a discriminant content validity perspective, taken together these results support keeping to the 12 original domains as a basis for the development of TDF questionnaires. When using the 12-domain framework [31] to develop a TDF-based questionnaire, items measuring the domains *Behavioral regulation* and *Nature of the behaviors* should be identified to maintain the comprehensive nature of the TDF. This could be done by selecting domains' related key constructs as provided by Michie et al. [31] and selecting items from existing validated scales.

Lastly, the findings indicate that further refinement of the final questionnaire is required. In general, the amount of items measuring most of the domains could be increased to at least three items for each domain (at least three items with a loading above .80 will give a reliable component [168]). With regard to the specific domains, the final items measuring the domain *Environmental context and resources* are framed entirely in terms of the socio-political context, while there may be additional environmental and resources influences that remain unmeasured. The initial version of the questionnaire included items related to characteristics of the innovation, organization, socio-political context, and innovation strategies [5,7,17,24,27], however, only the items assessing the socio-political context were judged to discriminately assess this domain. Lack of discriminant content validity of items measuring characteristics of the innovation, organization, and innovation strategies might be due to our method of developing a generic questionnaire based on factors related to a specific implementation behavior (i.e., the implementation of PA interventions). Moreover, the domain *Environmental context and resources* is arguably among the least well conceptualized domains of the TDF, which may partly explain challenges that judges faced in allocating items to this domain. Nevertheless, potential users of the final questionnaire may wish to incorporate additional more contextually sensitive items focusing on the environment and

resources whilst recognizing that their discriminant content validity has not yet been demonstrated. In the initial questionnaire, items measuring the domain *Emotion* were adapted from previously published questionnaires. Specifically, items measuring the construct Affect were based on the Positive and Negative Affect Schedule [154] and Stress items were based on the General Health Questionnaire [153]. Items measuring the construct Stress demonstrated to be able to discriminately assess the domain *Emotions*, while Affect items did not. Therefore, the final questionnaire includes items concerning health care professionals' general feelings (i.e., Stress) instead of their emotions related to performing a specific behavior (i.e., Affect). Yet, when investigating determinants of health care professionals' implementation behaviors, items assessing emotions in relation to performing a specific behavior should also be taken into account as these have been found to be linked to implementation behaviors in previous research [169–171]. Although initial TACT-specific items assessing the construct Affect were not judged to discriminately assess the domain *Emotions*, potential users of the final questionnaire may want to consider using such items by including other emotions such as pride, empathy [171], fear [169–171], and embarrassment [170]. Furthermore, the assessment of the domain *Knowledge* could be improved by adding items to test health care professionals' knowledge on a certain implementation behavior [170,172].

Strengths and limitations of assessing TDF domains using questionnaires

Limitations with regard to the use of the TDF for questionnaire development involve the large amount of domains and underlying constructs that can only be assessed by a large amount of items. Quantitative TDF-based research might preclude measuring all constructs within each domain due to time constraints as described earlier by Amemori et al. [46]. As a result, it is not clear which constructs to choose when measuring a given domain. In this study, constructs were selected based on close relatedness to the content of the domains, being a part of important theories of behavior change, existence of validated scales, and/or relevance to the implementation of PA interventions in routine health care as determined in previous studies [131,149]. However, it is unclear to what extent the constructs that we selected measure the full breadth of the domains instead of a part of them. This questionnaire strove to balance representation of the constructs within the domains with a parsimonious questionnaire that could be feasibly used in the field. However, some domains cover a wider breath of constructs than others and future work could investigate the broader range of constructs within each domain. In addition, the TDF domains are *potential* behavioral determinants, instead of factors proven to influence implementation behavior and the framework does not specify relationships between domains [32]. On the other hand, quantitative applications of the framework can be beneficial for use in exploratory research and to guide theory selection.

Corresponding with the major rationale for the development of the original TDF, the framework can be used to assess a broad range of factors from a multitude of behavior change theories, helpful when little *a priori* information is available to base the selection of appropriate theories on. In comparison with other frameworks used in implementation research, e.g., [17,24,27], and empirical work on the introduction of PA interventions in primary health care [131,149] the TDF [30], however, mainly focuses on factors related to the adopting person, instead of taking into account a variety of factors related to characteristics of the innovation, patient, social setting, organizational context, and innovation methods and strategies [5,7,17,24,27]. This implies factors outside

psychological behavior change theory are not adequately elaborated in the framework. We believe that these factors may be included in the domain *Environmental context and resources* or multiple 'environmental' domains should be incorporated in the TDF.

Strengths and limitations of our methods

While we used a rigorous DCV approach to validate the content of items in the questionnaire, some limitations of our study need to be taken into account. The DCV exercise of allocating 79 items to 14 domains was a challenging task for judges, requiring consideration of multiple possible definitions. This approach is a degree of magnitude more challenging than how DCVs have typically been applied in the past (to a much smaller number of constructs). A larger number of judges and a less complex task would have possibly increased information on discriminant content validity of the items. Major strengths of this study include the sample of academics with expertise on TDF domains and the formulation of items using the 'TACT principle' [146], which allows potential users of the questionnaire to tailor the content to their own target, action, context, and time. However, the operationalization and validation of the domains of the TDF are limited to these specific methods. It could be, for example, that in 'real life' the validity of the domains would differ from the one perceived by an academic audience. Therefore, this study represents an important *first step* in the thorough development of a questionnaire to measure TDF-based factors underlying health care professionals' implementation behaviors. As a *next step* we tested the Determinants of Implementation Behavior Questionnaire (DIBQ) on a sample of 270 health care professionals with specification of a particular target, action, context, and time, and showed good construct validity, with the majority of domains showing high internal consistency reliability and discriminant validity [173].

Conclusion

To our knowledge, this study is the first to develop a generic (i.e., formulation of items following the 'TACT principle' [146]) TDF-based questionnaire in both English and Dutch including items which are able to discriminately measure a majority of the domains. The results partly support Cane et al.'s validation of the TDF [30] and suggest that the 12-domain version [31] might be more applicable in developing a TDF-based questionnaire. The items of this questionnaire can be used for the development of a questionnaire to measure TDF-based determinants of health care professionals' specific implementation behaviors. Future research should investigate the concurrent and predictive validity and reliability of such a questionnaire in practice, among a large health care professional sample.

In general, a valid TDF-based questionnaire will increase the use of theory in the assessment of barriers and facilitators for implementation problems [31,174,175], which can inform the selection of possible techniques that can be used to change health care professionals' behaviors [6,35,36]. Consequently, research on the development of a generic TDF questionnaire will improve our understanding of factors influencing health care professionals' implementation and advance theory and methods in implementation research.

Appendix 1. Questionnaire items and related constructs and domains

Domain		Construct	Item	Source
D1	Knowledge	Knowledge (3)	I am aware of the content and objectives of [innovation/guideline] I know the content and objectives of [innovation, guideline] I am familiar with the content and objectives of [innovation/guideline]	Adapted from Amemori et al. [46] and Beenstock et al. [47]
		Procedural knowledge (3)	I am aware of how to [A] in [C, T] with [Ta] I know how to [A] in [C, T] with [Ta] I am familiar with how to [A] in [C, T] with [Ta] (Strongly disagree – strongly agree)	
D2	Skills	Skills (4)	I have been trained how to [A] in [C, T] with [Ta] I have the proficiency to [A] in [C, T] with [Ta] I have the skills to [A] in [C, T] with [Ta] I have practiced [A] in [C, T] with [Ta] (Strongly disagree – strongly agree)	New items
D3	Social/ professional role and identity	Professional role (4)	[A] in [C, T] with [Ta] is part of my work as a [profession] As a [profession], it is my job to [A] in [C, T] with [Ta] It is my responsibility as a [profession] to [A] in [C, T] with [Ta] Doing [A] in [C, T] with [Ta] is consistent with my [profession] (Strongly disagree – strongly agree)	New items
D4	Beliefs about capabilities	Self-efficacy (2)	I am confident that I can [A] in [C, T] with [Ta] even when [Ta] is not motivated I am confident that I can [A] in [C, T] with [Ta] even when there is little time	Adapted from Bandura [139]
		Perceived behavioral control (4)	I am confident that if I wanted I could [A] in [C, T] with [Ta] (Strongly disagree – strongly agree) How much control do you have over [A] in [C, T] with [Ta]? (No control at all – a lot of control) For me, [A] in [C, T] with [Ta] is... (Very difficult – very easy) For me, [A] in [C, T] with [Ta] is... (Impossible – possible)	Adapted from Ajzen [138]

Appendix 1. **Questionnaire items and related constructs and domains (continued)**

Domain		Construct	Item	Source
D5	Optimism	Optimism (3)	With regard to [A] in [C, T] with [Ta] in uncertain Times, I usually expect the best With regard to [A] in [C, T] with [Ta] I'm always optimistic about the future With regard to [A] in [C, T] with [Ta] overall, I expect more good things to happen than bad	Adapted from Scheie et al. [157]
		Pessimism (3)	With regard to [A] in [C, T] with [Ta] if something can go wrong, it will With regard to [A] in [C, T] with [Ta] I hardly ever expect things to go my way With regard to [A] in [C, T] with [Ta] I rarely count on good things happening to me (Strongly disagree – strongly agree)	
D6	Beliefs about consequences	Attitudes (2)	For me, [A] in [C, T] with [Ta] is... (Useless – useful) For me, [A] in [C, T] with [Ta] is... (Bad – good)	Adapted from Ajzen [138]
		Outcome expectancies (2)	If I [A] in [C, T] with [Ta] it will benefit public health If I [A] in [C, T] with [Ta] it will have disadvantages for my relationship with [Ta] (Strongly disagree – strongly agree)	Adapted from Bandura [139]]
D7	Reinforcement	Reinforcement (3)	Whenever I [A] in [C, T] with [Ta], I get financial reimbursement Whenever I [A] in [C, T] with [Ta], I get recognition from professionals who are important to me If I [A] in [C, T] with [Ta], I feel like I am making a difference (Never – always)	New items
D8	Intentions	Intention (4)	For how many of the next 10 [Ta] do you intend to [A] in [C]? (1 – 10) I will definitely [A] in [C] with [Ta]in the next [T] I intend to [A] in [C] with [Ta] in the next [T] (Strongly disagree – strongly agree) How strong is your intention to [A] with [Ta] in [C] in the next [T]? (Not strong at all – very strong)	Adapted from Ajzen [138]

Appendix 1. **Questionnaire items and related constructs and domains (continued)**

Domain		Construct	Item	Source
D9	Goals	Action planning (4)	I have a clear plan of how I will [A] in [C, T] with [Ta] I have a clear plan under what circumstances I will [A] in [C, T] with [Ta] I have a clear plan when I will [A] in [C, T] with [Ta] I have a clear plan how often I will [A] in [C, T] with [Ta] (Strongly disagree – strongly agree)	Adapted from Sniehotta et al. [151]
		Priority (4)	Generally, in [C, T] with [Ta], how often is covering something else on your agenda a higher priority than [A] Generally, in [C, T] with [Ta], how often does covering something else on your agenda take precedence over [A] Generally, in [C, T] with [Ta], how often is covering something else on your agenda more urgent than [A] Generally, in [C, T] with [Ta], how often is covering something else on your agenda more pressing than [A] (Never – always)	New items
D10	Memory, attention and decision processes	Memory (4)	[A] in [C, T] with [Ta] is easy to remember (Strongly disagree – strongly agree) How often do you forget [A] in [C, T] with [Ta]? How often do you have to check the [innovation/guideline] before [A] in [C, T] with [Ta]? (Never – almost always) To what extent do you know [innovation/guideline] by heart to [A] in [C, T] with [Ta]? (Not at all – very much so)	New items
		Attention (4)	When I need to concentrate to [A] in [C, T] with [Ta], I have no trouble focusing my attention When I am working hard on [A] in [C, T] with [Ta], I still get distracted by events around me When trying to focus my attention on [A] in [C, T] with [Ta], I have difficulty blocking out distracting thoughts When concentrating on [A] in [C, T] with [Ta], I can focus my attention so that I become unaware of what's going on around me (Strongly disagree – strongly agree)	Adapted from Derryberry and Reed [156]

Appendix 1. **Questionnaire items and related constructs and domains (continued)**

Domain		Construct	Item	Source
D11	Environmental context and	Resources/material (8)	[Innovation/guideline] has a good fit with routine practice [Innovation/guideline] provides the possibility to adapt it to the [Ta]'s needs (e.g., culture) In the organization I work [A] in [C, T] with [Ta] is routine In the organization I work there is enough time to [A] in [C, T] with [Ta] Within the socio-political context there is sufficient financial support (e.g., from local authorities, insurance companies, the government) for [innovation/guideline] Within the socio-political context there are good networks between parties involved in [innovation/guideline] Prior to delivery of [innovation/guideline] professionals are provided with a training to [A] in [C, T] with [Ta] During the delivery of [innovation/guideline] professionals are provided with sufficient financial reimbursement to [A] in [C, T] with [Ta] (Strongly disagree – strongly agree)	New items
D12	Social influences	Social support (4)	I can rely on the team of professionals with whom I deliver [innovation] when things get tough on [A] in [C, T] with [Ta] My colleagues are willing to listen to my problems related to [A] in [C, T] with [Ta] The team of professionals with whom I deliver [innovation] is helpful in getting [A] in [C, T] with [Ta] done I can rely on my colleagues when things get tough on [A] in [C, T] with [Ta]	Adapted from Frese [155]
		Subjective norm (2)	Most people who are important to me think that I should [A] in [C, T] with [Ta] Most people whose opinion I value would approve me of [A] in [C, T] with [Ta]	Adapted from Ajzen [138]
		Descriptive norm (2)	The team of professionals with whom I deliver [innovation/guideline] [A] in [C, T] with [Ta] Respected colleagues [A] in [C, T] with [Ta] (Strongly disagree – strongly agree)	Adapted from Cialdini et al. [158]

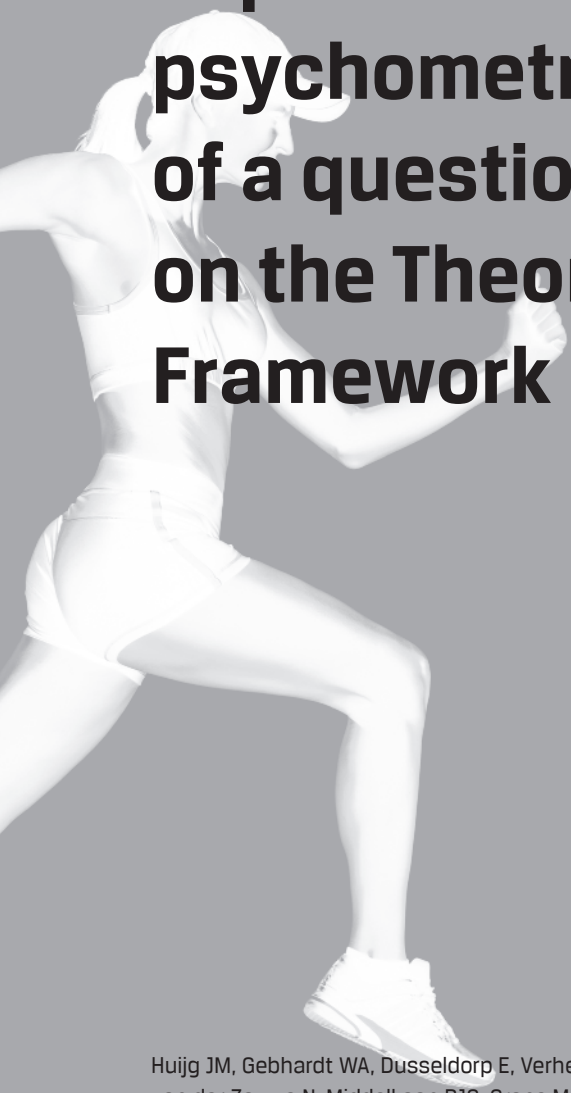
Appendix 1. Questionnaire items and related constructs and domains (continued)

Domain	Construct	Item	Source
D13 Emotion	Affect (2)	Thinking about yourself and how you normally feel as a professional that delivers [innovation/guideline], to what extent do you generally feel inspired with regard to [A] in [C, T] with [Ta] Thinking about yourself and how you normally feel as a professional that delivers [innovation/guideline], to what extent do you generally feel nervous with regard to [A] in [C, T] with [Ta]	Adapted from Thompson [154]
	Stress (2)	Have you recently, during the past two weeks been able to enjoy your normal day-to-day activities? Have you recently, during the past two weeks been feeling unhappy and depressed? (Never always)	Goldberg and Blackwell [153]
D14 Behavioral regulation	Automaticity (2)	[A] in [C, T] with [Ta] is something I do automatically [A] in [C, T] with [Ta] is something I do without thinking	Adapted from Gardner et al. [152]
	Self-monitoring (4)	I keep track of my overall progress towards [A] in [C, T] with [Ta] I tend to notice my successes while working towards [A] in [C, T] with [Ta] I am aware of my day-to-day behavior as I work towards [A] in [C, T] with [Ta] I check regularly whether I am getting closer to attaining [A] in [C, T] with [Ta]	Adapted from Maes et al. [150]
	Action planning (4)	I have a clear plan of how I will [A] in [C, T] with [Ta] I have a clear plan under what circumstances I will [A] in [C, T] with [Ta] I have a clear plan when I will [A] in [C, T] with [Ta] I have a clear plan how often I will [A] in [C, T] with [Ta] (Strongly disagree – strongly agree)	Adapted from Sniehotta et al. [151]

Note. [A], action; [C], context; [T], time; [Ta], target

Chapter 6

Measuring determinants of implementation behavior: psychometric properties of a questionnaire based on the Theoretical Domains Framework



Huijg JM, Gebhardt WA, Dusseldorp E, Verheijden MW,
van der Zouwe N, Middelkoop BJC, Crone MR.
Measuring determinants of implementation behavior: psychometric
properties of a questionnaire based on the Theoretical Domains Framework.
Implementation Science 2014; 9:33.

Abstract

Background

To be able to design effective strategies to improve health care professionals' implementation behaviors, a valid and reliable questionnaire is needed to assess potential implementation determinants. The present study describes the development of the Determinants of Implementation Behavior Questionnaire (DIBQ) and investigates the reliability and validity of this Theoretical Domains Framework (TDF)-based questionnaire.

Method

The DIBQ was developed to measure the potential behavioral determinants of the 12-domain version of the TDF (Michie et al., 2005). We identified existing questionnaires including items assessing constructs within TDF domains and developed new items where needed. Confirmatory factor analysis was used to examine whether the predefined structure of the TDF-based questionnaire was supported by the data. Cronbach's alpha was calculated to assess internal consistency reliability of the questionnaire, and domains' discriminant validity was investigated.

Results

We developed an initial questionnaire containing 100 items assessing 12 domains. Results obtained from confirmatory factor analysis and Cronbach's alpha resulted in the final questionnaire consisting of 93 items assessing 18 domains, explaining 63.3% of the variance and internal consistency reliability values ranging from .68 to .93. Domains demonstrated good discriminant validity, although the domains *Knowledge* and *Skills* and the domains *Skills* and *Social/professional role and identity* were highly correlated.

Conclusion

We have developed a questionnaire with acceptable validity and reliability that can be used to assess potential determinants of health care professional implementation behavior following the theoretical domains of the TDF. The DIBQ can be used by researchers and practitioners who are interested in identifying determinants of implementation behaviors in order to be able to develop effective strategies to improve health care professionals' implementation behaviors. Furthermore, the findings provide a novel validation of the TDF and indicate that the domain *Environmental context and resources* might be divided into several environment-related domains.

Background

Much research and funding is invested into developing, piloting, and evaluating evidence-based innovations to promote health. However, the transfer of effective innovations, such as pharmacological and behavior change interventions, into routine health care practice often does not happen as desired [1,3,4,141,176]. With the public health impact of these innovations depending on their implementation in practice it is important to understand health care professionals' (HCP) implementation behaviors and factors associated with suboptimal use of research evidence [7,16].

Many factors can potentially influence HCPs' implementation behaviors. These factors may be

related to characteristics of the innovation (e.g., compatibility, complexity), social setting (e.g., norms, support), organizational context (e.g., capacity, resources), innovation strategies (e.g., training, reimbursement), patient (e.g., attitudes, compliance), and the individual HCP (e.g., skills, attitudes) [5,7,17,24,27,64,149]. Identifying the key factors associated with HCP implementation behavior can inform the development of strategies to promote evidence-based behavior [6,7,34–38].

Research has shown that active implementation strategies, such as educational outreach and reminders, can be effective in enhancing implementation behaviors [175,177]. However, due to the scarce use of theory to inform the choice and design of implementation strategies [174] there is a lack understanding of why strategies are effective or not [178]. To enhance the effective development of implementation strategies, therefore, many advocate using a theoretical approach to guide the investigation of implementation determinants [6,22,36,43,178].

Behavior change theories provide testable hypotheses about when and why specific factors will lead to a certain implementation behavior. However, a limitation in the use of these theories to asses and identify factors underlying HCP implementation behavior is the large number of theories that might be used and their overlapping constructs [22,32,64,145]. The Theoretical Domains Framework (TDF) [30,31] is an integrative framework that can be used to overcome this constraint. Within the original TDF [31], constructs from 33 behavior change theories were grouped into 12 domains of behavioral determinants covering the full range of current scientific explanations for human behavior (i.e., *Knowledge, Skills, Social/professional role and identity, Beliefs about capabilities, Beliefs about consequences, Memory, attention and decision processes, Environmental context and resources, Social influences, Emotion, Behavioral regulation,* and *Nature of the behaviors*). As a consequence, researchers can use this integrative framework instead of having to choose between different theories.

The TDF has instigated a new line of investigation and has been applied in many implementation studies. Specifically, qualitative studies concluded that the TDF was useful for the comprehensive exploration of possible explanations for suboptimal implementation behavior (e.g., [44,45,171,179–181]) and for the identification of suitable theories to further investigate these behaviors [32,182]. Furthermore, the framework was used for the development of questionnaires to assess potential implementation behavior determinants [46–48]. So far, however, questionnaires' internal consistency reliability was insufficient [46–48] and only one out of three questionnaires was able to measure the theoretical domains independently [48]. Consequently, there is need for a valid and reliable method to identify theory-based factors influencing HCPs' implementation behaviors to be able to design effective implementation strategies [64].

Recently, the TDF [31] has been validated, leading to the revised TDF including 14 domains [30]. Main differences between the original and the revised framework include the separation of the domain *Optimism* from the domain *Beliefs about capabilities* and the domain *Reinforcement* from the domain *Beliefs about consequences*. Moreover, the domain *Motivation and goals* was divided into two separate domains, i.e., *Intentions* and *Goals*, and the domain *Nature of the behaviors* was omitted in the revised framework. As a first step in the development of a TDF-based questionnaire for the valid and reliable assessment of factors influencing HCP implementation behavior we

developed a generic questionnaire assessing the 14 domains of behavioral determinants of the revised TDF [30]. Investigation of questionnaire items' discriminant content validity based on judgments of a sample of experts on behavior change theory resulted in a questionnaire able to assess all domains discriminately, except for the domains *Reinforcement, Goals*, and *Behavioral regulation*. Accordingly, the findings suggested that the 12-domain original version of the TDF [31] might be more applicable in developing a TDF-based questionnaire [183].

The main aim of the current study was to develop a questionnaire based on the 12-domain version of the TDF [31] and to test the psychometric properties of this questionnaire on a sample of HCPs. To validate the Determinants of Implementation Behavior Questionnaire (DIBQ) the following research questions were addressed: 1. does confirmatory factor analysis support the predefined structure of the TDF-based questionnaire (i.e., construct validity), 2. is the questionnaire able to measure TDF domains in a reliable way (i.e., internal consistency reliability), and 3. are the domains of the questionnaire independently measurable (i.e., discriminant validity)? Our specific interest is in HCPs' implementation of physical activity (PA) interventions, which we used in this study as a field of application for the DIBQ.

Method

Development of the Determinants of Implementation Behavior Questionnaire

We developed a questionnaire that initially included 100 items assessing each of the domains through their related key constructs (see Appendix 1). First, constructs within domains were selected based on:

a. their conceptual relatedness to the content of the domain (i.e., Knowledge, Skills, Professional role, and Memory),
b. their inclusion in relevant theories frequently used in the field of behavior change (and thus ready access to existing items): the Theory of Planned Behavior [138] (i.e., Perceived behavioral control, Attitude, Subjective norm, and Intention) and Social Cognitive Theory [139] (i.e., Self-efficacy, Outcome expectancies, and Social support),
c. the existence of validated scales to measure constructs (i.e., Role clarity, Optimism, Emotions, Action planning, Coping planning, Automaticity), and/or
d. constructs' relevance to the implementation of PA intervention in routine health care by mapping factors resulting from previous research [131,149] onto the TDF domains (i.e., Reinforcement, Priority, Characteristics of the innovation, Characteristics of the socio-political context, Characteristics of the organization, Characteristics of the participants, Characteristics of the innovation strategy, Descriptive norm).

Second, for each domain a minimum of two and a maximum of 24 items were developed, with an average of 4 items for each construct. Items were related to the target behavior 'delivering PA interventions following the guidelines'. Items measuring the constructs within the domains *Knowledge, Beliefs about capabilities, Social influences, Emotion, Behavioral regulation*, and *Nature of the behaviors* [46,138,139,151,152,155,157,158,184] were adapted from previously published questionnaires. The content of these items was based on previous research on factors influencing the implementation of PA intervention in routine health care [131,149]. For instance, items measuring

the constructs Self-efficacy [138] and Coping planning [151] were developed so that they included HCPs' barriers of lack of time and patient motivation. Items measuring constructs within the domains *Skills, Social/professional role and identity, and Memory, attention, and decision processes* were based on results of the discriminant content validity study [182]. With regard to the domain *Beliefs about consequences*, items measuring the constructs Attitude [138] and Outcome expectancies [139] were adapted from previously published questionnaires, whereas items measuring the construct Reinforcement were newly developed (as none could be located in the literature). Regarding the domain *Motivation and goals*, items measuring the construct Intention were adapted from a previously published questionnaire [138], while items were newly developed for the construct Priority. Furthermore, new items were created for the domain *Environmental context and resources*. New items were developed based on discussions between WAG, MRC, and JMH. These discussions were informed by the academic literature on the concept and definition of specific domains and constructs, questions to identify behavior change processes as formulated by Michie et al. [31], and themes emerging from interviews on the implementation of PA interventions [131]. Finally, the questionnaire was piloted among five colleague researchers and a sample of eight physical therapists. Piloting indicated that the questionnaire was easily understood and well received by the respondents.

Respondents and procedure

We recruited physical therapists delivering PA interventions to a variety of target groups (i.e., people with chronic obstructive pulmonary disease, diabetes, arthritis or obesity). They were recruited through physical therapist associations and contacted opportunistically via their practice websites. Physical therapists were sent an email including the link to the online questionnaire and were assured that their responses would be confidential and anonymous. They reported on their gender, age, practice experience (years), sort of practice/workplace, and socioeconomic status (SES) of the majority of their intervention participants. Full questionnaire completion was rewarded with a 25 euro voucher. Non-respondents were sent an email with a questionnaire on their demographic characteristics.

Data management

Questionnaires were exported from Qualtrics Software, version 45433 [132] to IBM SPSS Statistics version 19.0 [136] for analyses. Responses were scored from 1 (strongly disagree) to 7 (strongly agree). Items worded negatively, such as 'Delivering [PA intervention] following the guidelines is something I often forget', were reverse-coded. For the six Social support items it was possible to fill in 'Not applicable', because not all physical therapists work together with others in delivering PA interventions and some are part of the management of their organization and therefore do not receive management support. Scores on this category were recoded as missing.

Data analyses

Confirmatory factor analyses

Confirmatory factor analysis was used to examine whether the a priori assignment of items to Michie et al.'s [31] TDF domains was supported by the data (i.e., research question 1). To perform the confirmatory factor analysis, we used the oblique multiple group (OMG) method [185,186], which has been previously shown to perform better or to be highly comparable to the more well-known confirmatory common factor analysis [187–189]. The OMG method involves calculating

correlations between items and domains, from which the following conclusions are drawn: if an item correlates highest with the domain the item was assigned to, the item is correctly assigned to the domain (and the predefined structure is confirmed); if an item correlates highest with a domain the item was not assigned to, the item is incorrectly assigned to the domain (and the predefined structure is not confirmed). In the OMG method, correlations between items and domains are corrected for self-correlation and test length [185].

When an item is assigned incorrectly, adjustments should be made. We used the iterative OMG procedure to make adjustments to the structure of our questionnaire. This step-wise procedure involves testing the adjusted assignment obtained from an OMG analysis in a subsequent OMG analysis on the same data set, which will either support the assignment or provide suggestions for new adjustments. When, based on these suggestions, a new adjustment is made, this assignment can be tested again on the same data set. The iterative procedure continues until the adjusted assignment is supported by the data (i.e., items correlate highest with the domain they are assigned to, the adjustment leads to a higher total explained variance) or when none of the adjusted assignments are supported by the data and a newly obtained adjusted assignment is equal to one of the previously assignments. Preferably, changes in item assignment can be justified by a theoretical or conceptual link between the incorrect assigned item and the domain to which it has been assigned [187].

In this study, the iterative procedure of adjustment consisted of two iterations. In the first iteration, adjustments were made based on suggestions from the OMG analyses and theoretical or conceptual links between items and domains. In the second iteration, adjustments were also based on suggestions from the OMG analyses and theoretical or conceptual assumptions. In addition, we compared poor fitting domains from the OMG solution to the solution based on exploratory factor analysis (i.e., principal component analysis; PCA [190]) to guide adjustments of the assignment of items to domains. Following the iterative OMG procedure, adjustments were only retained when they were supported by the new results from the OMG analysis. Finally, the variance-accounted-for by the adjusted predefined components was compared to the variance-accounted-for by the components resulting from the PCA. Preferably this difference is small, which indicates that the adjusted predefined structure fits the data well.

Internal consistency reliability and discriminant validity

Cronbach's alpha [191] was computed to assess the internal consistency reliability of the items assessing each domain (i.e., research question 2). Two tests of discriminant validity [192] were undertaken to assess if the DIBQ was able to measure the TDF domains discriminately (i.e., research question 3). First, discriminant validity was assessed by determining whether the bootstrapped 95% confidence interval around Pearson's correlations between domains included 1.00 [193]. Second, we calculated attenuation-corrected correlations to discover the "true correlation" between the domains [194].

Computational note

The analyses were performed using IBM SPSS Statistics version 19.0 [136]. For the OMG analyses we used a SPSS-macro file obtained from Timmerman and Stuive [195]. Attenuation-corrected correlations were calculated using the R software environment [165] using the R-package Psy [166].

Ethics

The Medical Ethics Committee of the Leiden University Medical Centre granted ethical approval of this study (reference number NV/CME 09/081).

Results

Characteristics of the respondents

Of the 496 physical therapists who were invited for the study, 274 (55.2%) delivering 15 different PA interventions completed the questionnaire. The number of questionnaires analyzed was 270, following removal of physical therapists reporting no experience with PA intervention delivery. Table 1 shows characteristics of respondents and non-respondents. Of the respondents, 58.1% (*n* = 157) were female, they were on average 39.7 (SD = 12.3) years old, and had on average 14.9 (SD = 11.3) years of practice experience. Most of them worked in a group practice (68.5%, *n* = 185) and most delivered PA interventions to an equal percentage of participants with a low and high SES (53%, *n* = 143) or to people with a low SES (44.8%, *n* = 121). A total of 68 out of 222 non-respondents (30.6%) filled in the non-respondents questionnaire. Comparisons between respondents and non-respondents indicated that the latter were significantly older and had more practice experience.

Table 1. Demographic characteristics of respondents and non-respondents

Demographic variable	Respondents (*N* = 270)				Non-respondents (*N* = 68)			
	Mean	(SD)	*n*	(%)	Mean	(SD)	*n*	(%)
Gender								
Male			113	(12.3)			27	(38.6)
Female			157	(58.1)			39	(55.7)
Age	39.7	(12.3)*			45.6	(11.7)*†		
Practice experience (years)	14.9	(11.3)*			19.8	(11.8)*‡		
Sort of practice/workplace								
Solo practice			7	(2.6)			3	(4.3)†
Duo practice			9	(3.3)			1	(1.4)†
Group practice			185	(68.5)			36	(51.4)†
Multidisciplinary HC center			61	(22.6)			11	(15.7)†
Other			8	(3.0)			4	(5.7)†
SES intervention participants								
Mostly high SES			6	(2.2)			4	(5.7)†
50-50			143	(53.0)			30	(42.9)†
Mostly low SES			121	(44.8)			21	(30.0)†

Note. Results of chi-square tests and independent *t*-tests are reported; *, $p < .05$; †, based on *N* = 55; ‡, based on *N* = 54; HC, health care; SES, socioeconomic status

Psychometric properties of the questionnaire

Confirmatory factor analysis

OMG analyses showed that the total variance explained by the initial questionnaire was 48.0%. In other words, the initial assignment of the items to the 12 domains of the TDF explained about half of the total variance in item scores. In the first iteration of adjustments, results of the OMG analysis indicated that model fit could be improved by adjusting the domains *Environmental context and resources* and *Beliefs about capabilities*. Based on Fleuren et al.'s [17] categorization of innovation determinants into factors related to the innovation, socio-political context, organization, innovation strategy, and Chaudoir et al.'s [64] additional category of factors related to the patient, the first adjustment of the questionnaire included dividing the domain *Environmental context and resources* into the domains *Innovation, Socio-political context, Organization, Patient,* and *Innovation strategy.* This process was done in five subsequent steps (in each step one new domain was entered) with every step leading to a higher total explained variance, validating the adjustment. With regard to the domain *Beliefs about capabilities*, the constructs Self efficacy and Perceived behavioral control did not fit well with the conceptually different *Optimism* items, and therefore *Optimism* items were assigned to a standalone domain. Subsequently, this adjustment was supported by the results of the re-run of the OMG analysis.

In the second iteration, further improvement of model fit was informed by comparing the poor fitting domains from the OMG solution with the solution from the PCA. This led to the assignment of items measuring social support from the management to the domain *Organization,* and *Priority* items to a separate domain. Furthermore, the domain *Emotion* was divided into two domains (i.e., *Negative emotions* and *Positive emotions*) and items measuring the domain *Memory, attention, and decision processes* and the construct Automaticity were combined in the *Nature of the behaviors* domain. Again, these adjustments were validated by re-running the OMG analyses.

For each of the resulting 18 domains, a Cronbach's alpha was computed. Investigation of 'alpha, if item deleted' values revealed that seven items could be deleted. These were one item measuring the domain *Priority*, one item measuring the domain *Innovation*, three items measuring the domain *Organization*, one item measuring the domain *Socio-political context*, and one item measuring the domain *Patient*. After these adjustments, the final questionnaire included 93 items assessing 18 domains (see Table 2). Definitions of these domains are shown in Table 3. In addition, OMG results showed that the total variance explained by the domains was increased with more than 15% to 63.3%. The variance-accounted-for by the structure of the questionnaire as we built it differed 4.7% with the variance-accounted-for by the components resulting from the PCA. This can be considered a small difference [195], indicating that the predefined (and adjusted) structure fits the data well. A comparison between the initial and the final questionnaire is shown in Table 4.

Internal consistency reliability and discriminant validity

Internal consistency reliability values for the 18 domains of the final questionnaire ranged from .68 for the domain *Innovation* (i.e., the only domain with an alpha <.70) to .93 for the domain *Knowledge*. None of the bootstrapped 95% confidence intervals around Pearson's correlations included 1.00, indicating sufficient discriminant validity (for an overview of all correlations between domains see Appendix 2). In addition, we found high attenuation-corrected correlations between the domains *Knowledge* and *Skills* (r = .80) and the domains *Skills* and *Social/professional role and identity* (r = .86), which suggests overlap between these domains (see Appendix 3).

Table 2. Final questionnaire

Domain		Construct	Item	Source
D1	Knowledge	Knowledge (1)	I know how to deliver [PA intervention] following the guidelines	Adapted from Amemori et al. [46]
		Role clarity(3)	Objectives of [PA intervention] and my role in this are clearly defined for me	Adapted from Wännström [197]
			With regard to [PA intervention] I know what my responsibilities are	
			In my work with [PA intervention] I know exactly what is expected from me	
D2	Skills	Skills (3)	I have been trained in delivering [PA intervention] following the guidelines	New items
			I have the skills to deliver [PA intervention] following the guidelines	
			I am practiced to deliver [PA intervention] following the guidelines	
D3	Social/ professional role and identity	Professional role (3)	Delivering [PA intervention] following the guidelines is part of my work as a PT	New items
			As a PT it is my job to deliver [PA intervention] following the guidelines	
			It is my responsibility as a PT to deliver [PA intervention] following the guidelines	
D4	Beliefs about capabilities	Self-efficacy (4)	I am confident that I can deliver [PA intervention] following the guidelines	Adapted from Bandura [139]
			I am confident that I can deliver [PA intervention] following the guidelines even when other professionals with whom I deliver [PA intervention] do not do this	Content based on Huijg et al. [131] and Huijg, et al. [149]
			I am confident that I can deliver [PA intervention] following the guidelines even when there is little time	
			I am confident that I can deliver [PA intervention] following the guidelines even when participants are not motivated	
		Perceived Behavioral Control (7)	I have control over delivering [PA intervention] following the guidelines	Adapted from Ajzen [138]
			For me, delivering [PA intervention] following the guidelines is (very difficult – very easy)	
			For me, performing the intake is (very difficult – very easy)	
			For me, delivering the training program is (very difficult – very easy)	

Table 2. **Final questionnaire (continued)**

Domain		Construct	Item	Source
			For me, performing the evaluation is (very difficult – very easy) For me, giving attention to participant's maintenance of PA behavior outside [PA intervention] is (very difficult – very easy) For me, reporting about the [PA intervention] to the referring professional is (very difficult – very easy)	
D5	Optimism	Optimism (3)	In my work as a PT, in uncertain times, I usually expect the best In my work as a PT, I'm always optimistic about the future In my work as a PT, overall, I expect more good things to happen than bad	Adapted from Scheier et al. [157]
D6	Beliefs about consequences	Attitude (4)	For me, delivering [PA intervention] following the guidelines is (not useful at all – very useful) For me, delivering [PA intervention] following the guidelines is (not worthwhile at all – very worthwhile) For me, delivering [PA intervention] following the guidelines is (not pleasurable at all – very pleasurable) For me, delivering [PA intervention] following the guidelines is (not interesting at all – very interesting)	Adapted from Ajzen [138]
		Outcome expectancies (5)	If I deliver [PA intervention] following the guidelines [PA intervention] will be most effective If I deliver [PA intervention] following the guidelines participants will appreciate this If I deliver [PA intervention] following the guidelines this will strengthen the collaboration with professionals with whom I deliver [PA intervention] If I deliver [PA intervention] following the guidelines I will feel satisfied If I deliver [PA intervention] following the guidelines it will help participants to be more physically active	Adapted from Bandura [139] Content based on Huijg et al. [131] and Huijg et al. [149]

Table 2. **Final questionnaire (continued)**

Domain		Construct	Item	Source
		Reinforcement (3)	When I deliver [PA intervention] following the guidelines, I get financial reimbursement When I deliver [PA intervention] following the guidelines, I get recognition from the work context When I deliver [PA intervention] following the guidelines, I get recognition from participants	New items Content based on Huijg et al. [131] and Huijg et al. [149]
D7	Intentions	Intention (3)	I intend to deliver [PA intervention] following the guidelines in the next three months I will definitely deliver [PA intervention] following the guidelines in the next three months How strong is your intention to deliver [PA intervention] following the guidelines in the next three months	Adapted from Ajzen [138]
D8	Goals	Priority (2)	How often is working on something else on your agenda a higher priority than delivering [PA intervention] following the guidelines How often is working on something else on your agenda more urgent than delivering [PA intervention] following the guidelines	New items
D9	Innovation	Innovation characteristics (5)	It is possible to tailor [PA intervention] to participants' needs It is possible to tailor [PA intervention] to professionals' needs [PA intervention] costs little time to deliver [PA intervention] is compatible with daily practice [PA intervention] is simple to deliver	New items Content based on Rogers [24]
D10	Socio- political context	Socio-political context (3)	Government and local authorities provide sufficient support to interventions such as [PA intervention] Insurance companies provide sufficient support to interventions such as [PA intervention] PHC is sufficiently oriented towards prevention	New items Content based on Huijg et al. [131] and Huijg et al. [149]
D11	Organization	Organizational resources and support (4)	In the organization I work, all necessary resources are available to deliver [PA intervention] I can count on support from the management of the organization I work in, when things get tough around delivering [PA intervention] following the guidelines	New items Content based on Huijg et al. [131] and Huijg et al. [149]

Table 2. **Final questionnaire (continued)**

Domain	Construct	Item	Source
		The management of the organization I work in is willing to listen to my problems with delivering [PA intervention] following the guidelines The management of the organization I work in is helpful with delivering [PA intervention] following the guidelines	
D12 Patient	Patient characteristics (2)	Participants of [PA intervention] are motivated Participants of [PA intervention] are positive about [PA intervention]	New items Content based on Huijg et al. [131] and Huijg et al. [149]
D13 Innovation strategy	Innovation strategies (7)	[Implementing organization] provides professionals with a training to deliver [PA intervention] [Implementing organization] provides the possibility to experience delivering [PA intervention] before professionals need to commit to it [Implementing organization] provides sufficient intervention materials [Implementing organization] provides assistance to professionals with delivering [PA intervention] [Implementing organization] organizes intervision meetings for professionals [Implementing organization] provides sufficient financial reimbursement to professionals for [PA intervention] delivery [Implementing organization] provides insights into results of [PA intervention]	New items Content based on Huijg et al. [131] and Huijg et al. [149]
D14 Social influences	Subjective norm (2)	Most people who are important to me think that I should deliver [PA intervention] following the guidelines Professionals with whom I deliver [PA intervention] think I should deliver [PA] intervention] following the guidelines	Adapted from Ajzen [138]
	Descriptive norm (2)	Professionals with whom I deliver [PA intervention] deliver [PA] intervention following the guidelines	Adapted from Cialdini et al. [158]

Table 2. **Final questionnaire (continued)**

Domain		Construct	Item	Source
			Other professionals who work with [PA intervention] deliver [PA intervention] following the guidelines	
		Social support (3)	I can count on support from professionals with whom I deliver [PA intervention] when things get tough around delivering [PA intervention] following the guidelines	Adapted from Frese [155]
			Professionals with whom I deliver [PA intervention] are willing to listen to my problems with delivering [PA intervention] following the guidelines	
			Professionals with whom I deliver [PA intervention] are helpful with delivering [PA intervention] following the guidelines	
D15	Positive emotions	Positive emotions (6)	When I work with [PA intervention] I feel optimistic	Adapted from van Veldhoven et al. [184]
			When I work with [PA intervention] I feel comfortable	
			When I work with [PA intervention] I feel calm	
			When I work with [PA intervention] I feel relaxed	
			When I work with [PA intervention] I feel cheerful	
			When I work with [PA intervention] I feel elated	
D16	Negative emotions	Negative emotions (6)	When I work with [PA intervention] I feel nervous	Adapted from van Veldhoven et al. [184]
			When I work with [PA intervention] I feel pessimistic	
			When I work with [PA intervention] I feel depressed	
			When I work with [PA intervention] I feel agitated	
			When I work with [PA intervention] I feel sad	
			When I work with [PA intervention] I feel uncomfortable	
D17	Behavioral regulation	Action planning (3)	I have a clear plan of how I will deliver [PA intervention] following the guidelines	Adapted from Sniehotta et al. [151]
			I have a clear plan under what circumstances I will deliver [PA intervention] following the guidelines	
			I have a clear plan when I will deliver [PA intervention] following the guidelines	
		Coping planning (3)	I have a clear plan with regard to delivering [PA intervention] following the guidelines when participants are not motivated	Adapted from Sniehotta et al. [151]

Table 2. **Final questionnaire (continued)**

Domain		Construct	Item	Source
			I have a clear plan with regard to delivering [PA intervention] following the guidelines when there is little time I have a clear plan with regard to delivering [PA intervention] following the guidelines when other professionals with whom I deliver [PA intervention] do not do this	Content based on Huijg et al. [131] and Huijg et al. [149]
D18	Nature of the behaviors	Automaticity (4)	Delivering [PA intervention] following the guidelines is something I do automatically Delivering [PA intervention] following the guidelines is something I do without having to consciously remember Delivering [PA intervention] following the guidelines is something I do without thinking Delivering [PA intervention] following the guidelines is something I start doing before I realize I am doing it	Gardner et al. [152]
		Memory (2)	Delivering [PA intervention] following the guidelines is something I seldom forget Delivering [PA intervention] following the guidelines is something I often forget	New items

Note. PA, physical activity; PT, physical therapist; PHC, primary health care

Table 3. **Domain definitions**

Domain		Definition
D1	Knowledge	An awareness of the existence of something
D2	Skills	An ability or proficiency acquired through practice
D3	Social/professional role and identity	A coherent set of behaviors and displayed personal qualities of an individual in a social or work setting
D4	Beliefs about capabilities	Acceptance of the truth, reality, or validity about an ability, talent, or facility that a person can put to constructive us
D5	Optimism	The confidence that things will happen for the best or that desired goals will be attained
D6	Beliefs about consequences	Acceptance of the truth, reality, or validity about outcomes of a behavior in a given situation
D7	Intentions	A conscious decision to perform a behavior or a resolve to act in a certain way
D8	Goals	Mental representations of outcomes or end states that an individual wants to achieve
D9	Innovation	Any characteristics of the innovation that discourages or encourages the development of skills and abilities, independence, social competence, and adaptive behavior
D10	Socio-political context	Any characteristics of the socio-political context that discourages or encourages the development of skills and abilities, independence, social competence, and adaptive behavior
D11	Organization	Any characteristics of the organization that discourages or encourages the development of skills and abilities, independence, social competence, and adaptive behavior
D12	Patient	Any characteristics of the patient that discourages or encourages the development of skills and abilities, independence, social competence, and adaptive behavior
D13	Innovation strategy	Any characteristics of the innovation strategy that discourages or encourages the development of skills and abilities, independence,social competence, and adaptive behavior
D14	Social influences	Those interpersonal processes that can cause individuals to change their thoughts, feelings, or behaviors
D15	Positive emotions	A complex positive reaction pattern, involving experiential, behavioral,

Note. All domain definitions, except for the definition of the domain 'Nature of the behaviors,' were based on definitions from Cane et al. [29], who derived their definitions from the American Psychological Associations' Dictionary of Psychology [67].

Table 4. **Comparison between initial and final questionnaire**

Domains	Item numbers (from initial questionnaire)	Amount of items	Cronbach's Alpha method	Explained variance OMG	Explained variance PCA
D1 Knowledge	1 - 4	4	.93	48.0%	56.5%
D2 Skills	5 - 7	3	.86		
D3 Social/professional role and identity	8 - 10	3	.90		
D4 Beliefs about capabilities	11 - 24	14	.84		
D5 Beliefs about consequences	25 - 36	12	.83		
D6 Motivation and goals	37 - 42	6	.77		
D7 Memory, attention, and decision processes	43 - 44	2	.71		
D8 Environmental context and resources	45 - 68	24	.82		
D9 Social influences	69 - 78	10	.84		
D10 Emotion	79 - 90	12	.88		
D11 Behavioral regulation	91 - 96	6	.79		
D12 Nature of the behaviors	97 - 100	4	.85		
D1 Knowledge	1 - 4	4	.93	63.3%	68.0%
D2 Skills	5 - 7	3	.86		
D3 Social/professional role and identity	8 - 10	3	.90		
D4 Beliefs about capabilities	11 - 21	11	.84		
D5 Optimism	22 - 24	3	.79		
D6 Beliefs about consequences	25 - 36	12	.83		
D7 Intentions	37 - 39	3	.91		
D8 Goals	40, 41	2	.88		
D9 Innovation	45 - 49	5	.68		
D10 Socio-political context	51 - 53	3	.73		
D11 Organization	57, 76 - 78	4	.85		
D12 Patient	60, 61	2	.74		
D13 Innovation strategy	62 - 68	7	.82		
D14 Social influences	69 - 75	7	.86		
D15 Positive emotions	80, 82, 84, 87, 89, 90	6	.85		
D16 Negative emotions	79, 81, 83, 85, 86, 88	6	.85		
D17 Behavioral regulation	91 - 96	6	.79		
D18 Nature of the behaviors	43, 44, 97 - 100	6	.85		

Note. OMG method, oblique multiple group method; PCA, principal component analysis

Discussion

We developed and tested a questionnaire assessing factors influencing HCPs' implementation behaviors that was based on a theoretical framework of behavioral determinants [31]. The DIBQ was one of the first TDF-based questionnaires that was developed in a rigorous manner, and showing good psychometric properties. That is, it had acceptable construct validity and the majority of domains showed high internal consistency reliability and discriminant validity (based on our specific methods of psychometric testing). While our focus was on the measurement of factors influencing the implementation of PA interventions in PHC, we suggest that the DIBQ can be applied more broadly as the questionnaire can easily be adapted to other contexts in which implementation research takes place. Consequently, the DIBQ can solve previously reported problems with the measurement of theory-based factors underlying HCP behavior [22,32,64,145]. This can contribute to the development of effective implementation strategies and subsequently the impact of evidence-based interventions.

With regard to the questionnaire's construct validity, our findings supported the majority of the predefined structure of the questionnaire that was based on the 12 domains of the TDF [31]. They correspond with Taylor et al. [48,167] who found good discriminant validity of TDF domains in a questionnaire measuring influences on patient safety behaviors [48] and in the Determinants of Physical Activity Questionnaire [167]. These results provide an additional level of validation for the content of the TDF and they confirm the viability of using the framework for construction of a theory-based questionnaire. Nevertheless, the questionnaire's construct validity could be enhanced by some adjustments in content of the domains and the structure of the questionnaire to 18 domains.

The main adjustment we made to the structure of the questionnaire was dividing the domain *Environmental context and resources* into five different environment-related domains: *Innovation, Socio-political context, Organization, Patient,* and *Innovation strategy*. This adjustment is consistent with leading theoretical models on the introduction of innovations in health care [5,7,17,24,27,64]. Replication of this domain-structure in future research may suggest including five different environment-related domains in the TDF. Next, *Optimism* items were separated from the domain *Beliefs about capabilities*. This separation makes sense because *Optimism* items were measured as a general disposition (e.g., 'In my work as a physical therapist, in uncertain times, I usually expect the best'), whereas *Beliefs about capabilities* items concerned capabilities that are required to achieve a specific outcome (e.g., 'I am confident that I can deliver [PA intervention] following the guidelines'). Furthermore, the adjustment corresponds with the results of the recent validation of the TDF [30]. Items measuring social support from the management were assigned to the domain *Organization* and *Priority* items were separated from *Intention* items. The first adjustment could also be justified by conceptual links between items and domains and the latter adjustment corresponded with results of the validated TDF [30]. In addition, dividing the domain *Emotion* into the domains *Positive emotions* and *Negative emotions* could be explained by previous research that indicated that positive and negative affect are two relatively independent constructs that can be measured discriminately [198,199]. Based on similarities in their content, items measuring the domain *Memory, attention, and decision processes* and Automaticity items were

merged into the domain *Nature of the behaviors*. Moreover, the link between automatic behaviors and memory was highlighted by Wood and Neal [200]. When developing a TDF-based questionnaire, it is possible that adding questions on attention and decision making to the memory items might decrease the overlap between the domains *Memory, attention, and decision processes* and *Nature of the behaviors*. Finally, some items measuring the domains *Priority, Innovation, Organization, Socio-political context*, and *Patient* were deleted based on the domains' Cronbach's alpha values. An explanation based on the content of these items could not be found, however, lack of internal consistency reliability of the domains *Priority, Innovation, Organization, Socio-political context*, and *Patient* might be related to the fact that the items measuring these domains were all newly developed. This suggests that items measuring the domain *Environmental context and resources* can be improved (see Chaudoir et al. [64] for an overview of measures assessing these domains related to the environment).

No adjustments were needed for five out of the 12 domains of the initial questionnaire: *Knowledge, Skills, Social/professional role and identity, Beliefs about consequences*, and *Behavioral regulation*. This might be explained by the use of previously published questionnaires for the development of *Knowledge and Behavioral regulation items*, and most of the *Beliefs about consequences* items. Furthermore, items measuring the domains *Skills* and *Social/professional role and identity* were validated by the discriminant content validity study [183]. Noticeably, the *Knowledge* item 'I know how to…', *Reinforcement* items, and items measuring the construct Action Planning performed well, while they could not be validated by the discriminant content validity study [183]. This might be explained by the divergence in the main aims of the two studies; the increased focus on *differences between individual items* when investigating items' discriminant content validity and the emphasis on *similarities between groups of items* when examining a questionnaire's construct validity. Indeed, in the present study, items that were not validated in the discriminant content validity study were added to other previously validated items.

Compared to three other studies using a TDF-based questionnaire to identify implementation behavior determinants [46–48], our questionnaire demonstrated high internal consistency reliability for the majority of domains. Explanations for this might be the lower number of items that the previous studies used to measure each domain [46–48] and the development of items for domains instead of constructs within domains [47,48]. Furthermore, it is not clear to what extent Beenstock et al. [47] and Taylor et al. [48] used items from previously published questionnaires.

Although OMG analyses revealed sufficient discriminant validity on item level, attenuation-corrected correlations revealed overlap between the domains *Knowledge* and *Skills* and *Skills* and *Social/professional role and identity*. On the other hand, bootstrapped 95% confidence intervals around correlations suggested that the questionnaire was able to measure TDF domains discriminately. Based on these results and the different content of the domains we did not merge them into one single domain. However, high correlations between domains might be problematic when analyzing associations between domains and outcome variables taking a multivariate approach.

While our focus was on the measurement of factors influencing HCPs' implementation of PA interventions, the questionnaire was designed to be easily adaptable so it can be used in studies

investigating implementation behaviors performed by other HCPs in other settings. However, depending on the behavior, the implementing HCP, and the context, it may be necessary to include items for specific barriers and facilitators. For example time, patient motivation, and financial support may play a role in the delivery of PA interventions by physical therapists, while these factors might not relate to other behaviors, HCPs, and settings. Moreover, validity and reliability of use of the questionnaire for other behaviors, HCPs, and settings need further investigation.

Some limitations of this study need to be taken into consideration when interpreting the results. First, respondents were physical therapists delivering PA interventions to a variety of target groups. In this study, we did not distinguish between the different PA interventions. Our results suggest sufficient internal validity of the DIBQ. However, a question remains as to whether the structure of the DIBQ holds for every specific PA intervention. In this study, small sample sizes within each PA intervention (sample sizes varied from 4 to 101) hindered the performance of confirmatory factor analysis for each PA intervention separately. A recommendation for future applications of the DIBQ is to replicate the reliability analysis for the target group at hand. Second, the questionnaire assessed TDF domains through their related constructs. However, to develop a questionnaire that is of an acceptable length to fill in, only a selection of constructs could be measured. Although the selection of key-constructs was based on previous research on factors influencing the implementation of PA interventions in primary health care [131,149], it could be that some of the domains' key-constructs are not part of the questionnaire leading to decreased validity of the measurement of domains. For example, the construct Intrinsic motivation [201] was not included to measure the domain *Motivation and goals* and the construct Burnout [202] was not included to measure the domain *Emotion*, although we know from previous research that these are important determinants for HCPs' evidence-based practice [203,204]. Nevertheless, a questionnaire including 93 items might still be too long to fill in. This could also be an explanation for the 55.2% response rate, which was comparable to previous reported response rates of 54% [116] and 57% [205] in surveys among physical therapists, but can be considered low in comparison to Barrett et al. [55] who reached a response rate of 88%. A next step in the development process could be to develop a shorter version of the DIBQ and assess its psychometric properties. One strategy to decrease the amount of items would be to select items measuring the domains directly, instead of through their related key construct. Taking into account the criterion for a reliable component (i.e., at least three items with a loading above .80 [168]), this could decrease the average of 4 items for each construct to 4 items for each domain. The results of the discriminant content validity study [183] may guide the selection of items in order to obtain a shortened version of the questionnaire. Comparisons between respondents and non-respondents indicated that the latter were significantly older and had more practice experience, which limits the generalizability of our results. Finally, the methods used to validate our questionnaire were limited to factor analyses and the examination of discriminant validity of the domains and only internal consistency reliability was assessed. Future research should further investigate the psychometric properties of the questionnaire, such as items' predictive validity and test-retest reliability.

Conclusion

This study describes the development and initial validation of the DIBQ. The questionnaire showed acceptable construct validity (i.e., research question 1) and the majority of domains showed high internal consistency reliability (i.e., research question 2) and discriminant validity (i.e., research

question 3). Therefore, the questionnaire is viable to measure potential determinants of implementation behavior in a theory-based and comprehensive way. The identification of factors influencing implementation behaviors provides important information on what factors should be targeted when designing strategies to promote the effective implementation of interventions [6,7,34–38]. This is highly likely to increase the impact of health behavior change interventions. Future studies on the psychometric properties of the questionnaire are warranted and should go beyond construct validity, internal consistency reliability, and discriminant validity. In addition, more research is needed to understand the strengths and limitations of the questionnaire when it is used for other behaviors among other HCPs and in other settings.

Appendix 1. **Initial questionnaire**

	Domain	Constructs		Items	Source
D1	Knowledge	Knowledge (1)	1.	I know how to deliver [PA intervention] following the guidelines	Adapted from Amemori et al. [46]
		Role clarity(3)	2.	Objectives of [PA intervention] and my role in this are clearly defined for me	Adapted from Wännström [197]
			3.	With regard to [PA intervention] I know what my responsibilities are	
			4.	In my work with [PA intervention] I know exactly what is expected from me	
D2	Skills	Skills (3)	5.	I have been trained in delivering [PA intervention] following the guidelines	New items
			6.	I have the skills to deliver [PA intervention] following the guidelines	
			7.	I am practiced to deliver [PA intervention] following the guidelines	
D3	Social/professional role and identity	Professional role (3)	8.	Delivering [PA intervention] following the guidelines is part of my work as a PT	New items
			9.	As a PT it is my job to deliver [PA intervention] following the guidelines	
			10.	It is my responsibility as a PT to deliver [PA intervention] following the guidelines	
D4	Beliefs about capabilities	Self-efficacy (4)	11.	I am confident that I can deliver [PA intervention] following the guidelines	Adapted from Bandura [139]
			12.	I am confident that I can deliver [PA intervention] following the guidelines even when other professionals with whom I deliver [PA intervention] do not do this	Content based on Huijg et al. [131] and Huijg et al. [149]
			13.	I am confident that I can deliver [PA intervention] following the guidelines even when there is little time	
			14.	I am confident that I can deliver [PA intervention] following the guidelines even when participants are not motivated	
		Perceived Behavioral Control (7)	15.	I have control over delivering [PA intervention] following the guidelines	Adapted from Ajzen [138]
			16.	For me, delivering [PA intervention] following the guidelines is (very difficult – very easy)	
			17.	For me, performing the intake is (very difficult – very easy)	
			18.	For me, delivering the training program is (very difficult – very easy)	
			19.	For me, performing the evaluation is (very difficult – very easy)	
			20.	For me, giving attention to participant's maintenance of PA behavior outside [PA intervention] is (very difficult – very easy)	
			21.	For me, reporting about the [PA intervention] to the referring professional is (very difficult – very easy)	
		Optimism (3)	22.	In my work as a PT, in uncertain times, I usually expect the best	Adapted from Scheier et al. [157]
			23.	In my work as a PT, I'm always optimistic about the future	
			24.	In my work as a PT, overall, I expect more good things to happen than bad	

Appendix 1. **Initial questionnaire (continued)**

	Domain	Constructs	Items	Source
D5	Beliefs about consequences	Attitude (4)	25. For me, delivering [PA intervention] following the guidelines is (not useful at all – very useful)	Adapted from Ajzen [138]
			26. For me, delivering [PA intervention] following the guidelines is (not worthwhile at all – very worthwhile)	
			27. For me, delivering [PA intervention] following the guidelines is (not pleasurable at all – very pleasurable)	
			28. For me, delivering [PA intervention] following the guidelines is (not interesting at all – very interesting)	
		Outcome expectancies (5)	29. If I deliver [PA intervention] following the guidelines [PA intervention] will be most effective	Adapted from Bandura [139]
			30. If I deliver [PA intervention] following the guidelines participants will appreciate this	
			31. If I deliver [PA intervention] following the guidelines this will strengthen the collaboration with professionals with whom I deliver [PA intervention]	Content based on Huijg et al. [131] et aand Huijg et al. [149]
			32. If I deliver [PA intervention] following the guidelines I will feel satisfied	
			33. If I deliver [PA intervention] following the guidelines it will help participants to be more physically active	
		Reinforcement (3)	34. When I deliver [PA intervention] following the guidelines, I get financial reimbursement	New items
			35. When I deliver [PA intervention] following the guidelines, I get recognition from the work context	Content based on Huijg et al. [131] and Huijg et al. [149]
			36. When I deliver [PA intervention] following the guidelines, I get recognition from participants	
D6	Motivation and goals	Intention (3)	37. I intend to deliver [PA intervention] following the guidelines in the next three months	Adapted from Ajzen [138]
			38. I will definitely deliver [PA intervention] following the guidelines in the next three months	
			39. How strong is your intention to deliver [PA intervention] following the guidelines in the next three months	
		Priority (3)	40. How often is working on something else on your agenda a higher priority than delivering [PA intervention] following the guidelines	New items
			41. How often is delivering [PA intervention] following the guidelines more important than working on something else on your agenda	
			42. How often is working on something else on your agenda more urgent than delivering [PA intervention] following the guidelines	
D7	Memory, attention, and decision processes	Memory (2)	43. Delivering [PA intervention] following the guidelines is something I seldom forget	New items
			44. Delivering [PA intervention] following the guidelines is something I often forget	
D8	Environmental context and resources	Characteristics of the innovation (6)	45. It is possible to tailor [PA intervention] to participants' needs	New items
			46. It is possible to tailor [PA intervention] to professionals' needs	
			47. [PA intervention] costs little time to deliver	Content based on Rogers [24], Huijg et al. [131] and Huijg et al. [149]
			48. [PA intervention] is compatible with daily practice	
			49. [PA intervention] is simple to deliver	
			50. [PA intervention] has advantages compared to standard care	

Appendix 1. **Initial questionnaire (continued)**

	Domain	Constructs		Items	Source
		Characteristics of the socio-political context (4)	51.	Government and local authorities provide sufficient support to interventions such as [PA intervention]	
			52.	Insurance companies provide sufficient support to interventions such as [PA intervention]	
			53.	PHC is sufficiently oriented towards prevention	
			54.	There is a good collaboration between professionals who deliver [PA intervention]	
		Characteristics of the organization (4)	55.	In the organization I work, are sufficient potential participants of [PA intervention] present	
			56.	In the organization I work, is enough time to deliver [PA intervention]	
			57.	In the organization I work, all necessary resources are available to deliver [PA intervention]	
			58.	In the organization I work, there is a good collaboration between professionals who deliver [PA intervention]	
		Characteristics of the [PA intervention] participants (3)	59.	I know participants of [PA intervention] personally	
			60.	Participants of [PA intervention] are motivated	
			61.	Participants of [PA intervention] are positive about [PA intervention]	
		Characteristics of the innovation strategy (7)	62.	[Implementing organization] provides professionals with a training to deliver [PA intervention]	
			63.	[Implementing organization] provides the possibility to experience delivering [PA intervention] before professionals need to commit to it	
			64.	[Implementing organization] provides sufficient intervention materials	
			65.	[Implementing organization] provides assistance to professionals with delivering [PA intervention]	
			66.	[Implementing organization] organizes intervision meetings for professionals	
			67.	[Implementing organization] provides sufficient financial reimbursement to professionals for [PA intervention] delivery	
			68.	[Implementing organization] provides insights into results of [PA intervention]	
D9	Social influences	Subjective norm (2)	69.	Most people who are important to me think that I should deliver [PA intervention] following the guidelines	Adapted from Ajzen [138]
			70.	Professionals with whom I deliver [PA intervention] think I should deliver [PA] intervention] following the guidelines	
		Descriptive norm (2)	71.	Professionals with whom I deliver [PA intervention] deliver [PA] intervention following the guidelines	Adapted from Cialdini et al. [158]
			72.	Other professionals who work with [PA intervention] deliver [PA intervention] following the guidelines	
		Social support (6)	73.	I can count on support from professionals with whom I deliver [PA intervention] when things get tough around delivering [PA intervention] following the guidelines	Adapted from Frese [155]
			74.	Professionals with whom I deliver [PA intervention] are willing to listen to my problems with delivering [PA intervention] following the guidelines	
			75.	Professionals with whom I deliver [PA intervention] are helpful with delivering [PA intervention] following the guidelines	
			76.	I can count on support from the management of the organization I work in, when things get tough around delivering [PA intervention] following the guidelines	

Appendix 1. **Initial questionnaire (continued)**

	Domain	Constructs		Items	Source
			77.	The management of the organization I work in is willing to listen to my problems with delivering [PA intervention] following the guidelines	
			78.	The management of the organization I work in is helpful with delivering [PA intervention] following the guidelines	
D10	Emotion	Emotions (12)	79.	When I work with [PA intervention] I feel nervous	Adapted from van Veldhoven [184]
			80.	When I work with [PA intervention] I feel optimistic	
			81.	When I work with [PA intervention] I feel pessimistic	
			82.	When I work with [PA intervention] I feel comfortable	
			83.	When I work with [PA intervention] I feel depressed	
			84.	When I work with [PA intervention] I feel calm	
			85.	When I work with [PA intervention] I feel agitated	
			86.	When I work with [PA intervention] I feel sad	
			87.	When I work with [PA intervention] I feel relaxed	
			88.	When I work with [PA intervention] I feel uncomfortable	
			89.	When I work with [PA intervention] I feel cheerful	
			90.	When I work with [PA intervention] I feel elated	
D11	Behavioral regulation	Action planning (3)	91.	I have a clear plan of how I will deliver [PA intervention] following the guidelines	Adapted from Sniehotta et al. [151]
			92.	I have a clear plan under what circumstances I will deliver [PA intervention] following the guidelines	
			93.	I have a clear plan when I will deliver [PA intervention] following the guidelines	
		Coping planning (3)	94.	I have a clear plan with regard to delivering [PA intervention] following the guidelines when participants are not motivated	Adapted from Sniehotta et al. [151]
			95.	I have a clear plan with regard to delivering [PA intervention] following the guidelines when there is little time	
			96.	I have a clear plan with regard to delivering [PA intervention] following the guidelines when other professionals with whom I deliver [PA intervention] do not do this	Content based on Huijg et al. [131] and Huijg et al. [149]
D12	Nature of the behaviors	Automaticity (4)	97.	Delivering [PA intervention] following the guidelines is something I do automatically	Gardner et al. [152]
			98.	Delivering [PA intervention] following the guidelines is something I do without having to consciously remember	
			99.	Delivering [PA intervention] following the guidelines is something I do without thinking	
			100.	Delivering [PA intervention] following the guidelines is something I start doing before I realize I am doing it	

Note. PA, physical activity; PT, physical therapist; PHC, primary health care

Appendix 2. Correlations between domains

		D1	D2	D3	D4	D5	D6	D7	D8	D9	D10	D11	D12	D13	D14	D15	D16	D17	D18
D1	Knowledge		.71**	.68**	.35**	.09	.38**	.24**	.17**	.20**	.04	.14*	.14*	.06	.16*	.33**	-.30**	.28**	.25**
D2	Skills			.76**	.40**	.12*	.45**	.36**	.18**	.16**	.02	.13*	.21**	.03	.24**	.32**	-.30**	.39**	.38**
D3	Social/prof. role and identity				.34**	.08	.46**	.41**	.21**	.15*	.08	.10	.21**	.10	.27**	.26**	-.25**	.32**	.34**
D4	Beliefs about capabilities					.30**	.52**	.40**	.26**	.53**	.12	.32**	.29**	.22**	.41**	.47**	-.35**	.64**	.56**
D5	Optimism						.24**	.08	.06	.21**	.08	.23*	.18**	.02	.16**	.30**	-.15*	.21**	.16**
D6	Beliefs about consequences							.50**	.34**	.32**	.13*	.29**	.39**	.27**	.45**	.50**	-.30**	.52**	.42**
D7	Intentions								.35**	.22**	.15	.24**	.37**	.18**	.42**	.36**	-.31**	.46**	.47**
D8	Goals									.18**	.06	.18**	.25**	.08	.27**	.25**	-.26**	.29**	.29
D9	Innovation										.29**	.28**	.20**	.26**	.34**	.35**	-.29**	.40**	.43**
D10	Socio-political context											.17**	.19**	.36**	.24**	.15*	-.02	.15*	.12*
D11	Organization												.19**	.16**	.31**	.28**	-.27**	.19**	.20**
D12	Patient													.17**	.42**	.34**	-.22**	.33**	.36**
D13	Innovation strategy														.25**	.16**	-.02	.11	.08
D14	Social influences															.37**	-.21**	.46**	.45**
D15	Positive emotions																-.52**	.48**	.38
D16	Negative emotions																	-.37**	-.33**
D17	Behavioral regulation																		.52**
D18	Nature of the behaviors																		

Note. *, $p < .05$; **, $p < .01$

Appendix 3. **Attenuation-corrected correlations**

		D1	D2	D3	D4	D5	D6	D7	D8	D9	D10	D11	D12	D13	D14	D15	D16	D17	D18
D1	Knowledge		.80	.74	.40	.11	.43	.26	.19	.26	.05	.16	.17	.07	.17	.38	-.34	.33	.28
D2	Skills			.86	.47	.15	.53	.41	.21	.21	.02	.16	.26	.04	.28	.37	-.36	.47	.45
D3	Social/prof. role and identity				.39	.10	.53	.46	.23	.19	.10	.11	.26	.12	.31	.29	-.29	.38	.39
D4	Beliefs about capabilities					.37	.62	.46	.30	.70	.15	.38	.37	.26	.49	.55	-.42	.79	.66
D5	Optimism						.30	.10	.08	.29	.11	.28	.23	.02	.19	.37	-.18	.27	.20
D6	Beliefs about consequences							.58	.40	.42	.16	.34	.50	.32	.53	.59	-.36	.64	.51
D7	Intentions								.39	.28	.19	.28	.45	.21	.47	.41	-.35	.55	.53
D8	Goals									.23	.08	.20	.31	.09	.31	.29	-.30	.34	.34
D9	Innovation										.41	.36	.28	.35	.45	.45	-.38	.55	.57
D10	Socio-political context											.21	.26	.46	.30	.19	-.02	.20	.16
D11	Organization												.23	.19	.36	.33	-.31	.23	.24
D12	Patient													.22	.53	.43	-.28	.44	.46
D13	Innovation strategy														.30	.19	-.03	.14	.10
D14	Social influences															.43	-.25	.56	.52
D15	Positive emotions																-.61	.59	.45
D16	Negative emotions																	-.46	-.38
D17	Behavioral regulation																		.63
D18	Nature of the behaviors																		

Chapter 7

Factors associated with physical therapists' implementation of physical activity interventions in the Netherlands

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Abstract

Background

Physical therapists can play an important role in physical activity (PA) promotion and the effectiveness of PA interventions. However, little is known on how they implement PA interventions and the factors that may influence their implementation behaviors.

Objective

The present study aimed to investigate physical therapists' PA intervention implementation fidelity, including completeness and quality of delivery, and potential influencing factors using a Theoretical Domains Framework (TDF)-based questionnaire.

Design

The study was based on a cross-sectional design.

Methods

The final analyses included 268 physical therapists who completed the Determinants of Implementation Behavior Questionnaire. Questions on completeness and quality of delivery were based on PA intervention components and tasks described by the Royal Dutch Society for Physical Therapy. Multilevel regression analyses were conducted to identify factors associated with completeness and quality.

Results

Physical therapists reported high implementation fidelity with higher completeness compared to quality of delivery. Analyses revealed that physical therapists' knowledge, skills, beliefs about capabilities and consequences, positive emotions, behavioral regulation, and the automaticity of PA intervention delivery were most important predictors of implementation fidelity. Results indicated that the TDF domains together accounted for 23% ($p < .001$) of the variance in both total completeness and quality scores.

Limitations

Our study was cross-sectional, so we could not determine any causal relationships. Furthermore, we used a self-report measure to assess implementation fidelity, which due to a possible social desirable response could have led to more favorable ratings of completeness and quality.

Conclusions

This study enhances our understanding of how physical therapists implement PA interventions and which factors may influence their behaviors. Knowledge on these factors can inform the development of strategies to improve physical therapists' implementation behaviors.

Introduction

Although physical activity (PA) is well-known to play an important role in disease prevention, health promotion and quality of life [206–208], many people are not sufficiently active [209]. In the Netherlands, 40% of the of the adults between 18 and 65 years of age fail to achieve the national recommendation of at least 30 minutes of moderately intense PA, on at least five days a week [210–212]. Moreover, half of the people with a chronic disease do not meet this norm [212]. Primary health care (PHC) is an ideal setting to promote PA in the general population [116,213]. The majority of adults visits a PHC professional at least once a year [213] and PHC professionals perceive PA promotion as important and part of their role [65]. Furthermore PHC-based PA interventions, such as PA counseling, prescribing PA, and referral to a PA training program, have been shown to be successful in increasing PA, at least with regard to the short term [60–63].

The public health impact of efficacious PHC-based PA interventions is, however, strongly dependent on how they are implemented in practice [7,16,19]. Implementation fidelity refers to the extent to which an intervention is delivered as intended (also known as adherence, compliance, integrity) [16,21], including both the quantity or completeness (i.e., how much of the intervention components are delivered) [16,21,127,214] and quality of the delivery (i.e., how well intervention components are delivered) [12,16,21,127]. In addition, other described aspects of implementation fidelity include participant responsiveness and program differentiation [16,21]. Although many studies have reported on the efficacy of PHC-based PA interventions, relatively little attention has been paid as yet to PHC professionals' implementation of these evidence-based interventions in practice [12,58]. Investigating PHC professionals' implementation behaviors is important, because the extent to which interventions are delivered as intended can moderate the relationship between interventions and their intended outcomes [16]. Therefore, implementation research is likely to enhance accurate interpretation of intervention outcomes [16,21]; in other words, it can provide information on why interventions are effective or not [6].

Due to their training and experience, physical therapists are PHC professionals who can play an important role in PA promotion, and through implementation fidelity they have a strong potential to increase the effectiveness of PA interventions [55,116,215]. Moreover, they are an important group of health care professionals delivering PA interventions in Dutch PHC. During the past two decades evidence-based practice has become of major importance in physical therapy [216,217]. This has led to the development of clinical practice guidelines by the Royal Dutch Society for Physical Therapy (KNGF) regarding physical therapy for people with a variety of conditions [218,219] (for an overview of KNGF guidelines see the KNGF website [220]). Furthermore, the KNGF has developed protocols for PA interventions, which inform physical therapists on PA interventions' core components (i.e., intake, training program, evaluation, attention to maintenance of PA, and contact with referring professional) and their underlying tasks (e.g., determine goals, set up training program with right content and intensity) (KNGF protocols for PA interventions are available in Dutch, for an overview see the KNGF website [221]). Many of the PA interventions delivered by physical therapists in Dutch PHC are based on these protocols.

Despite the promising findings related to the efficacy of PHC-based PA interventions [60–63], PA interventions are quite frequently not delivered as intended by the intervention developers [53,54]. Furthermore, research has indicated that physical therapists' evidence-based practices can be

improved [55–57,217]. This might be partially caused by the complexity of the behaviors involved in providing patient care and delivering behavior change interventions (e.g., PA interventions), and the many different potential determinants of such behaviors, including factors related to the innovation, social setting, organizational context, innovation strategies, patient, and the intervention provider [7,17,24,27]. Indeed, qualitative studies identified similar factors to be important for PHC professionals' implementation of PA interventions in general [131] and physical therapists' delivery of evidence-based physical therapy in specific [203]. However, there is limited data on physical therapists' implementation of PA interventions and the factors that influence their behaviors. Knowledge on how physical therapists deliver PA interventions and influencing factors is however a necessary prerequisite for the development of effective strategies to enhance physical therapists' implementation behaviors [6,7,35–38].

Given the range of potential factors associated with health care professionals' implementation behaviors, many advocate the use of theory to guide the selection of factors to investigate [6,22,36,43,145]. First, there is quite some evidence that behavior change interventions that are based on theory are likely to be more effective than those that are not [32,36,39,222], which might also hold true for interventions aimed at changing health care professionals' implementation behavior, i.e., implementation strategies. Second, by assessing the importance of theory-based factors, theoretical constructs can be identified that impact patterns of care and therefore may be targeted by implementation strategies [6,35,36]. However, the heterogeneity of theories and frameworks that guide implementation research have led to some challenges in measuring theory-based factors underlying health care professional behavior [22,32,64,145]. The Theoretical Domain Framework [30,31] (TDF) is an integrative framework of constructs from behavior change theories that can be used to develop a measurement instrument able to assess determinants of health care professionals' implementation of behavior change interventions [46,47]. In this way, the TDF can be used to identify suitable theories to further investigate specific implementation behaviors [182]. Furthermore, it links influencing factors to techniques of behavior change which can be used in implementation strategies [30,35]. Huijg et al. [173] developed a TDF-based questionnaire to assess potential behavioral determinants in a theory-based way. In a first investigation of its psychometric properties, the Determinants of Implementation Behavior Questionnaire (DIBQ) was suggested to have acceptable construct validity (based on confirmatory factor analysis) and the majority of the TDF domains appeared to be reliably and discriminately measurable [173].

The present study aimed to investigate the extent to which physical therapists deliver PA interventions with high fidelity (i.e., following the intervention protocol) and which TDF domains [31] are associated with completeness and quality of delivery. Research questions were as follows: 1. to what extent do physical therapists deliver all PA intervention components to all of their patients (i.e., completeness), 2. how well do they deliver PA interventions (i.e., quality), and 3. which TDF domains are associated with physical therapists' completeness and quality of delivery?

Methods

Design and respondents

The study was a cross-sectional questionnaire study conducted through the Internet by the use of

Qualtrics Software, version 45433 [132]. Recruitment and data collection took place from June 2012 until March 2013. We recruited physical therapists delivering PA interventions to a variety of target groups (i.e., people with chronic obstructive pulmonary disease, diabetes, arthritis or obesity) to be able to examine the association between TDF domains and the implementation of PA interventions in general. Interventions were similar with regard to their core components (i.e., intake, training program, evaluation, attention to maintenance of PA, and contact with referring professional), that were to a small or greater extent based on KNGF protocols for PA interventions [221].

The first strategy to recruit physical therapists was contacting their associations and collaborations in the Netherlands. These associations and collaborations invest time and effort in the implementation of PA interventions by, for example, developing PA intervention protocols, providing training, and organizing meetings. When they were willing to participate in the study, a questionnaire was developed specifically on the implementation of the PA intervention they chose to be evaluated. Subsequently, member physical therapists were sent an email including the link to the online questionnaire and were assured that their responses would be confidential and anonymous. Physical therapists were eligible for participation if they had experience with and were currently delivering one of the PA interventions that were under study and if they were working in PHC. Completing the questionnaires indicated consent, so no separate consent was obtained. Individual physical therapists were rewarded a 25 euro voucher for participating. Associations and collaborations were provided with a summary of the results. A second recruitment strategy was to identify physical therapists delivering PA interventions through the internet and practice websites. These physical therapists were contacted by phone and/or email to invite them for the study. When they were willing to participate in the study, they were sent an email including the link to the online questionnaire. After one, two, and three weeks non-respondents received a reminder and at the end of the study, non-respondents were sent an email with a questionnaire on their demographic characteristics and reasons not to participate in the study.

Measurement

Demographic characteristics

Respondents and non-respondents reported their gender, age, practice/workplace, and socioeconomic status (SES) of the majority of their intervention participants. Practice experience was reported in years. Experience with PA interventions was measured differently for the first part of respondents compared to the second part of respondents and the non-respondents. Initially, we asked how many patients physical therapists delivered the intervention to in total. Later on, we asked how many patients physical therapists delivered the intervention to in the past two years. This change in measurement was based on respondents' comments that it was difficult to report the total amount of participants they delivered the intervention to. Therefore, median scores were calculated for experience with PA intervention. Scores below median indicated short experience and median scores and higher indicated long experience.

Implementation fidelity

Physical therapists' implementation fidelity of PA interventions, including completeness and quality of delivery, was assessed using a self-report questionnaire. Content of the questionnaire was based on the core components of PA interventions (i.e., intake, training program, evaluation, attention to maintenance of PA, and contact with referring professional) and their underlying tasks (Appendix 1).

Completeness of delivery was assessed by asking physical therapists with how many of the intervention participants they performed a certain task. Therefore, completeness of the different intervention components was assessed by multiple items. On average, intake completeness was measured with 12 items, training program completeness with nine items, evaluation completeness with five items, and attention to maintenance of PA completeness and contact with the referring professional completeness with two items each. An example question was: 'With how many of the participants did you determine PA intervention goals?'. Responses were assessed on a 7-point Likert scale (1 = none, 2 = a few, 3 = less than half, 4 = half, 5 = more than half, 6 = almost all, and 7 = all). For each respondent, a total completeness score was calculated based on mean scores of all completeness items, in addition to mean completeness scores for each intervention component. PA intervention protocols were used to tailor completeness items to specific PA interventions concerning chronic obstructive pulmonary disease (COPD), diabetes, arthritis, or obesity. This resulted in questionnaires that were similar for all physical therapists with regard to the intervention components and tasks, but questionnaires differed slightly for the various PA interventions with regard to the assessment of completeness at item level. For instance, questionnaires assessing completeness of interventions aimed at promoting PA in people with COPD included assessing patients' breathlessness score, whereas this was not included in diabetes, arthritis, or obesity questionnaires. Furthermore, physical therapists' measurement of waist circumference was included in questionnaires on diabetes and obesity PA interventions, whereas this task was not included in the other questionnaires.

Quality of delivery was assessed by asking physical therapists' satisfaction with their delivery of a specific intervention component (i.e., intake, training program, evaluation, attention to maintenance of PA, and contact with referring professional). Therefore, quality was assessed by five items in total. An example question was: 'How satisfied are you with how you did the intake?'. Responses were assessed on a 7-point Likert scale (1 = not satisfied at all, 2 = a little dissatisfied, 3 = not satisfied/ not dissatisfied, 4 = a little satisfied, 5 = satisfied, 6 = very satisfied, and 7 = totally satisfied). For each respondent, a total quality of delivery score was calculated based on the mean scores of all quality items.

TDF domains

The Determinants of Implementation Behavior Questionnaire (DIBQ; Huijg et al. [173]; Appendix 2) was used to assess potential factors influencing physical therapists' completeness and quality of delivery of PA interventions. This part of the questionnaire was similar for all participants, because physical therapists' implementation behaviors were referred to as 'delivery of [PA intervention] following the intervention protocol'. This allowed us to assess one general behavior in relation to each domain instead of all different tasks involved in delivering PA interventions. To remind respondents about what this general behavior included for them, they were presented with the tasks that they were required to perform if they were to deliver the specific PA intervention they were working with following the intervention protocol. An example question is: 'I am confident that I can deliver [PA intervention] following the intervention protocol'. Responses were assessed on a 7-point Likert scale (1 = strongly disagree, 7 = strongly agree). Mean scores were calculated for each of the 18 domains. For the domains *Organization* and *Social influences* it was possible to fill in 'Not applicable' for some of the items. These scores were recorded as missing. To calculate the mean of the specific domains, items with missing values were imputed for each respondent separately with the respondents' mean of the remaining items.

The questionnaire was piloted among five colleague researchers and a sample of physical therapists (n = 8). Piloting indicated that the questionnaire was understood and received well by the respondents. Questions on the implementation of specific PA interventions were discussed with physical therapists who had experience with its delivery.

Data analyses

The target sample size was based on a recommendation by Stevens et al. [168] to have a minimum of 270 respondents when undertaking multiple regression analysis with 18 predictors.

Questionnaires were exported from Qualtrics [132] to IBM SPSS Statistics 19.0 [136] for analyses. Differences in demographic characteristics between respondents and non-respondents were analyzed with chi-square tests for categorical variables and independent t-tests for continuous variables. Associations between domains were assessed using Pearson's correlation and defined as small (.10), medium (.30), and large (.50), according to the guidelines of Cohen [196]. Intraclass correlations were calculated to assess the proportion of the total variability in the outcome that was attributed to the different PA interventions. Multilevel regression analyses [223] were performed to explore the association between the 18 domains of potential behavioral determinants and self-reported completeness and quality of delivery. These analyses take into account the non-independence of physical therapist scores (level 1) nested within the different PA interventions they deliver (level 2). Multilevel analyses were performed for each of the 18 predictor variables separately, i.e., to assess univariate associations, followed by analyses including all predictor variables, i.e., to assess multivariate associations. Total completeness and quality scores were treated as outcome variables. The false discovery rate controlling procedure [162] was used to correct for multiple testing. The proportion of variance explained at the first level was calculated as the decrease in residual variance from the intercept-only model to the model of interest (see formula 4.8 in Hox [223], p. 71, based on Raudenbush & Byrk [224]).

Results

Characteristics of the respondents

Of the 496 physical therapists who were invited for the study, 274 (55.2%) delivering 15 different PA interventions completed the questionnaire. From the 274 questionnaires, 268 were used in the analysis. Reasons for removal were: no experience with PA intervention delivery (n = 4) and non-reliable completeness and quality scores (n = 2). Table 1 shows characteristics of the respondents and non-respondents. Of the respondents, 58.2% (n = 156) was female, they were on average 39.8 (SD = 12.3) years old, and they had on average 15.0 (SD = 11.3) years of practice experience. Most of the respondents worked in a group practice (68.3%, n = 183) and most delivered PA interventions to an equal percentage of intervention participants with a low and high SES (52.6%, n = 141) or specifically to intervention participants with a low SES (45.1%, n = 121). None of the demographic variables correlated significantly with total completeness and quality scores (data not shown).

Sixty-eight out of 222 non-respondents (30.6%) completed the non-respondents questionnaire. Comparisons between respondents and non-respondents indicated that the latter were significantly older and had more practice experience. Main reasons for not filling out the

questionnaire were lack of experience with the specific PA intervention the questionnaire was about (n = 26), lack of experience with delivering the PA intervention because of a lack of PA intervention participants (n = 33), and lack of time to fill out the questionnaire (n = 16).

Table 1. Demographic characteristics of respondents and non-respondents

Demographic variable	Respondents (N = 268)		Non-respondents (N = 68)	
	Mean (SD)	n (%)	Mean (SD)	n (%)
Gender				
Male		112 (41.8)		27 (38.6)
Female		156 (58.2)		39 (55.7)
Age	39.8 (12.3)*		45.6 (11.7)*†	
Practice experience (years)	15.0 (11.3)*		19.8 (11.8)*‡	
Experience with PA intervention (based on median scores)				
Short		121 (45.1)		26 (48.1)‡
Long		147 (54.9)		28 (51.9)‡
Sort of practice/workplace				
Solo practice		7 (2.6)		3 (4.3)†
Duo practice		9 (3.4)		1 (1.4)†
Group practice		183 (68.3)		36 (51.4)†
Multidisciplinary HC center		61 (22.8)		11 (15.7)†
Other		8 (3.0)		4 (5.7)†
SES intervention participants				
Mostly high SES		6 (2.2)		4 (5.7)†
50-50		141 (52.6)		30 (42.9)†
Mostly low SES		121 (45.1)		21 (30.0)†

Note. Results of chi-square tests and independent t-tests are reported; *, $p < .05$; †, based on N = 55; ‡, based on N = 54; HC, health care; SES, socio economic status

Implementation fidelity

Physical therapists' completeness and quality scores are shown in Table 2. Mean completeness scores ranged from 5.6 (SD = 1.4; i.e., contact with referring professional) to 6.2 (SD = 0.7; i.e., intake), which indicates that on average respondents deliver PA interventions following the intervention protocol to more than half to almost all of the intervention participants. Mean quality scores were lower, but still fairly high with mean scores ranging from 4.9 (SD = 1.2; i.e., attention to maintenance of PA) to 5.5 (SD = 0.9; i.e., intake). This indicates that on average respondents are satisfied with how they deliver PA interventions. Correlations between completeness and quality scores ranged between .36 and .68 indicating that they were different outcome measures (data not shown).

Role of different PA interventions in data

Intraclass correlations are displayed in Table 2. Intraclass correlations for completeness were higher compared to intraclass correlations for quality, which indicates that the influence of the different PA interventions was larger for how respondents report completeness of delivery compared to how they report quality of delivery. Intraclass correlations for intake, training program, and evaluation completeness were higher than .10 supporting the appropriateness of multilevel analyses [225].

Table 2. Mean completeness and quality scores and intraclass correlations (N = 268)

Intervention component	Completeness		Quality	
	Mean (SD)	ICC	Mean (SD)	ICC
A. Intake	6.2 (0.7)	.11	5.5 (0.9)	.00
B. Training program	6.1 (0.7)	.12	5.4 (0.8)	.00
C. Evaluation	6.1 (1.1)	.15	5.1 (1.1)†	.00†
D. Attention to maintenance of PA	6.0 (1.2)	.03	4.9 (1.2)	.04
E. Contact with referring professional	5.6 (1.4)†	.10†	4.9 (1.2)†	.01†
Total	6.0 (0.7)	.04	5.2 (0.8)	.00

Note. SD, standard deviation; ICC, intraclass correlation; PA, physical activity; †, N = 255

Domains

Table 3 shows descriptive variables and correlations for all domains. Mean scores indicated that physical therapists have generally favorable perceptions towards delivering PA interventions following the intervention protocol. Highest mean scores were found for the domains *Knowledge* (M = 5.95, SD = 0.84), *Organization* (M = 5.82, SD = 1.06), and *Skills* (M = 5.80, SD = 1.01). This indicates that respondents are positive about their knowledge and skills to deliver PA interventions following the intervention protocol and that the organization they work in provides them with sufficient resources and support to deliver PA interventions following the intervention protocol. Lowest mean scores were found for the domains *Negative emotions* (M = 1.68, SD = 0.79), *Socio-political context* (M = 3.05, SD = 1.22), and *Innovation strategy* (M = 4.16, SD = 0.96). This indicates that respondents experience few negative emotions while working with the PA intervention they are delivering, and that they think that the medical culture and availability of support from the socio-political context can be improved, in addition to innovation strategies, such as training, material, and reimbursement. Correlations between domains were mostly small or medium, while eleven correlations were large.

Table 3. **Correlations and descriptive statistics for all domains (*N* = 268)**

	D1	D2	D3	D4	D5	D6	D7	D8	D9	D10	D11	D12	D13	D14	D15	D16	D17	D18
D1 Knowledge		.72**	.68**	.34**	.09	.37**	.23**	.17**	.20**	.05	.14**	.14*	.06	.16**	.33**	-.30**	.28**	.24**
D2 Skills			.76**	.38**	.11	.43**	.36**	.19**	.16**	.03	.15*	.22**	.04	.24**	.32**	-.32**	.35**	.37**
D3 Social/prof. role and identity				.33**	.08	.45**	.41**	.21**	.15*	.09	.11	.22**	.11	.28**	.25**	-.26**	.31**	.33**
D4 Beliefs about capabilities					.30**	.50**	.39**	.27**	.54**	.14	.34**	.29**	.23**	.43**	.46**	-.36**	.63**	.55**
D5 Optimism						.23**	.08	.07	.21**	.09	.23**	.18**	.02	.16**	.30**	-.15*	.21**	.15**
D6 Beliefs about consequences							.50**	.35**	.32**	.14*	.30**	.40**	.28**	.46**	.50**	-.31**	.50**	.41**
D7 Intentions								.35**	.22**	.17**	.25**	.37**	.19**	.43**	.35**	-.31**	.46**	.46**
D8 Goals									.18**	.07	.18**	.25**	.07	.27**	.26**	-.26**	.30**	.30
D9 Innovation										.29**	.28**	.20**	.26**	.34**	.35**	-.29**	.42**	.43**
D10 Socio-political context											.17**	.19**	.16*	.31**	.28**	-.26**	.21**	.21**
D11 Organization												.19**	.36**	.24**	.16*	-.02	.18**	.14*
D12 Patient													.17**	.43**	.34**	-.22**	.34**	.36**
D13 Innovation strategy														.25**	.17**	-.02	.13*	.09
D14 Social influences															.37**	-.22**	.48**	.46**
D15 Positive emotions																-.52**	.48**	.38**
D16 Negative emotions																	-.40**	-.33**
D17 Behavioral regulation																		.51**
D18 Nature of the behaviors																		
Cronbach's alpha	.93	.85	.91	.84	.79	.83	.91	.88	.68	.72	.85	.74	.82	.86	.86	.85	.77	.86
(number of items)	(4)	(3)	(3)	(11)	(3)	(12)	(3)	(2)	(5)	(3)	.(4)	(2)	.(7)	(7)	(6)	(6)	(6)	(6)
Mean	5.95	5.80	5.75	5.37	5.46	5.12	5.68	4.95	4.82	3.05	5.82	5.51	4.16	5.11	5.38	1.68	5.38	5.08
SD	0.84	1.01	1.00	0.66	0.91	0.76	1.06	1.19	0.84	1.22	1.06	0.86	0.96	0.92	0.86	0.79	0.70	0.99

Note. SD, standard deviation; *, $p < .05$; **, $p < .01$

Domains and implementation fidelity

With regard to total completeness and quality, univariate multilevel analyses revealed multiple significant predictors (Table 4). Based on ranked *p*-values, most important predictors of both total completeness and quality were *Beliefs about capabilities, Behavioral regulation, Nature of the behaviors*, and *Knowledge*. Furthermore, *Beliefs about consequences* was one of the most important predictors of total completeness and *Positive emotions* was one of the most important predictors of total quality. Multivariate analyses resulted in only one significant predictor of both total completeness and quality, i.e., *Beliefs about capabilities*. Together, TDF domains accounted for 23% ($p < .001$) of the variance in both total completeness and quality of delivery.

Most important predictors of physical therapists' total completeness and quality scores were confirmed by univariate multilevel analyses on completeness and quality of delivery of the different intervention components (Tables 5 and 6). *Knowledge, Skills, Beliefs about capabilities*, and *Behavioral regulation* were significantly associated with completeness and quality of delivery of all intervention components. In addition to these domains, *Nature of the behaviors*, *Beliefs about consequences*, and *Positive emotions* were significantly associated with quality, but not completeness of delivery, of all intervention components.

Domains unrelated to implementation fidelity outcomes were *Innovation strategy* (i.e., unrelated to total completeness and quality of delivery) and *Optimism*, *Socio-political context*, and *Negative emotions* (i.e., unrelated to total completeness; Table 4). Furthermore, the domains *Innovation strategy* and *Socio-political context* were unrelated to completeness of any of the intervention components (Table 5).

Table 4. **Domains and total completeness and quality of delivery (*N* = 268)**

		Univariate analyses						Multivariate analysis					
		Completeness			Quality			Completeness			Quality		
		b	95% CI	*p*	*b*	95% CI	*p*	*b*	95% CI	*p*	*b*	95% CI	*p*
D1	Knowledge	**.20**	**0.11 - 0.30**	**.000[5]**	**.30**	**0.19 – 0.40**	**.000[5]**						
D2	Skills	.17	0.09 - 0.25	.000[6]	.24	0.15 – 0.33	.000[6]						
D3	Social/professional role and identity	.13	0.04 - 0.21	.003[10]	.15	0.06 – 0.25	.001[13]						
D4	Beliefs about capabilities	**.43**	**0.32 - 0.55**	**.000[1]**	**.60**	**0.48 – 0.73**	**.000[1]**	.32	0.15 – 0.50	.000	.48	0.30 – 0.67	.000
D5	Optimism				.16	0.06 – 0.26	.003[14]						
D6	Beliefs about consequences	**.26**	**0.15 – 0.37**	**.000[3]**	.30	0.28 – 0.42	.000[7]						
D7	Intentions	.14	0.06 – 0.22	.000[7]	.13	0.04 – 0.22	.005[15]						
D8	Goals	.09	0.02 – 0.16	.014[12]	.08	0.00 – 0.16	.041[17]						
D9	Innovation	.14	0.04 – 0.24	.006[11]	.24	0.13 – 0.35	.000[8]						
D10	Socio-political context				.08	0.01 – 0.16	.034[16]						
D11	Organization	.09	0.01 - 0.17	.033[14]	.18	0.10 – 0.27	.000[10]						
D12	Patient	.11	0.02 – 0.21	.022[13]	.19	0.08 – 0.30	.001[12]						
D13	Innovation strategy												
D14	Social influences	.16	0.07 – 0.25	.001[8]	.21	0.11 – 0.31	.000[11]						
D15	Positive emotions	.17	0.07 – 0.27	.001[9]	**.30**	**0.20 – 0.41**	**.000[4]**						
D16	Negative emotions				-.25	-0.37 – -0.13	.000[9]						
D17	Behavioral regulation	**.33**	**0.22 – 0.45**	**.000[2]**	**.40**	**0.27 – 0.53**	**.000[2]**						
D18	Nature of the behaviors	**.19**	**0.11 – 0.27**	**.000[4]**	**.27**	**0.18 – 0.36**	**.000[3]**						
Model fit (R^2)									.23			.23	

Note. *b*, regression coefficient; overall *p*-value is .05 after false discovery rate controlling procedure for multiple testing; CI, confidence interval (note that *p*-values were controlled for multiple testing and CIs were not)

Bold results indicate most important predictors based on corrected *p*-values

Superscript numbers indicate rank of *p*-value

Table 5. **Domains and completeness of intervention components (univariate analyses; *N* = 268)**

		A. Intake		B. Training program		C. Evaluation		D. Attention to maintenance of PA		E. Contact with referring professional†		#
		b	95% CI	b	95% CI	b	96% CI	b	96% CI	b	96% CI	
D1	**Knowledge**	.16	0.06 – 0.25	.16	0.06 – 0.25	.18	0.04 – 0.32	.28	0.11 – 0.44	.27	0.07 – 0.46	**5/5**
D2	**Skills**	.12	0.04 – 0.20	.14	0.06 – 0.22	.17	0.06 – 0.29	.18	0.04 – 0.32	.24	0.08 – 0.41	**5/5**
D4	**Beliefs about capabilities**	.31	0.19 – 0.43	.33	0.21 – 0.45	.35	0.17 – 0.53	.56	0.35 – 0.76	.65	0.41 – 0.90	**5/5**
D17	**Behavioral regulation**	.27	0.16 – 0.39	.33	0.22 – 0.45	.26	0.09 – 0.43	.34	0.15 – 0.54	.50	0.27 – 0.74	**5/5**
D18	Nature of the behaviors	.14	0.06 – 0.22	.21	0.13 – 0.29	.21	0.09 – 0.33			.25	0.09 – 0.42	4/5
D6	Beliefs about consequences	.24	0.13 – 0.34	.28	0.18 – 0.38					.42	0.21 – 0.64	3/5
D7	Intentions	.16	0.09 – 0.24	.18	0.10 – 0.25					.19	0.04 – 0.35	3/5
D14	Social influences	.18	0.09 – 0.27	.18	0.09 – 0.26					.29	0.11 – 0.47	3/5
D15	Positive emotions	.14	0.04 – 0.24	.18	0.09 – 0.28			.25	0.09 – 0.41			3/5
D3	Social/professional role and identity			.11	0.03 – 0.19					.21	0.04 – 0.37	2/5
D8	Goals			.11	0.04 – 0.18					.18	0.03 – 0.32	2/5
D9	Innovation			.14	0.04 – 0.24			.24	0.07 – 0.41			2/5
D16	Negative emotions	-.14	-0.24 – -0.03	-.11	-0.22 – -0.01							2/5
D5	Optimism							.28	0.13 – 0.43			1/5
D11	Organization	.09	0.01 – 0.17									1/5
D12	Patient			.13	0.04 – 0.23							1/5
D10	Socio-political context											0/5
D13	Innovation strategy											0/5

Note. †, n = 255; *b*, regression coefficient; overall *p*-value is .05 after false discovery rate controlling procedure for multiple testing; CI, confidence interval (note that *p*-values were controlled for multiple testing and CIs were not)

Table 6. **Domains and quality of delivery of intervention components (univariate analyses; *N* = 268)**

		A. Intake		B. Training program		C. Evaluation		D. Attention to maintenance of PA		E. Contact with referring professional†		#
		b	95% CI	b	95% CI	b	96% CI	b	96% CI	b	96% CI	
D1	**Knowledge**	.22	0.09 – 0.34	.24	0.12 – 0.35	.33	0.18 – 0.48	.28	0.11 – 0.46	.42	0.25 – 0.59	**5/5**
D2	**Skills**	.21	0.11 – 0.31	.22	0.12 – 0.31	.28	0.15 – 0.41	.16	0.02 – 0.31	.33	0.19 – 0.48	**5/5**
D4	**Beliefs about capabilities**	.48	0.33 – 0.63	.56	0.43 – 0.70	.74	0.56 – 0.91	.69	0.48 – 0.90	.55	0.34 – 0.77	**5/5**
D6	**Beliefs about consequences**	.17	0.04 – 0.31	.32	0.19 – 0.44	.39	0.21 – 0.56	.23	0.04 – 0.42	.41	0.22 – 0.61	**5/5**
D15	**Positive emotions**	.23	0.11 – 0.35	.28	0.16 – 0.39	.44	0.29 – 0.59	.25	0.07 – 0.42	.30	0.13 – 0.47	**5/5**
D17	**Behavioral regulation**	.29	0.15 – 0.44	.40	0.26 – 0.53	.47	0.28 – 0.65	.38	0.18 – 0.59	.45	0.24 – 0.65	**5/5**
D18	**Nature of the behaviors**	.22	0.12 – 0.32	.32	0.22 – 0.41	.35	0.22 – 0.48	.20	0.05 – 0.34	.24	0.09 – 0.39	**5/5**
D11	Organization			.23	0.14 – 0.32	.22	0.09 – 0.34	.17	0.03 – 0.31	.17	0.03 – 0.31	4/5
D3	Social/professional role and identity			.14	0.04 – 0.24	.19	0.06 – 0.32			.23	0.08 – 0.38	3/5
D5	Optimism	.13	0.02 – 0.25	.18	0.07 – 0.28			.23	0.07 – 0.39			3/5
D7	Intentions			.19	0.10 – 0.28	.20	0.07 – 0.32			.17	0.04 – 0.31	3/5
D9	Innovation			.33	0.21 – 0.44	.23	0.08 – 0.40	.35	0.17 – 0.52			3/5
D12	Patient	.16	0.04 – 0.28	.25	0.14 – 0.37	.22	0.06 – 0.37					3/5
D14	Social influences			.21	0.10 – 0.31	.20	0.05 – 0.34	.24	0.08 – 0.40	.30	0.13 – 0.46	3/5
D16	Negative emotions	-.20	-0.33 - -0.07	-.34	-0.46 – -0.22	-.46	-0.62 – -0.30					3/5
D8	Goals					.13	0.02 – 0.24					1/5
D10	Socio-political context			.11	0.02 – 0.19							1/5
D13	Innovation strategy							.19	0.03 – 0.34			1/5

Note. †, n = 255; *b*, regression coefficient; overall *p*-value is .05 after false discovery rate controlling procedure for multiple testing; CI, confidence interval (note that *p*-values were controlled for multiple testing and CIs were not)

Discussion

Related to the recently growing literature on physical therapists' evidence-based practices and implementation of specific guidelines, this study investigated physical therapists' completeness and quality of delivery of PA interventions. To our knowledge, this is the first study that investigated physical therapists' implementation of PA interventions in general, and the factors associated with their implementation behaviors.

Respondents reported that they deliver PA interventions with high fidelity. Their completeness and quality scores indicate that they deliver PA interventions following the intervention protocol to more than half to almost all of their patients and that they are satisfied with the quality that they provide. Completeness scores appear to be quite to very good, particularly when considering that tailoring PA interventions to individual patients' needs may at times require deviation from the protocol [57]. These high scores may be to some extent explained by the time and effort physical therapist associations and collaborations invest in the implementation of PA interventions, for example, by developing PA intervention protocols, providing training, and organizing meetings. The findings do, however, suggest that quality of delivery can still be improved. Although differences in study design and measurement of implementation fidelity make it difficult to compare study outcomes, our results seem in line with Swinkels et al. [56] who found that physical therapists' practices matched the evidence-based guideline for the majority of patients with low back pain and van der Wees et al. [57] who found that physical therapists' adherence to the Acute ankle injury guideline was quite high, but that there was still room for improvement.

Most important factors associated with implementation fidelity were physical therapists' 1. knowledge, 2. skills, 3. beliefs about capabilities to deliver PA interventions following the intervention protocol, 4. beliefs about consequences of delivering PA interventions following the intervention protocol, 5. positive emotions towards working with PA interventions, 6. plans with regard to intervention delivery, including what to do when barriers, such as lack of time or lack of patient motivation, are encountered, and 7. the extent to which delivering PA interventions following the intervention protocol is an automatic behavior. The importance of these domains was previously reported in qualitative studies on health care professional behavior [32,40,179,180,203]. Furthermore, constructs related to the domains *Knowledge* [55], *Beliefs about capabilities* (i.e., self-efficacy [37,172], perceived behavioral control [37,113,172]), *Beliefs about consequences* (i.e., outcome expectations [37,172], attitudes [113,172,217]), *Behavioral regulation* (i.e., action planning [37,172], coping planning [37]), and *Nature of the behaviors* (i.e., automaticity or habit [37,113,172]) were found to predict health care professional behaviors in multiple quantitative studies. The findings suggest suitable theories to further investigate physical therapists' implementation of PA interventions, e.g., Social Cognitive Theory [139], Theory of Planned Behavior [138], and self-regulation theory [226]. Furthermore, when linking associated domains to techniques of behavior change [30,35], strategies to enhance physical therapists' implementation fidelity may include: a. discussion and elaboration of guidelines to enhance knowledge and beliefs about consequences [15], b. modeling and self-monitoring to enhance beliefs about capabilities and skills [15], c. forming implementation intentions to enhance planning [15], and d. self-monitoring and positive feedback to increase automaticity of implementing PA interventions following the intervention protocol [227]. This could, for example, be achieved by well-designed implementation strategies, such as the provision of workshops, conferences, and systems to register behaviors related to guidelines.

Together, the domains accounted for 23% of the variance in both total completeness and quality of delivery. This percentage is somewhat higher compared to results of Beenstock et al. [47], who found that TDF domains together with professional and demographic variables accounted for 20% of variance in midwives' referral behavior. However, the percentage is slightly lower compared to studies using only social-cognitive factors as predictors of health care professionals' behaviors. In their systematic review, Godin et al. [228] found that 31% of the variation in these behaviors could be explained by social-cognitive factors. Although Huijg et al. [173] demonstrated discriminant validity of the domains of the DIBQ, the lower percentage of explained variance in our study might be explained by the large correlations between some of the domains, implying that they are not independent. In addition, the fact that only one significant predictor was found in the multivariate analyses, while in the univariate analyses many domains were significantly associated with the outcome variables, indicates that domains explain more or less the same part of variation in implementation behavior. This can be explained by the fact that the TDF does not specify relationships between domains, which exist between the theoretical constructs that are integrated in the TDF. Taking the approach of exploring direct relationships between domains and implementation behavior therefore lacks the theoretical strength of the individual theories that inform the TDF. The results suggest that the TDF is a good framework for use in implementation science in the sense that domains are included that relate to implementation behavior, but that more efforts are needed in formulating the paths via which the domains influence this behavior. Moreover, the TDF may be used taking a different approach, e.g., to operationalize different theories and compare their predictive validity, or to operationalize a specific theory (e.g., the Theory of Planned Behavior [138]) and investigate the integration of other theoretical domains (e.g., Environmental context and resources) to enhance the prediction of health care professionals' behaviors.

Domains that were unrelated to implementation completeness were physical therapists' optimism, their negative emotions, and characteristics of the socio-political context and innovation strategies. The lack of effect of optimism and negative emotions may be related to physical therapists' feedback on these specific questionnaire items that emotions do not play a role in how they do their work. However, positive emotions was significantly related to the outcome variables. Noticeably, domains unrelated to implementation fidelity mainly concerned the context, while most important factors associated with implementation fidelity were related to the individual physical therapist. A plausible explanation for the lack of effect of the context domains might be that we included physical therapists who were already delivering PA interventions to their patients, as we were interested in physical therapists' implementation behaviors. Therefore, usually encountered contextual barriers before delivery takes place (i.e., in the adoption stage), such as lack of financial support from insurance companies and a consequent lack of PA intervention respondents, did no longer play a role. The results correspond with previous research in which it was observed that contextual factors are mostly related to the adoption of innovations and not so much to their implementation [137,149].

Some limitations of this study should be taken into account when interpreting the results. First, we took the perspective that, generally, PHC-based interventions are effective when they are delivered as intended. However, more research is needed to identify the active ingredients within PA intervention components and the conditions under which interventions are effective [229].

Second, the study was cross-sectional, and as a consequence only associations and no causal relationships could be determined. In addition, we used a self-report questionnaire to assess implementation fidelity, which due to a possible social desirable response could have led to more favorable completeness and quality of delivery ratings. Specifically, it might be problematic to ask physical therapists to rate the quality of their own practices, which in this study is operationalized by a series of satisfaction questions. Moreover, it might be difficult for physical therapists to recall their behaviors with regard to specific tasks (i.e., recall bias). Future studies may wish to observe physical therapists delivering PA interventions to their patients, but in this preliminary stage of using a TDF-based questionnaire we found that it was important to collect data from a large sample of physical therapists delivering a variety of PA interventions. Furthermore, the high mean scores on implementation completeness could possibly have been prevented by applying the same strategy that we used for the assessment of quality of delivery, i.e., by combining the 'none' and 'a few' response categories and adding a category between 'half' and 'all'. Only 55.2% of the physical therapists completed the questionnaire, which suggests a potential selection bias of study recruitment. In addition, comparisons between respondents and non-respondents indicated that the latter were significantly older and had more practice experience. Although the response rate is similar to Shirley et al. [116] and van der Wees et al. [205], the respondents may have been those who find it more important to deliver PA interventions following the intervention protocol. This might be an explanation for the high scores on implementation fidelity and little variation among them and limits the generalizability of our results. The sample that was used for this study comprised physical therapists delivering PA interventions to people with COPD, diabetes, arthritis, or obesity. Although the sample of our study is a heterogeneous group, the PA interventions that they deliver might be more similar to each other than other PA interventions, such as PA interventions for people with low back pain. Therefore, our findings should be interpreted with caution and cannot be automatically generalized to physical therapists delivering PA interventions to other target groups. Finally, we did not ask respondents for the reasons why they may not have followed the intervention protocol. We would recommend to include such a question in future research, as deviation from the protocol might be a good thing, for example when it concerns tailoring the intervention to individual patients' needs. Furthermore, it can provide information on how to improve PA intervention protocols.

Conclusions

To our knowledge, this study was the first to investigate physical therapists' completeness and quality of delivery of PA interventions in general, as well as the theory-based factors potentially influencing their implementation behaviors. Exploring influencing factors using a TDF-based questionnaire can help identify theories that can be used to further investigate the implementation of PA interventions [182]. Knowledge on what factors influence physical therapists' implementation fidelity can inform the development of strategies to promote the effective implementation of PA interventions, which can ultimately enhance the public health impact of evidence-based PA interventions [6,7,35–38]. With regard to the first two research questions, respondents report that they deliver PA interventions following the intervention protocol to the majority of the intervention participants and that they are satisfied with the quality that they provide. Based on most important factors associated with completeness and quality of delivery, it can be hypothesized that implementation fidelity may be enhanced by developing implementation strategies that increase physical therapists' capabilities, beliefs about capabilities, beliefs about consequences, positive

emotions, quality of implementation plans, and the automaticity of delivery of PA interventions following the intervention protocol (i.e., research question 3). Future studies should preferably focus on investigating causal relationships between factors and implementation behaviors and incorporate more objective measures of implementation fidelity. Finally, when theory-based determinants are targeted by implementation strategies, this should be done by well-specified behavior change techniques [229] and their effectiveness should be investigated in randomized controlled trials.

Appendix 1. PA intervention components, tasks, and example items measuring implementation fidelity

PA Intervention components	Tasks	Example items
A. Intake		With how many participants did you…
	Discuss patient history	…discuss the patient history?
	Determine goals	…determine PA intervention goals?
	Administer questionnaires	…administer the PAR-Q?
	Do physical tests	…do the 6MWT?
	Report intake	…report the intake data following the reporting guidelines?
	Intake satisfaction	How satisfied are you with how you did the intake?
B. Training program		For how many participants did you…
	Set up training program	…set up a training program based on the intake?
	Training program content	…provide a training program with strength and cardio training?
	Intensity	…provide a training program for at least 3 months 2 times a week?
	Do measurements	…regularly measure training parameters?
	Report parameters	…report the parameters data following the reporting guidelines?
	Training program satisfaction	How satisfied are you with how you delivered the training program?
C. Evaluation		With how many participants did you…
	Conduct evaluation session	…conduct an evaluation session?
	Check goal achievement	…check if goals were achieved?
	Retake questionnaires	…retake the questionnaires from the intake at least once?
	Repeat physical tests	…repeat the physical tests from the intake at least once?
	Report evaluation	…report the evaluation data following the reporting guidelines?
	Evaluation satisfaction	How satisfied are you with how you did the evaluation?
D. Attention to maintenance of PA	Attention to maintenance of PA	For how many participants did you… …give attention to the maintenance of PA after the intervention is finished?
	Attention to maintenance of PA satisfaction	How satisfied are you with how you gave attention to participants' maintenance of PA after the intervention is finished?
E. Contact with referring professional	Contact with referring professional	For how many participants did you… …report to the referring professional on the course and results of the PA intervention?
	Contact with referring professional satisfaction	How satisfied are you with how you reported to the referring professional?

Note. PA, physical activity

The questionnaire was developed in Dutch. For the purpose of writing this manuscript, items were translated to English.

Appendix 2. **Determinants of Implementation Behavior Questionnaire (Huijg et al. [173])**

Domains		Constructs	Items
D1	Knowledge	Knowledge (1)	I know how to deliver [PA intervention] following the intervention protocol
		Role clarity (3)	Objectives of [PA intervention] and my role in this are clearly defined for me
			With regard to [PA intervention] I know what my responsibilities are
			In my work with [PA intervention] I know exactly what is expected from me
D2	Skills	Skills (3)	I have been trained in delivering [PA intervention] following the intervention protocol
			I have the skills to deliver [PA intervention] following the intervention protocol
			I am practiced to deliver [PA intervention] following the intervention protocol
D3	Social/ professional role and identity	Professional role (3)	Delivering [PA intervention] following the intervention protocol is part of my work as a PT
			As a PT it is my job to deliver [PA intervention] following the intervention protocol
			It is my responsibility as a PT to deliver [PA intervention] following the intervention protocol
D4	Beliefs about capabilities	Self-efficacy (4)	I am confident that I can deliver [PA intervention] following the intervention protocol
			I am confident that I can deliver [PA intervention] following the intervention protocol even when other professionals with whom I deliver [PA intervention] do not do this
			I am confident that I can deliver [PA intervention] following the intervention protocol even when there is little time
			I am confident that I can deliver [PA intervention] following the intervention protocol even when participants are not motivated
		Perceived behavioral control (7)	I have control over delivering [PA intervention] following the intervention protocol
			For me, delivering [PA intervention] following the intervention protocol is (very difficult – very easy)
			For me, performing the intake is (very difficult – very easy)
			For me, delivering the training program is (very difficult – very easy)
			For me, performing the evaluation is (very difficult – very easy)
			For me, giving attention to participant's maintenance of PA behavior outside [PA intervention] is (very difficult – very easy)
			For me, reporting about the [PA intervention] to the referring professional is (very difficult – very easy)
D5	Optimism	Optimism (3)	In my work as a PT, in uncertain times, I usually expect the best
			In my work as a PT, I'm always optimistic about the future
			In my work as a PT, overall, I expect more good things to happen than bad

Appendix 2. **Determinants of Implementation Behavior Questionnaire (Huijg et al. [173]) (continued)**

Domains		Constructs	Items
D6	Beliefs about consequences	Attitude (4)	For me, delivering [PA intervention] following the intervention protocol is (not useful at all – very useful)
			For me, delivering [PA intervention] following the intervention protocol is (not worthwhile at all – very worthwhile)
			For me, delivering [PA intervention] following the intervention protocol is (not pleasurable at all – very pleasurable)
			For me, delivering [PA intervention] following the intervention protocol is (not interesting at all – very interesting)
		Outcome expectancies (5)	If I deliver [PA intervention] following the intervention protocol [PA intervention] will be most effective
			If I deliver [PA intervention] following the intervention protocol participants will appreciate this
			If I deliver [PA intervention] following the intervention protocol this will strengthen the collaboration with professionals with whom I deliver [PA intervention]
			If I deliver [PA intervention] following the intervention protocol I will feel satisfied
			If I deliver [PA intervention] following the intervention protocol it will help participants to be more physically active
		Reinforcement (3)	When I deliver [PA intervention] following the intervention protocol, I get financial reimbursement
			When I deliver [PA intervention] following the intervention protocol, I get recognition from the work context
			When I deliver [PA intervention] following the intervention protocol, I get recognition from participants
D7	Intentions	Intention (3)	I intend to deliver [PA intervention] following the intervention protocol in the next three months
			I will definitely deliver [PA intervention] following the intervention protocol in the next three months
			How strong is your intention to deliver [PA intervention] following the intervention protocol in the next three months
D8	Goals	Priority (2)	How often is working on something else on your agenda a higher priority than delivering [PA intervention] following the intervention protocol
			How often is working on something else on your agenda more urgent than delivering [PA intervention] following the intervention protocol
D9	Innovation	Innovation characteristics (5)	It is possible to tailor [PA intervention] to participants' needs
			It is possible to tailor [PA intervention] to professionals' needs
			[PA intervention] costs little time to deliver
			[PA intervention] is compatible with daily practice
			[PA intervention] is simple to deliver

Appendix 2. Determinants of Implementation Behavior Questionnaire (Huijg et al. [173]) (continued)

Domains		Constructs	Items
D10	Socio-political context	Socio-political context (3)	Government and local authorities provide sufficient support for interventions such as [PA intervention] Insurance companies provide sufficient support for interventions such as [PA intervention] Primary health care is sufficiently oriented towards prevention
D11	Organization	Organizational resources and support (4)	In the organization I work, all necessary resources are available to deliver [PA intervention] I can count on support from the management of the organization I work in, when things get tough around delivering [PA intervention] following the intervention protocol The management of the organization I work in is willing to listen to my problems with delivering [PA intervention] following the intervention protocol The management of the organization I work in is helpful with delivering [PA intervention] following the intervention protocol
D12	Patient	Patient characteristics (2)	Participants of [PA intervention] are motivated Participants of [PA intervention] are positive about [PA intervention]
D13	Innovation strategy	Innovation strategies (7)	[Implementing organization] provides professionals with a training to deliver [PA intervention] [Implementing organization] provides the possibility to experience delivering [PA intervention] before professionals need to commit to it [Implementing organization] provides sufficient intervention materials [Implementing organization] provides assistance to professionals with delivering [PA intervention] [Implementing organization] organizes intervision meetings for professionals [Implementing organization] provides sufficient financial reimbursement to professionals for [PA intervention] delivery [Implementing organization] provides insights into results of [PA intervention]
D14	Social influences	Subjective norm (2)	Most people who are important to me think that I should deliver [PA intervention] following the intervention protocol Professionals with whom I deliver [PA intervention] think I should deliver [PA] intervention] following the intervention protocol
		Descriptive norm (2)	Professionals with whom I deliver [PA intervention] deliver [PA] intervention following the intervention protocol Other professionals who work with [PA intervention] deliver [PA intervention] following the intervention protocol
		Social support (3)	I can count on support from professionals with whom I deliver [PA intervention] when things get tough around delivering [PA intervention] following the intervention protocol Professionals with whom I deliver [PA intervention] are willing to listen to my problems with delivering [PA intervention] following the intervention protocol Professionals with whom I deliver [PA intervention] are helpful with delivering [PA intervention] following the intervention protocol

Appendix 2. **Determinants of Implementation Behavior Questionnaire (Huijg et al. [173]) (continued)**

Domains		Constructs	Items
D15	Positive emotions	Positive emotions (6)	When I work with [PA intervention] I feel optimistic
			When I work with [PA intervention] I feel comfortable
			When I work with [PA intervention] I feel calm
			When I work with [PA intervention] I feel relaxed
			When I work with [PA intervention] I feel cheerful
			When I work with [PA intervention] I feel elated
D16	Negative emotions	Negative emotions (6)	When I work with [PA intervention] I feel nervous
			When I work with [PA intervention] I feel pessimistic
			When I work with [PA intervention] I feel depressed
			When I work with [PA intervention] I feel agitated
			When I work with [PA intervention] I feel sad
			When I work with [PA intervention] I feel uncomfortable
D17	Behavioral regulation	Action planning (3)	I have a clear plan of how I will deliver [PA intervention] following the intervention protocol
			I have a clear plan under what circumstances I will deliver [PA intervention] following the intervention protocol
			I have a clear plan when I will deliver [PA intervention] following the intervention protocol
		Coping planning (3)	I have a clear plan with regard to delivering [PA intervention] following the intervention protocol when participants are not motivated
			I have a clear plan with regard to delivering [PA intervention] following the intervention protocol when there is little time
			I have a clear plan with regard to delivering [PA intervention] following the intervention protocol when other professionals with whom I deliver [PA intervention] do not do this
D18	Nature of the behaviors	Automaticity (4)	Delivering [PA intervention] following the intervention protocol is something I do automatically
			Delivering [PA intervention] following the intervention protocol is something I do without having to consciously remember
			Delivering [PA intervention] following the intervention protocol is something I do without thinking
			Delivering [PA intervention] following the intervention protocol is something I start doing before I realize I am doing it
		Memory (2)	Delivering [PA intervention] following the intervention protocol is something I seldom forget
			Delivering [PA intervention] following the intervention protocol is something I often forget

Note. PA, physical activity; PT, physical therapist

Chapter 8

Summary & General Discussion

Summary

Introduction

Despite the promising findings related to the efficacy of primary health care (PHC)-based physical activity (PA) interventions [60–63] and recommendations for PHC professionals to promote PA [230,231], the introduction of PA interventions in routine daily PHC practice does not always happen as desired. Specifically, rates of PA promotion by PHC professionals are far from optimal [50–52] and PA interventions are not delivered as intended by the intervention developers [1,9, 53–57]. Based on a systematic literature review, VanWormer et al. [52] estimated that 30-50% of the US physicians regularly counsel their patients on PA. When delivering PA interventions, PHC professionals fail to accurately assess patients' motivation to change their PA behavior [53], set PA treatment goals [56], tailor PA advice to patients' goals and stage of behavior change, and provide follow up appointments [55]. Knowledge of the factors that determine the success or failure of the introduction of innovations in health care is important for the development of strategies to improve the introduction process [1,6,7,17,22,33–38]. The main aim of the present thesis was to explore what factors influence the introduction of PA interventions in PHC.

Main findings

A systematic literature review on factors influencing PHC professionals' PA promotion was presented in *Chapter 2*. The main aim of this review was to explore the factors described in the literature to be influencing PHC professionals' PA promotion practices. A secondary aim was to examine which methods are used to identify these factors and to take these methods into account when interpreting the results. Examination of 59 articles published in the last 20 years identified many potential influencing factors, as for only a minority of factors significant relationships with PA promotion were found. Figure 1 presents the most important potential influences on PA promotion, i.e., most cited perceived influencing factors and perceived influencing factors for which a significant positive relationship with PA promotion was found. Other factors for which significant relationships with PA promotion were found were only cited once and lacked support from qualitative studies, which indicates the need for further investigation. Moreover, factors were found to be unrelated to PA promotion or had inconclusive relationships with PHC professionals' PA promotion practices. Finally, the results indicated a preponderance of particular types of methods for certain categories of factors. Overall, the findings of this review emphasized the need for additional research on PA promotion determinants, by using a comprehensive theoretical framework. A combination of qualitative and quantitative methods was proposed for this purpose, which is likely to lead to a much better understanding of how the introduction of PA interventions in PHC can be most effective.

Following this review, a qualitative study on factors influencing the introduction of PA interventions in PHC was conducted, as presented in *Chapter 3*. The main research questions in this study were: 1. which factors are perceived by stakeholders to be influencing the introduction of PA interventions in PHC, and 2. are factors perceived as specifically important to the distinct stages (i.e., adoption, implementation, and continuation) of the process? In order to address these questions, 28 semi-structured interviews were held with intervention managers, PHC advisors, intervention providers, and referring general practitioners of five PA interventions delivered in PHC. They were asked about their experiences with the introduction of the intervention they were involved in, and

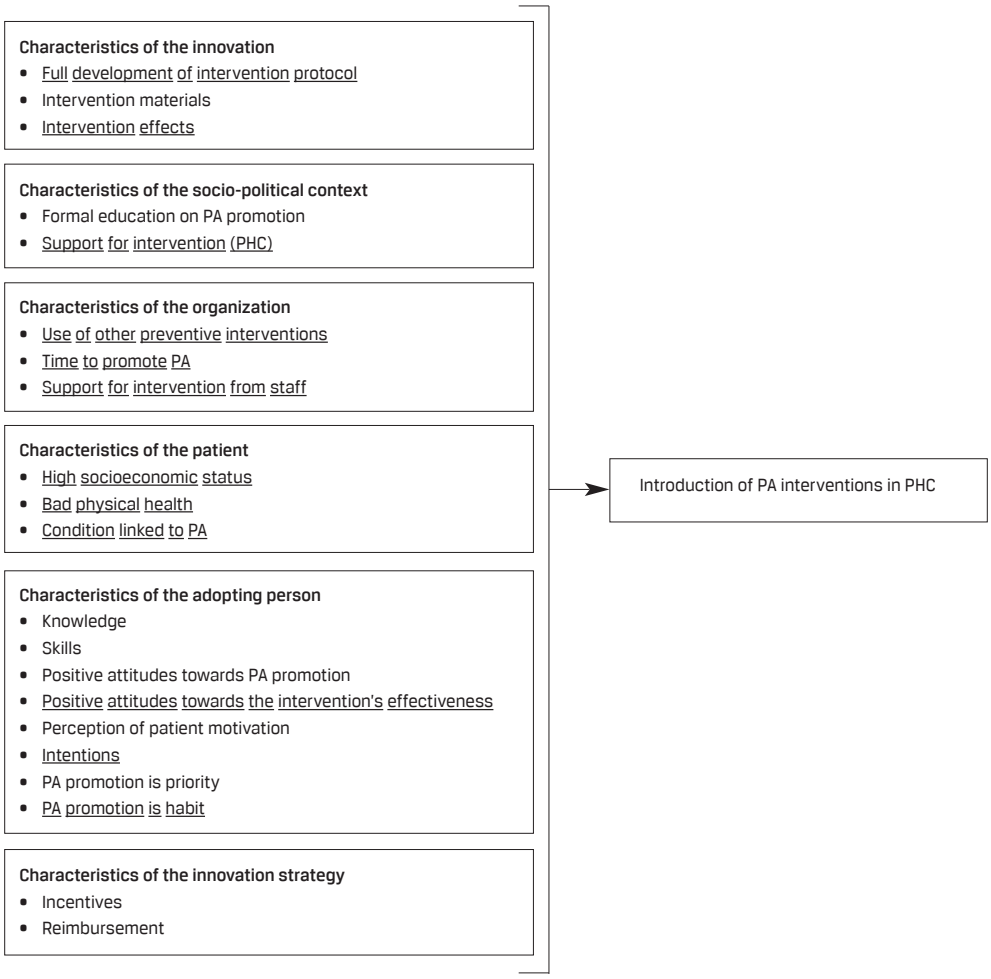


Figure 1. **Most important potential factors previously described to positively influence PHC professionals' PA promotion practices**

Note. Underlined factors are perceived influencing factors for which a significant positive relationship with PA promotion was found, the other factors are most cited perceived influencing factors

about barriers and facilitators to PA interventions' adoption, implementation, and continuation in PHC. Stakeholders reported many potential influential factors, including preconditions for the introduction of PA interventions in PHC, characteristics of interventions and PHC professionals that enhance the process, and strategies to develop PA interventions and to introduce interventions in practice. (see Figure 2). The majority of influencing factors was reported specifically in relation to one or two stages of the introduction process. Based on these findings it can be hypothesized that preconditions for the introduction process (e.g., prevention-oriented medical culture, formal education on prevention and lifestyle behaviors) are most important for the adoption and implementation of PA interventions, intervention characteristics (e.g., compatibility, flexibility) and PHC professionals' characteristics (e.g., knowledge, beliefs about capabilities) foremost play a role

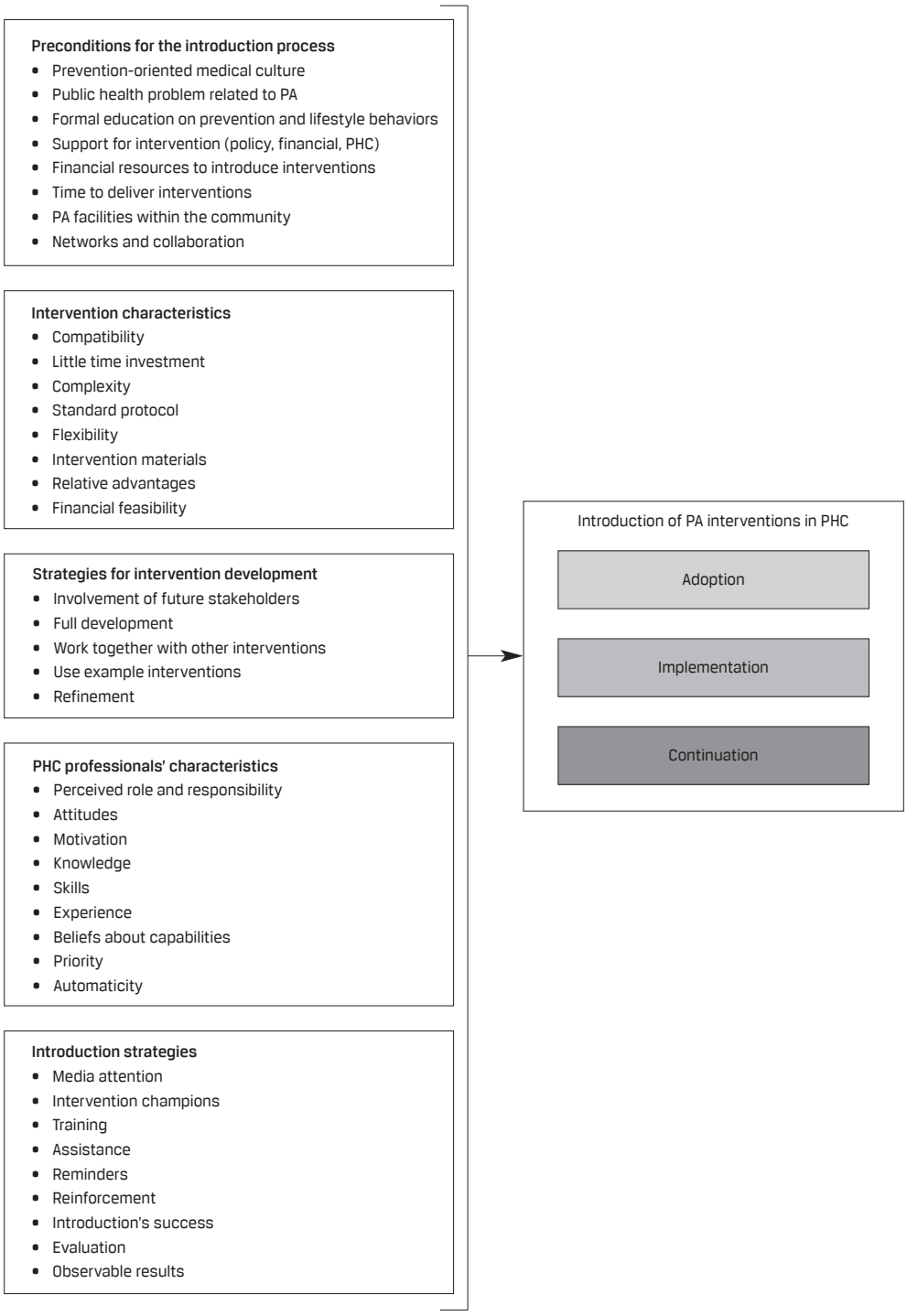


Figure 2. **Factors perceived by stakeholders to influence the introduction of PA interventions in PHC**

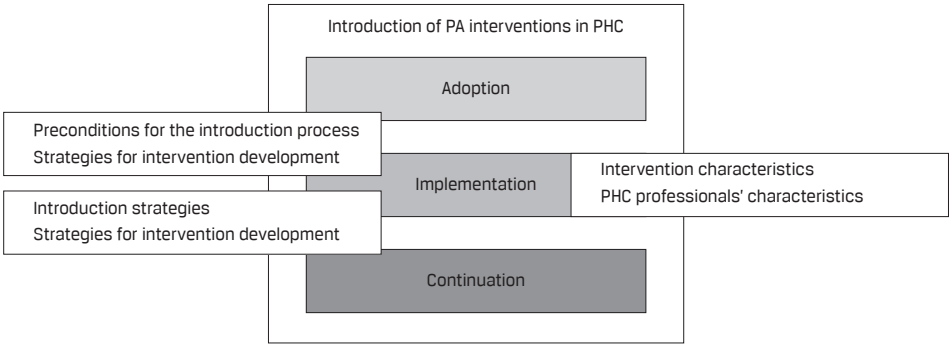


Figure 3. **Categories of factors and the distinct stages of the introduction process**

within the implementation stage, and introduction strategies (e.g., training, reinforcement) are most important for the implementation and continuation stage. Finally, some strategies for intervention development are considered most important for the early stages of the process (e.g., involvement of future stakeholders, full development of the intervention), while others (e.g., use of example interventions, refinement) foremost play a role during the later stages (Figure 3). Concluding, the study identified factors that should be considered when planning the introduction of PA interventions in PHC. Furthermore, the findings can guide future research on factors' relevance for the introduction of PA interventions in PHC and suggest the importance of taking into account the distinct stages of the process when doing research and designing introduction strategies.

The findings of the systematic literature review and the qualitative study resulted in an extensive list of factors potentially influencing the introduction of PA interventions in PHC. The aim of the two-round Delphi study described in *Chapter 4* was to reach consensus among experts on the relevance (i.e., importance and changeability) of these previously identified factors. In the first round, 44 experts scored factors on their importance for each stage of the introduction process, as well as on their changeability. In the second round, the same experts received a questionnaire containing a reduced list of factors, based on the first-round results. They were asked to indicate their top-10 most important factors for each stage, and to re-rate factors' changeability. The study identified general and stage-specific factors most important for the introduction of PA interventions in PHC. Specifically, factors related to time and money were perceived important for all stages, while for example, intervention champions within the organization were found to be important for the adoption stage, provider knowledge for the implementation stage, and intervention's sustainability for the continuation of PA interventions (see Figure 4). The results confirm the importance of taking into account the distinct stages and their specific influencing factors when designing introduction strategies. Since no consensus could be reached on the changeability of all most important factors, the extent to which these factors can be influenced by introduction strategies still needs further investigation.

The second part of this thesis focused on the implementation of PA interventions in PHC, as the extent to which interventions are implemented as intended is an important influence on intervention outcomes [21]. Specifically, the factors influencing PHC professionals' implementation

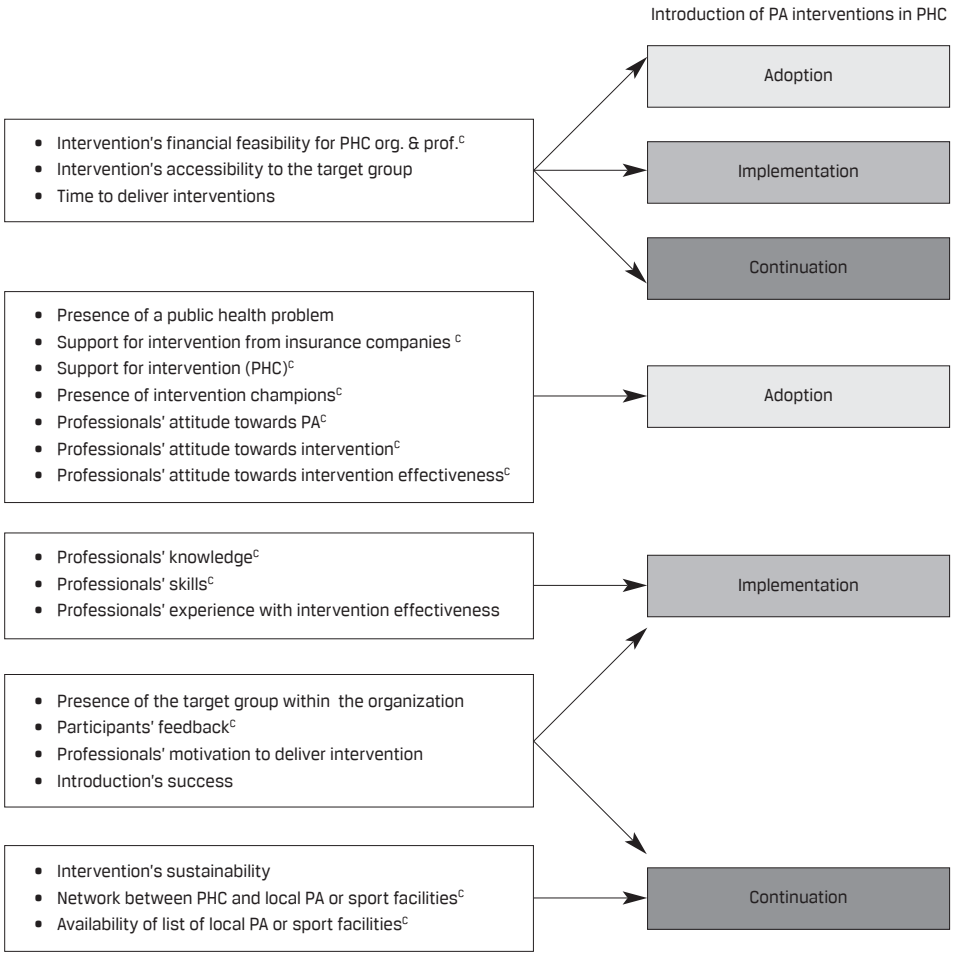


Figure 4. **Factors most important for the adoption, implementation, and continuation of PA interventions in PHC**
Note.C, changeable factors

of PA interventions (i.e., delivery as intended) were investigated. Based on the results of previous studies (Chapter 3 and Chapter 4) and the Theoretical Domains Framework (TDF) [30,31] a questionnaire was developed to measure factors underlying health care professionals' implementation behaviors. Chapter 5 and Chapter 6 describe the thorough development and initial validation of this questionnaire. In *Chapter 5*, the main aim was to develop a generic questionnaire assessing the 14 domains of behavioral determinants from the revised TDF [30] and to investigate questionnaire items' discriminant content validity. With regard to the development of the questionnaire, previously published questionnaires including items assessing constructs within TDF domains were identified, items were adapted based on the results of previous studies (Chapter 3 and Chapter 4), and new items were developed where needed. In a discriminant content validity exercise, nineteen judges allocated 79 items of the initial developed questionnaire to the domain

they perceived the item to measure and rated their confidence in each of their allocations. This resulted in the identification of 32 items judged to discriminately assess 11 out of the 14 domains. Items measuring the domains Reinforcement, Goals, and Behavioral regulation were judged to measure a combination of domains. Accordingly, the findings suggested that the TDF is viable to construct a theory-based questionnaire measuring potential behavioral determinants, but that the original 12-domain version of the TDF [31] might be more applicable in developing such a questionnaire than the 14-domain version. Therefore, this study represents an important first step in the systematic development of a questionnaire to measure TDF-based factors underlying health care professionals' implementation behaviors.

In the subsequent study described in *Chapter 6*, the main aim was to develop a questionnaire based on the original 12-domain version of the TDF [31] and to test the psychometric properties of this questionnaire in a sample of health care professionals. To validate the Determinants of Implementation Behavior Questionnaire (DIBQ), the following research questions were addressed: 1. does confirmatory factor analysis support the pre-defined structure of the TDF-based questionnaire (i.e., construct validity), 2. is the questionnaire able to measure TDF domains in a reliable way (i.e., reliability), and 3. are the domains of the questionnaire discriminately measurable (i.e., discriminant validity)? Health care professionals' implementation of PA interventions was used as an example behavior to illustrate how such a questionnaire might be developed and physical therapists were the targeted group of PHC professionals. Again, questionnaire items were generated using previously published questionnaires including items assessing constructs within TDF domains, of which the content was adapted based on factors influencing the implementation of PA interventions generated from previous studies (Chapter 3 and Chapter 4). Furthermore, items were based on the results of the study described in Chapter 5, and new items were developed where needed. In this second step in the systematic development of a questionnaire to measure TDF-based factors underlying health care professionals' implementation behaviors, emphasis was placed on developing a questionnaire covering the full breadth of domains, including the wide range of factors previously identified to influence the implementation of PA interventions. The initial questionnaire included 100 items assessing the 12 TDF domains. Analyses of 270 completed questionnaires resulted in a 93-item questionnaire assessing 18 domains of potential behavioral determinants (see Figure 5). The main adjustment we made to the structure of the questionnaire was dividing the domain Environmental context and resources into five different environment-related domains: Innovation, Socio-political context, Organization, Patient, and Innovation strategy. In addition, some of the domains were separated (Beliefs about capabilities and Optimism, Intentions and Goals, and Positive and Negative emotions) and others were merged into one domain (Memory, attention, and decision processes and Nature of the behaviors). In this first study of the psychometric properties of the DIBQ, the questionnaire appeared to have acceptable construct validity (based on confirmatory factor analysis) and the majority of domains showed high internal consistency reliability and discriminant validity. This indicates that the questionnaire is viable to measure potential determinants of implementation behavior in a theory-based and comprehensive way. However, future studies should investigate other types of validity (e.g., predictive, convergent, discriminant validity) and reliability (e.g., test-retest reliability) of the questionnaire and additional research is needed to understand the strengths and limitations of the DIBQ when it is used for other behaviors than the implementation of PA interventions, among other health care professionals, in other settings, and/or in other stages of the introduction process.

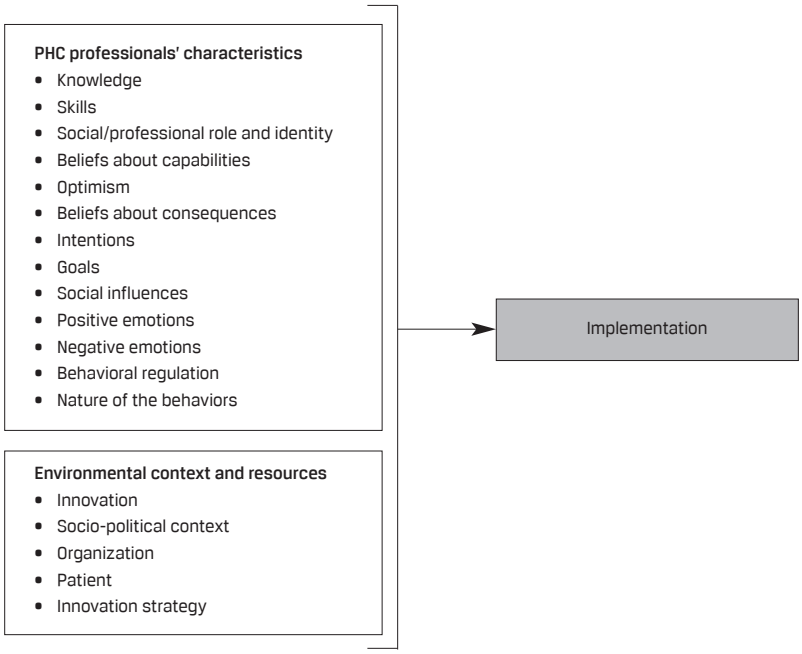


Figure 5. **18 domains of potential determinants of implementation behaviors**

In *Chapter 7* the DIBQ was used to examine which TDF domains are associated with physical therapists' implementation of PA interventions. The aim of this cross-sectional study was to investigate the extent to which physical therapists deliver PA interventions as intended and which TDF domains are associated with implementation fidelity, including completeness and quality of delivery. The final analyses included 268 physical therapists who completed an online version of the DIBQ. Questions on completeness and quality of delivery of PA interventions were based on the core components of PA interventions (i.e., intake, training program, evaluation, attention to maintenance of PA, and contact with referring professional) and their underlying tasks as described in the Royal Dutch Society for Physical Therapy (KNGF) protocols for PA interventions [221]. Physical therapists reported that they deliver PA interventions as intended to a small majority of the intervention participants and that they are quite satisfied with the quality that they provide. Accordingly, their responses indicated that the fidelity with which physical therapists implement PA interventions could be improved. Based on most important factors associated with completeness and quality of delivery, it can be hypothesized that implementation fidelity may be enhanced by developing strategies that increase physical therapists' knowledge, skills, beliefs about capabilities, beliefs about consequences, and positive emotions regarding the implementation of PA interventions, the quality of their implementation plans, and the automaticity of delivering PA interventions as intended (Figure 6). Theories to further investigate PHC professionals' implementation of PA interventions might be the Social Cognitive Theory [139], Theory of Planned Behavior [138], and self-regulation theory [226]. Future studies should preferably focus on investigating theoretical relationships between domains and causal relationships between factors and implementation behaviors. Finally, more objective measures of implementation fidelity should be used.

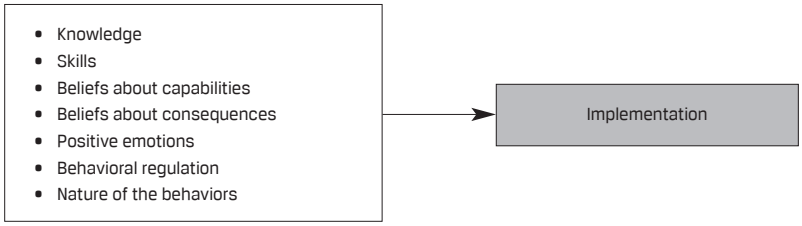


Figure 6. **Most important factors associated with physical therapists' implementation of PA interventions**

General Discussion

The introduction of PA interventions in PHC does not always happen as desired
Many factors potentially influence the introduction of PA interventions in PHC
Different factors may be important for the distinct stages of the process (i.e., adoption, implementation, and continuation)
The Determinants of Implementation Behavior Questionnaire can be used for the theory-based measurement of factors influencing health care professionals' implementation behaviors
This thesis provides a first step in the development of strategies to effectively introduce PA interventions in PHC

The introduction of PA interventions in PHC

In the past decades, many interventions have been developed aimed at promoting physical activity (PA) in primary health care (PHC) [60]. These PHC-based PA interventions, such as PA counseling, prescribing PA, and patient referral to PA programs, have been shown to be effective in research settings [61–63]. However, their introduction in routine daily practice does not always happen as desired [1,9,50–54]. In the studies presented in this thesis, experts on the introduction of PA interventions in PHC (i.e., academics, intervention managers, PHC advisors) and health care professionals delivering PA interventions to their patients confirmed that the adoption, implementation, and continuation of PHC-based PA interventions could be improved. Furthermore, and corresponding with other studies on physical therapists' implementation behaviors [56,57], our findings indicated that physical therapists' implement PA interventions with high fidelity, but that the number of participants to whom they deliver all intervention components and the quality of their delivery could be enhanced.

As a first step towards the effective introduction of PA interventions in PHC, this thesis contributes new insights on the factors that could be taken into account when planning the introduction of PA interventions in PHC and developing effective introduction strategies. It describes the importance of factors for the distinct stages of the process, i.e., the adoption, implementation, and continuation of PA interventions in PHC. Moreover, it forwards a questionnaire to measure theory-based factors underlying health care professionals' implementation behaviors, which appears to have acceptable construct validity, discriminant validity, and internal consistency reliability based on our first investigation of its psychometric properties. This may improve our understanding of implementation behavior determinants and advance theory and methods in implementation research.

Factors influencing the introduction of PA interventions in PHC

In line with the literature on the introduction of innovations in health care [5,7,8,17,20,24,27,30,64], the studies described in this thesis identified a diversity of factors potentially influencing the introduction of PA interventions in PHC (for an overview see Figure 7). These factors can be taken into account when planning the introduction of PA interventions in PHC and developing effective introduction strategies. Based on the various methods that were used to identify these factors (see Table 1), suggestions can be made with regard to the importance of the different factors for the introduction of PA interventions in PHC. Factors that were identified in more than one of the studies presented in this thesis and that were found in both qualitative and quantitative studies were the following: prevention-oriented medical culture, support for the intervention, time, full development of the intervention, and professionals' knowledge, skills, social/professional role and identity, beliefs about capabilities, beliefs about consequences, intentions, and goals, and the extent to which PA promotion and/or the implementation of PA interventions is a habit or automatic behavior. Subsequently, these factors could be described as perceived influencing factors for which a relationship was found with the introduction of PA interventions in PHC. This might indicate that these factors are most important to take into account when planning the introduction of PA interventions in PHC and developing effective introduction strategies. The relative importance of the identified factors for the introduction of specific PA interventions may vary across potential adopters, settings, and countries [38,49]. The findings of the study described in Chapter 7 tentatively suggest that PHC professionals' characteristics are more directly related to the adoption, implementation, and continuation of PA interventions in PHC, while factors related to characteristics of the socio-political context and the organization (i.e., preconditions for the introduction process), intervention characteristics, and patient characteristics are more distal factors, which is in line with Paulussen et al. [20].

The factors identified in this thesis correspond with determinants forwarded by theoretical frameworks on the introduction of innovations in health care practice in general (e.g., [8,24,27,30,31]), suggesting that they might also affect the introduction of other evidence-based interventions in health care, and not merely PA interventions. When comparing our findings specifically to the Consolidated Framework for Implementation Research (CFIR) [8] there is much overlap between the constructs of the framework and the factors identified in this thesis. However, some of the constructs within the framework were not identified by our studies and some of the factors identified by our studies were not specified in the framework. For example, the construct Trialability was not identified as an influencing factor in our studies. This might be due to the theoretical value of this intervention characteristic, while in practice it might not be feasible (or even possible) to reverse the introduction of an intervention after its adoption and/or implementation. The constructs Tension for Change and Learning Climate of the inner setting were also not identified in our studies. Tension for Change might not have been identified as an influencing factor as most PA interventions that were examined in the studies described in this thesis were already introduced into practice. The construct Learning Climate might have been overlooked in time-pressured daily PHC practice. Some of the factors that were identified in this thesis were not specified in the CFIR. These factors were mostly practice-based and specific for the implementation of PA interventions in PHC. Examples were the presence of a public health problem related to PA, the presence of PA facilities within the community, and the use of training, assistance, and reminders as introduction strategies. Additional overviews of strategies to improve health care practice in general can be found in Michie et al. [36,232] and Bartholomew et al. [15].

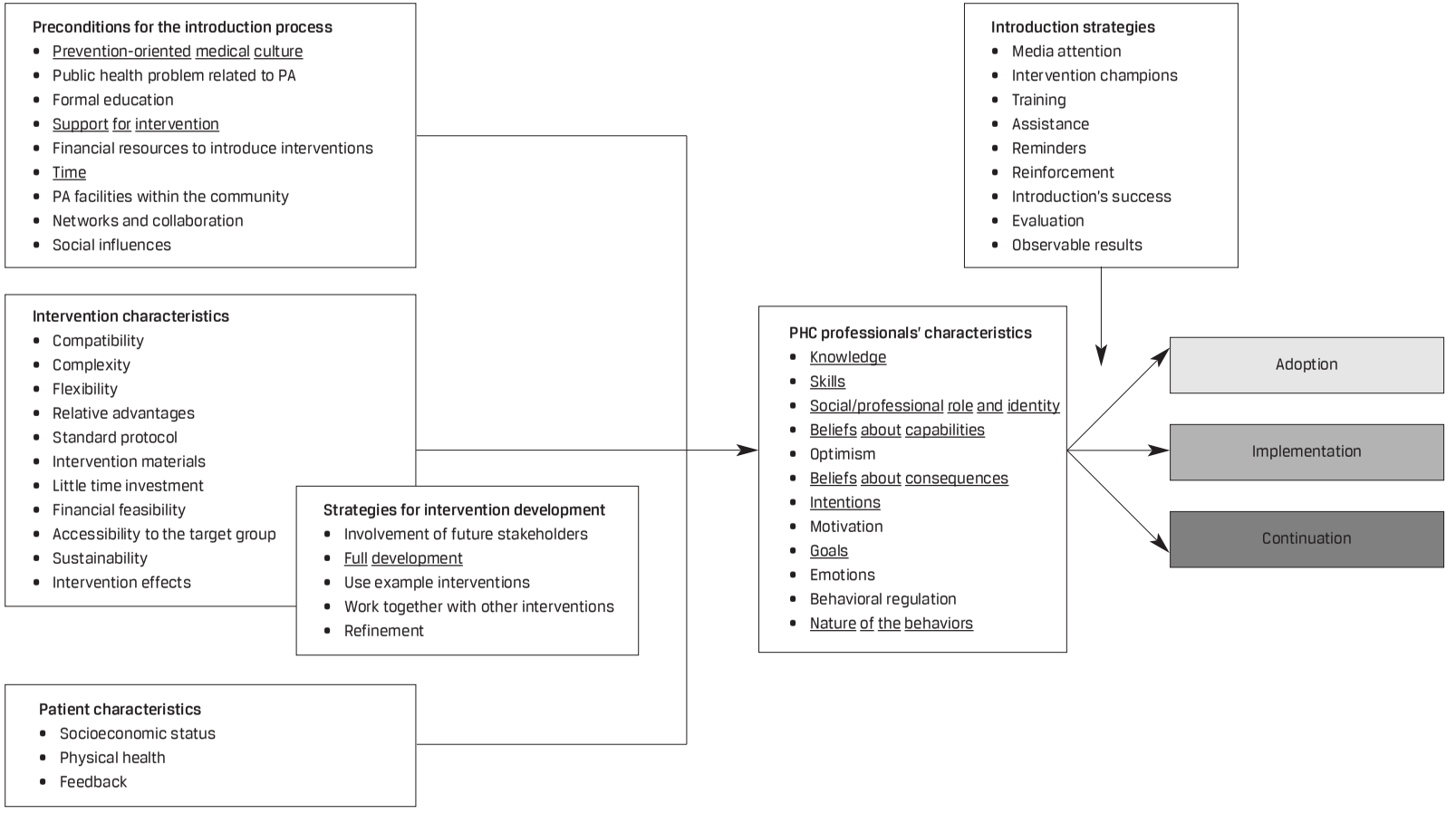


Figure 7. Overview of factors potentially influencing the introduction process

Note. Underlined factors are the factors that were identified in multiple studies presented in this thesis including both qualitative and quantitative studies

Table 1. **Overview of factors potentially influencing the introduction process and their evidence**

	Review (Ch 2)		Qualitative study (Ch 3)	Delphi study (Ch 4)			Cross-sectional study (Ch 7)	Summary of Evidence
	Perceived	Perceived + relationship	Perceived	Expert opinion				
				A	I	C		
Preconditions for the introduction process (e.g., socio-political context, organization)							X	Relationship
Prevention-oriented medical culture (e.g., use of other preventive interventions)		X	X					Perceived + relationship
Public health problem related to PA (e.g., within socio-political context, target group present in organization)			X	X	X	X		Perceived + expert (AIC)
Formal education (e.g., on PA promotion, prevention, and lifestyle behaviors)	X		X					Perceived
Support for intervention (e.g., policy, financial, PHC organizations and professionals)		X	X	X				Perceived + relationship + expert (A)
Financial resources to introduce interventions			X					Perceived
Time (e.g., to promote PA, deliver PA interventions)	X	X	X	X	X	X		Perceived + relationship + expert (AIC)
PA facilities within the community			X					Perceived
Networks and collaboration (e.g., between PHC and local PA or sport facilities)			X			X		Perceived + expert (C)
Social influences							X	Relationship
Intervention characteristics							X	Relationship
Compatibility			X					Perceived
Complexity			X					Perceived
Flexibility			X					Perceived
Relative advantages			X					Perceived
Standard protocol			X					Perceived
Intervention materials (e.g., availability of list of local PA or sport facilities)	X		X			X		Perceived + expert (C)
Little time investment			X					Perceived
Financial feasibility			X	X	X	X		Perceived + expert (AIC)

Table 1. **Overview of factors potentially influencing the introduction process and their evidence (continued)**

	Review (Ch 2)		Qualitative study (Ch 3)	Delphi study (Ch 4)			Cross-sectional study (Ch 7)	Summary of Evidence
	Perceived	Perceived + relationship	Perceived	Expert opinion				
				A	I	C		
Accessibility to the target group				X	X	X		Expert (AIC)
Sustainability						X		Expert (C)
Intervention effects		X						Perceived + relationship
Strategies for intervention development								
Involvement of future stakeholders			X					Perceived
Full development (e.g., of intervention protocol)		X	X					Perceived + relationship
Use example interventions			X					Perceived
Work together with other interventions			X					Perceived
Refinement			X					Perceived
Patient characteristics							X	Relationship
High socioeconomic status		X						Perceived + relationship
Bad physical health		X						Perceived + relationship
Condition linked to PA		X						Perceived + relationship
Participants' feedback					X	X		Expert (IC)
PHC professionals' characteristics							X	Relationship
Knowledge	X		X		X		X	Perceived + relationship + expert (I)
Skills (e.g., experience)	X		X		X		X	Perceived + relationship + expert (I)

Table 1. **Overview of factors potentially influencing the introduction process and their evidence (continued)**

	Review (Ch 2)		Qualitative study (Ch 3)	Delphi study (Ch 4)			Cross-sectional study (Ch 7)	Summary of Evidence
	Perceived	Perceived + relationship	Perceived	A	I	C		
Social/professional role and identity (e.g., perceived role and responsibility)			X				X	Perceived + relationship
Beliefs about capabilities			X				X	Perceived + relationship
Optimism							X	Relationship
Beliefs about consequences (i.e., attitudes, perceptions, experiences)	X	X	X	X	X		X	Perceived + relationship + expert (AI)
Intentions		X					X	Perceived + relationship
Motivation			X		X	X		Perceived + expert (IC)
Goals (e.g., priorities)	X		X				X	Perceived + relationship
Emotions							X	Relationship
Behavioral regulation							X	Relationship
Nature of the behaviors (e.g., habit, automaticity)		X	X				X	Perceived + relationship

Table 1. **Overview of factors potentially influencing the introduction process and their evidence (continued)**

	Review (Ch 2)		Qualitative study (Ch 3)	Delphi study (Ch 4)			Cross-sectional study (Ch 7)	Summary of Evidence
	Perceived	Perceived + relationship	Perceived	Expert opinion				
				A	I	C		
Characteristics of the innovation strategy								
Media attention			X					Perceived
Intervention champions			X	X				Perceived + expert (A)
Training			X					Perceived
Assistance			X					Perceived
Reminders			X					Perceived
Reinforcement (e.g., incentives, reimbursement)	X		X					Perceived
Introduction's success			X		X	X		Perceived Expert (IC)
Evaluation			X					Perceived
Observable results			X					Perceived

Note. Underlined factors are the factors that were identified in multiple studies presented in this thesis including both qualitative and quantitative studies

Factors and the different stages of the introduction process

The majority of potential influencing factors were found to be important for one or two stages of the introduction of PA interventions in PHC. This corresponds with theoretical frameworks on the introduction of innovations in health care (e.g., [17,24–29]) and suggests that specific strategies may be required to enhance the adoption, implementation, and continuation of PA interventions in PHC [5,15,17,18,20,22]. Below, hypotheses about factors' importance for the distinct stages will be discussed and compared with the scarce available literature on the factors that influence these stages of the introduction of innovations in health care.

Preconditions for the introduction process were found to be important to consider before the introduction process takes place, or maybe even before an intervention is being developed. Furthermore, they were also found to play a key role during the introduction of PA interventions in PHC. Financial resources and time were found to be important for the introduction process in general, while preconditions related to the medical culture, public health, and support for the intervention were found to be foremost central to the early stages of the process (i.e., the adoption and implementation stage). In line with these findings, Fixsen et al. [18] reported that evidence-based interventions will not be introduced in practice without political and financial support, and/or support from adopting organizations and professionals.

The identified *strategies for intervention development* may facilitate designing an intervention with characteristics that enhance the intervention's potential for being adopted, implemented, and continued to be used. Specifically, the involvement of future stakeholders and full development of the intervention (e.g., including the arrangement of finances, collaborations between PHC professionals, and networks with community PA facilities) were found to be most important for the early stages of the introduction process (i.e., the adoption and implementation stage) and the use of example interventions, collaboration between interventions, and intervention refinement (e.g., adaptations based on formal evaluations, intervention providers' feedback) were found to be most important for the later stages of the process (i.e., the implementation and continuation stage). Similarly, Bartholomew et al. [15] described the involvement of potential adopters and implementers as a crucial step in the development of interventions that are likely to be effectively adopted and implemented in practice.

Intervention characteristics were found to play an important role with regard to the actual delivery of the intervention (i.e., the implementation stage). Furthermore, the intervention's compatibility, relative advantages, and financial feasibility were also found to be important for the adoption and the continuation stage, and time investment, complexity, and sustainability of the intervention were found to be important for both the implementation and the continuation stage. The findings differ from Rogers' Diffusion of Innovations Theory [24] in which characteristics of the innovation are foremost important for the adoption stage. Furthermore, the importance of the intervention's relative advantages for PHC professionals' adoption of innovations was previously reported by Scott et al. [233] and Carlfjord et al. [137]. Moreover, Carlfjord et al. [137] identified the intervention's compatibility as an important influence on PHC professionals' adoption of lifestyle interventions.

PHC professionals' characteristics (e.g., knowledge, skills, beliefs about capabilities) were found to be foremost important during the implementation stage. In addition, professionals' perceived role

and responsibility and positive attitudes towards PA, the intervention, and the intervention's effectiveness were found to be important for the adoption of PA interventions in PHC. This corresponds with Bartholomew et al. [15] who state that outcome expectations are important for the adoption stage, while behavioral capability, skills, self-efficacy, and reinforcement become more important during the implementation of health promotion interventions. Furthermore, Carlfjord et al. [137] reported the importance of positive outcome expectations for the adoption of a lifestyle intervention in PHC.

Patient characteristics in general, and specifically patients' socioeconomic status, physical health, and their feedback on the intervention were found to be important for PA interventions' implementation and continuation in PHC. Similarly, Curran et al. [234] reported that high social stressors of patients with a lower socioeconomic status were perceived to inhibit professionals' implementation of an intervention for anxiety disorders in PHC.

Finally, the majority of the identified *introduction strategies* were found to be most important for the implementation and continuation stage, while media attention and the presence of intervention champions were found to be important for the adoption of PA interventions in PHC. These results are in line with Carlfjord et al. [137] who previously reported that the presence of intervention champions is important during the adoption stage.

The importance of different factors for the distinct stages of the introduction process validates the perspective of the introduction of innovations in health care as a staged process (e.g., [17,24–29]). It may be explained by PHC professionals' important role in the introduction of PA interventions in PHC, i.e., they need to adopt an intervention, deliver it as intended, and continue to use it over a longer period of time. From this perspective, the adoption, implementation, and continuation of PA interventions are different stages of behavior change associated with different beliefs, which should be influenced by different strategies. Looking at the introduction of PA interventions in PHC as a staged process can be beneficial as it takes into account professionals' readiness to change and draws attention to important influencing factors for a specific stage. However, a staged approach also has its limitations. First, boundaries between the so-called stages are arbitrary [235] as it is not clear when exactly a PHC professional working with a PA intervention is in the adoption, implementation, or the continuation stage. For example, when does the continuation stage start? After a set moment in time (e.g., six months after the intervention adoption) or when delivering the intervention becomes routine practice? Second, classifying professionals into stages assumes that they make coherent and stable plans about their work [235], while our research has indicated that many different characteristics of the context (e.g., patient characteristics, time-related issues) may impact their adoption, implementation, and continuation behaviors. Third, introducing PA interventions into PHC organizations in which professionals are in different stages could be complex. Stages of change theories have been tested mainly in studies on changing patients' health behaviors [22]. Future research should examine the reliability of the different stages of the introduction process as well as the effectiveness of strategies tailored to professionals' stage of change.

Factors associated with the implementation of PHC-based PA interventions

When focusing solely on the implementation stage, many factors related to characteristics of the

individual PHC professional were found to be associated with physical therapists' implementation of PA interventions (i.e., delivery as intended). Most important factors were physical therapists' knowledge, skills, beliefs about capabilities, beliefs about consequences, and positive emotions regarding the implementation of PA interventions, the quality of their implementation plans, and the automaticity of delivering PA interventions as intended. The importance of these factors was previously reported in qualitative studies on health care professional behavior [32,40,169,179,180, 203]. In addition, knowledge [55], beliefs about capabilities [37,113,172], beliefs about consequences [37,113,172], behavioral regulation [37,172], and the nature of the behaviors [37,113,172] were found to predict health care professional behaviors in multiple quantitative studies. The results confirm the importance of PHC professionals' characteristics for the implementation stage in general and the importance of their knowledge, skills, and beliefs about consequences in specific. Factors unrelated to implementation fidelity mainly pertained to the environmental context and resources. A plausible explanation for the lack of association between these factors and physical therapists' implementation behaviors might be that environmental factors (e.g., support for the intervention, public health problem) foremost play a role during the adoption and the continuation stage. Furthermore, factors related to characteristics of the socio-political context and the organization, intervention characteristics, and patient characteristics may be more distal factors indirectly related to health care professionals' implementation behaviors [20].

The Determinants of Implementation Behavior Questionnaire

The two steps that were taken to systematically develop a questionnaire to measure theory-based factors influencing health care professionals' implementation behaviors resulted in the Determinants of Implementation Behavior Questionnaire (DIBQ). In the first step, the discriminant content validity study indicated that the Theoretical Domains Framework (TDF) can be used for the development of a questionnaire measuring theory-based behavioral determinants, but that 12-domain version of the TDF [31] might be more applicable in developing a TDF-based questionnaire than the 14-domain version [30]. In the second step, the DIBQ was developed based on the 12-domain version of the TDF [31]. Emphasis was placed on developing a questionnaire covering the full breadth of domains, including the wide range of factors previously identified to influence the implementation of PA interventions by PHC professionals. Initial examination of the psychometric properties of the DIBQ suggested that the questionnaire is able to measure theory-based factors influencing health care professionals' implementation behaviors with acceptable validity and reliability. If these results are confirmed in future research, the DIBQ may be viable to solve previously reported problems with the measurement of theory-based factors underlying health care professional behavior [22,32,64,145].

Application of the DIBQ to explore factors associated with physical therapists' implementation of PA interventions suggests that the questionnaire is an appropriate tool for investigating implementation behavior determinants. However, using the questionnaire to explore direct relationships between domains and implementation behavior lacks theoretical strength as this approach neglects the relationships between the theoretical constructs that are integrated in the TDF. In future research, the DIBQ may be used taking a different approach, e.g., to compare the predictive validity of different theories included in the TDF (e.g., the Theory of Planned Behavior [138] and the Social Cognitive Theory [139]), or to investigate the integration of other theoretical domains (e.g., Environmental context and resources) within existing theories to enhance the

prediction of health care professionals' behaviors. Moreover, the 55.2% response rate of physical therapists implementing PA interventions suggests that the DIBQ might be too long to fill in. A next step in the development process could be to develop a shorter version of the DIBQ and assess its psychometric properties. One strategy to decrease the amount of items would be to select items measuring the domains directly, instead of through their related key construct. This selection process may be guided by the results of the discriminant content validity study [183]. Finally, additional research is needed to further investigate the DIBQ's psychometrics properties, specifically when the questionnaire is applied to other health care professional behaviors in different settings.

Strengths and limitations

To the best of our knowledge, this thesis describes a line of research in which for the first time factors influencing the introduction of PA interventions in PHC are systematically and thoroughly investigated. A comprehensive theoretical perspective on determinants of the introduction process was taken to investigate factors related to the innovation, socio-political context, organization, patient, PHC professional, and innovation strategies. In addition, special attention was given to the distinct stages of the process, i.e., the adoption, implementation, and continuation of PA interventions in PHC. The use of both experts on the introduction of PA interventions in PHC (i.e., academics, intervention managers, PHC advisors) and health care professionals delivering PA interventions to their patients contributed to the identification of potential influencing factors at many different levels of the introduction process. Another strength is the use of both qualitative and quantitative methods to examine influencing factors, a research strategy that was proposed by Palinkas et al. [126] as essential to understand the effective introduction of innovations in practice. Finally, a newly developed questionnaire showing sufficient validity and reliability in a first investigation of its psychometric properties was used to examine associations between theory-based factors and the implementation of PA interventions.

In addition, a number of limitations need to be addressed. First, the present thesis identified factors *potentially* influencing the introduction of PA interventions in PHC, as no causal relationships between factors and the adoption, implementation, and continuation could be investigated. During the period that the studies described in this thesis were conducted, many PA interventions were already introduced in PHC and no differences in their adoption, implementation, and continuation were expected over time. Furthermore, it was difficult to study determinants of the introduction of PA interventions in PHC *in general* as there was a multitude of PHC-based PA interventions comprising different intervention characteristics that were embedded in a variety of contexts. Future research may examine these relationships as introduction strategies are ideally developed based on causal assumptions. On the other hand, people responsible for the introduction of PA interventions in PHC seldom dispose of causal evidence when planning the introduction of innovations in practice [39]. For them, the overview of potential influencing factors are likely to provide insightful suggestions on which factors are important to consider when introducing PA interventions in PHC. Second, based on the studies that we conducted we can only hypothesize which factors influence the introduction process in general and which factors are stage-specific. The open character of the interviews in the qualitative study decreased the focus on the distinct stages of the process and the Delphi study resulted in general and stage-specific factors based on experts' perceptions. As a consequence, factors' importance for the adoption, implementation, and

continuation stage should be further investigated. To be able to determine causal relationships between factors and the distinct stages of the introduction process, we suggest a longitudinal study that closely monitors the introduction of a newly developed evidence-based PA intervention in PHC.

A third limitation is related to the possible occurrence of a positive sampling bias. As the majority of our participants was actively involved in the introduction of PA interventions in PHC this may have increased the identification of factors considered important from a more positive view. It is possible that the inclusion of a higher number of participants who had decided not to adopt the intervention, or who had discontinued working with the intervention after some time, would have increased our knowledge on barriers to the introduction process. In addition, the physical therapists that participated in the final study reported on average 15 years of practice experience, high levels of knowledge and skills to deliver PA interventions, and high levels of automaticity in delivering PA interventions following the guidelines. This may suggest that the physical therapists participating in our study were in the continuation stage instead of the implementation stage of the introduction process. Consequently, it could be that we actually identified factors associated with long term intervention delivery in which working with the intervention becomes routine practice. Moreover, the health care professionals that participated in our studies may have been those who find the introduction of PA interventions in PHC more important, which limits the generalizability of our results.

A final limitation is related to the measurement of health care professionals' implementation behaviors. In our study, we used a self-report questionnaire to measure physical therapists' implementation fidelity, which due to a possible social desirable response may have led to higher scores on completeness and quality of delivery of PA interventions. Future studies may wish to use other methods to measure health care professionals' implementation behaviors, such as observation, medical records data, and patient self-report. However, observation may be intrusive, can also promote socially-desirable behavior, and is time-consuming and costly to use. Furthermore, the evidence-base for the validity of medical records data and patient self-report is very limited [236]. Green et al. [237] found that the comprehensive assessment of the introduction of innovations in health care requires multiple data collection methods. This emphasizes the need for future research on instruments to reliably measure health care professional behavior, including the potential for using a combination of data collection methods. Finally, measuring completeness and quality of implementation might not be sufficient to measure implementation fidelity. Other aspects of implementation fidelity that may be evaluated include adherence (i.e., implementation that conforms to theoretical guidelines), participant responsiveness (i.e., the extent to which the innovation stimulates the interest of participants), and differentiation (i.e., the extent to which the innovation can be distinguished from other innovations) [21,238].

The use of theory

To identify factors influencing the process of introducing PA interventions in PHC we used Fleuren et al.'s [17] comprehensive theoretical framework describing the main stages of the process (i.e., adoption, implementation, and continuation) and the different categories of influencing factors (i.e., characteristics of the innovation, socio-political context, organization, adopting person, and innovation strategy). Similar to previous studies [40–42], the framework was found to be suitable

for the examination of factors potentially influencing the introduction of innovations in health care organizations. The framework provided us with a broad scope on the subject and helped us to uncover a great variety of factors influencing changes on multiple levels. Our findings did suggest to include Grol et al.'s [5] and Chaudoir et al.'s [64] additional category of characteristics of the patient in the framework.

With our increased focus on PHC professionals' implementation of PA interventions in the second part of this thesis, we used the TDF [30,31] to develop a questionnaire that is able to identify theory-based factors influencing health care professionals' implementation behaviors. Investigation of the psychometric properties of the DIBQ supported the majority of the pre-defined structure of the questionnaire that was based on the 12 domains of the TDF [31]. Similarly to Taylor et al. [48,167], our findings provide a new and an additional level of validation for the content of the TDF: not only do judges agree about the constructs within each domain and the domain structure as demonstrated by Cane et al. [30], but the majority of TDF domains have now been shown to be largely discriminately measurable. This confirms the viability of using the framework for construction of a theory-based questionnaire. Application of the DIBQ to identify factors associated with physical therapists' implementation of PA interventions suggests that the TDF is a good framework for use in implementation science in the sense that its domains indeed relate to implementation behavior. However, more efforts are needed to formulate the paths via which the domains influence this behavior, as the TDF does not specify relationships between domains. Indeed, the TDF was not developed to replace behavior change theories. Yet, the framework is useful to identify theories that are relevant to specific implementation behaviors and thus suitable to further investigate the factors influencing these behaviors [32,182].

Although Fleuren et al.'s framework [17] and the TDF [30,31] differ in their focus on either environmental [17] or individual factors [30,31] our findings suggest that the two can easily be integrated to advance research on determinants of the introduction process and health care professionals' behaviors. First, the factors identified by the use of Fleuren et al.'s [17] framework could be mapped onto the domains of behavioral determinants of the TDF. Second, our findings indicated that Fleuren et al.'s [17] categories of environmental factors (i.e., characteristics of the innovation, socio-political context, organization, and innovation strategy) and Grol et al.'s [5] and Chaudoir et al.'s [64] additional category of characteristics of the patient could be used to differentiate between different environmental factors in a TDF-based questionnaire. Accordingly, we recommend using this extended version of the TDF when investigating factors influencing health care professionals' behaviors. In addition to health care professionals' implementation behaviors, the framework may also be of use for the exploration of factors influencing health care professionals' adoption and continuation of innovations and the behaviors of other environmental agents in the introduction process.

Future directions

This thesis forwarded many factors potentially influencing the introduction of PA interventions in PHC. People responsible for the introduction of PA interventions in PHC can take these factors into account when planning the introduction process and developing strategies to improve the process and health care professionals' behaviors. Furthermore, the findings suggest that different factors may be important for the adoption, implementation, and continuation of PA interventions, which, if

replicated in future research, implies that special attention should be given to the distinct stages of the process when designing strategies and doing research. Consequently, researchers may wish to investigate causal relationships between factors and the adoption, implementation, and continuation of PHC-based PA interventions. Stages of change theories have been tested mainly in studies on changing patients' health behaviors [22]. Future research should examine the reliability of the different stages of the introduction process as well as the effectiveness of strategies tailored to professionals' stage of change. In order to do this, we suggest longitudinal research on the introduction of a newly developed evidence-based PA intervention in PHC. Such a research design can also test the hypothesis about distal and proximal factors.

In addition, this thesis resulted in a questionnaire to measure theory-based factors underlying health care professionals' implementation behaviors, which may solve previously described measurement problems (i.e., the DIBQ [22,32,64,145]). In a first investigation of its psychometric properties, the DIBQ appeared to have acceptable construct validity and the majority of the TDF domains were suggested to be reliably and discriminately measurable. Future studies should further investigate the psychometric properties of the questionnaire, such as items' predictive validity, the questionnaire's convergent and discriminant validity, and test-retest reliability of the questionnaire. In the last study presented in this thesis, the DIBQ was used to identify factors associated with physiotherapists' implementation of PHC-based PA interventions. Hence, further research is needed to understand the strengths and limitations of the DIBQ when it is used to identify factors influencing other health care professional behaviors in other settings. Moreover, the 55.2% response rate of the DIBQ study suggests that the DIBQ might be too long to fill in. A next step in the development process could be to develop a shorter version of the DIBQ and assess its psychometric properties. Also based on the TDF and our previous work, we are currently developing a TDF-based checklist, that can be used in practice (e.g., by people responsible for the introduction of PA interventions in PHC) to identify barriers and facilitators to the implementation of PHC-based PA interventions. In addition to the DIBQ, the checklist is based on Fleuren et al.'s [239] measurement instrument for the identification of determinants of the introduction process (i.e., MIDI). Piloting of the checklist by means of a think aloud and semi-structured interview study has indicated that future users (i.e., people responsible for the introduction of PA interventions in PHC) and respondents (i.e., PHC professionals delivering PA interventions to their patients) hold positive views towards the checklist. Appendix 1 shows the content of the checklist developed based on the results of this first evaluation study. Appendix 2 and Appendix 3 include the checklist and its manual. Moreover, the checklist's practical applicability will be further investigated by the evaluation of the use of the checklist in practice. Finally, future research should examine the checklist's psychometric properties for its use in implementation research.

The identification of factors important for the introduction of PA interventions in PHC is the first step in the systematic development of effective introduction strategies [1,6,7,17,22,33–39]. Strategies that are tailored to these factors are more likely to improve health care practice than solely the dissemination of guidelines or educational materials [240]. Furthermore, the use of theory to guide the development of introduction strategies may contribute to their effectiveness [32,36,39,178]. Selecting most important factors to address in introduction strategies is ideally based on causal assumptions. However, the present thesis did not provide empirical evidence on causal relationships between factors and implementation fidelity. Based on the strength of the

associations between factors and physical therapists' implementation of PA interventions, it is therefore merely hypothesized that physical therapists' implementation of PA interventions may be enhanced by strategies targeting physical therapists' knowledge, skills, beliefs about capabilities and consequences, and positive emotions regarding the implementation of PA interventions, the quality of their implementation plans, and the automaticity of their implementation PA interventions. After the identification of these targets for the introduction strategy, factors can be linked to theory-based behavior change techniques [36,39]. These techniques are likely to be the strategy's active ingredients as they have been matched directly to the theory and evidence-based factors potentially influencing the target behavior. With regard to the specific example of physical therapists' implementation of PA interventions, potential behavior change techniques to enhance knowledge and beliefs about consequences may be discussion and elaboration of guidelines [15], techniques to enhance beliefs about capabilities and skills may be self-monitoring and graded tasks [15,36], emotions may be improved by stress management [36], planning may be enhanced by forming implementation intentions [15,36], and the automaticity of implementing PA interventions following the guidelines may be increased by self-monitoring and positive feedback [227] (for an overview of techniques to change determinants see Michie et al. [36] and Bartholomew et al. [15]). Based on these techniques, methods can be selected for the practical application and delivery of the introduction strategy [15,36,39,241] (for examples on the practical application of behavioral change techniques see Bartholomew et al. [15,39]). Finally, the effectiveness of introduction strategies should be evaluated and reported, including the different factors that were targeted by the behavior change techniques. This provides information on why the strategy was effective or not [39,178]. Examples on how to develop tailored introduction strategies can be found in Armstrong et al. [242] and Sinnema et al. [243] and French et al. [35] and Taylor et al. [169] who used the TDF to guide the development process.

To end

This thesis describes the investigation of factors influencing the introduction of PA interventions in PHC. Taken together, the results have provided an overview of factors that can be taken into account when planning the introduction process. Furthermore, it reports on factors' importance for the distinct stages of the process, i.e., the adoption, implementation, and continuation of PA interventions in PHC. As the relative importance of the identified factors for the introduction of specific PA interventions may vary across potential adopters, settings, and countries [38,49], researchers and people responsible for the introduction of PA interventions in PHC may wish to identify most important barriers and facilitators for their specific PHC-based PA intervention. Subsequently, the DIBQ and TDF-based checklist may contribute towards the effective introduction of PA interventions in PHC and the development of effective introduction strategies.

Appendix 1. Content of the checklist to identify barriers and facilitators to the implementation of PA interventions

Domain	Item
Knowledge	I have sufficient knowledge to deliver [PA intervention] following the guidelines
Skills	I have sufficient skills to deliver [PA intervention] following the guidelines
Social/professional role and identity	I think that as a [professional] it is my job to deliver [task 1] I think that as a [professional] it is my job to deliver [task 2] I think that as a [professional] it is my job to deliver [task 3]
Beliefs about capabilities	I am confident that I can deliver [task 1] I am confident that I can deliver [task 2] I am confident that I can deliver [task 3] I am confident that I can deliver [PA intervention] following the guidelines even when I encounter barriers (e.g., lack of time, participants are not motivated)
Beliefs about consequences	If I deliver [PA intervention] following the guidelines this will lead to [goal 1] If I deliver [PA intervention] following the guidelines this will lead to [goal 2] If I deliver [PA intervention] following the guidelines this will lead to [goal 3] For me, delivering [PA intervention] following the guidelines is very pleasurable
Motivation and goals	I am motivated to deliver [PA intervention] following the guidelines Other work tasks/ things I need to do interfere with the delivery of [PA intervention] following the guideline
Memory	I can easily remember what I need to do to deliver [PA intervention] following the guidelines
Innovation	It is clear to me which activities I need to do and when/ in which order I need to do them to deliver [PA intervention] following the guidelines [PA intervention] is well-constructed (content wise) [PA intervention] is compatible with how I am accustomed to work [PA intervention] offers all information and materials that are necessary to deliver [PA intervention] following the guidelines It is possible to tailor [PA intervention] to participants' individual characteristics and needs (i.e., it is not a straightjacket) [PA intervention] effects are clearly visible to me (e.g., participants' motivation, behavior, health) Delivering [PA intervention] gives me a lot of benefits
Socio-political context	There are sufficient financial resources to deliver [PA intervention] following the guidelines I have sufficient time to deliver [PA intervention] following the guidelines Delivering [PA intervention] is a free choice for me (i.e., it is not imposed by others) I experience the collaboration with regard to the delivery of [PA intervention] as positive (e.g., with colleagues, management, others involved) [PA intervention] is well coordinated

Appendix 1. Content of the checklist to identify barriers and facilitators to the implementation of PA interventions (continued)

Domain	Item
Organization	In my organization, formal arrangements are made with regard to the delivery of [PA intervention] (i.e., policy, work plans)
	In my organization, there is sufficient personnel to deliver [PA intervention] following the guidelines
	In my organization, there are sufficient facilities to deliver [PA intervention] following the guidelines (e.g., equipment, material, space)
	In my organization, other changes interfere with the delivery of [PA intervention] (e.g., reorganizations, cutbacks, the introduction of other innovations)
	All colleagues who deliver [PA intervention] deliver it following the guidelines
Participants	In my organization, there is sufficient influx of participants for [PA intervention]
	In general, participants are positive about [PA intervention]
	Participants are motivated to participate in [PA intervention]
Innovation strategy	I would like to have (more) information to deliver [PA intervention] following the guidelines
	I would like to have (more) training to deliver [PA intervention] following the guidelines
	I would like to have (more) assistance to deliver [PA intervention] following the guidelines
	I get informed regularly about the course/ progress of [PA intervention]
	I get sufficient financial reimbursement for the delivery of [PA intervention] following the guidelines
	I get sufficient recognition for the delivery of [PA intervention] following the guidelines
Social influences	It is expected from me that I deliver [PA intervention] following the guidelines (e.g., by colleagues, management, others involved)
	I can count on sufficient support from people involved in delivering [PA intervention] when I need it with regard to delivering [PA intervention] following the guidelines (e.g., from colleagues, management, others involved)
Emotions and optimism	I feel good when I deliver the intervention following the guidelines (e.g., optimistic, comfortable, clam, relaxed, cheerful, elated)
	I feel unpleasant when I deliver the intervention following the guidelines (e.g., nervous, pessimistic, depressed, agitated, sad, uncomfortable)
Behavioral regulation	I have clear plans of how I will deliver [PA intervention] following the guidelines
	I have clear plans of how I will deliver [PA intervention] following the guidelines when I encounter barriers (e.g., lack of time, participants are not motivated)
	I check regularly whether I am doing everything necessary to deliver [PA intervention] following the guidelines
Nature of the behaviors	Delivering [PA intervention] following the guidelines is something I have made my own/ that has become habitual for me

Naam: ☐ anoniem (keuze)

Checklist uitvoering beweegprogramma's

Deze checklist gaat over de uitvoering van [naam beweegprogramma]. Het doel van de checklist is om in kaart te brengen wat u goed vindt gaan m.b.t. het uitvoeren van [naam beweegprogramma] en welke moeilijkheden u eventueel ervaart. Aan de hand van uw antwoorden op de vragen wordt duidelijk waar de coördinator ondersteuning kan bieden en welke verbeteringen er mogelijk zijn.
Het invullen van de checklist duurt ongeveer 10 minuten.

Vul in in hoeverre u het eens bent met de volgende stellingen:

1 = helemaal mee oneens, 2 = mee oneens, 3 = neutraal, 4 = mee eens, 5 = helemaal mee eens of nvt/ weet ik

		1	2	3	4	5	nvt
Beweegprogramma							
1.	Het is voor mij **helder welke activiteiten** ik **in welke volgorde** moet doen om het beweegprogramma goed uit te voeren	☐	☐	☐	☐	☐	☐
2.	Het beweegprogramma zit **inhoudelijk** goed in elkaar	☐	☐	☐	☐	☐	☐
3.	Het beweegprogramma **sluit goed aan** bij hoe ik gewend ben om te werken	☐	☐	☐	☐	☐	☐
4.	Het beweegprogramma biedt alle **informatie en materialen** die nodig zijn om het goed uit te voeren	☐	☐	☐	☐	☐	☐
5.	Het is mogelijk het beweegprogramma **aan te passen** aan de kenmerken en behoeften van individuele deelnemers (geen keurslijf)	☐	☐	☐	☐	☐	☐
6.	De **effecten** van het beweegprogramma zijn **goed zichtbaar** voor mij (bijv. motivatie, gedrag, gezondheid van de deelnemer)	☐	☐	☐	☐	☐	☐
7.	De uitvoering van het beweegprogramma biedt mij veel **voordelen**	☐	☐	☐	☐	☐	☐
Uitvoerder							
1.	Ik heb voldoende **kennis** over het beweegprogramma om het goed uit te voeren	☐	☐	☐	☐	☐	☐
2.	Ik heb voldoende **vaardigheden** om het beweegprogramma goed uit te voeren	☐	☐	☐	☐	☐	☐
3.	Ik vind het als [functie] mijn **taak** om [kerntaak 1] te doen	☐	☐	☐	☐	☐	☐
4.	Ik vind het als [functie] mijn **taak** om [kerntaak 2] te doen	☐	☐	☐	☐	☐	☐
5.	Ik vind het als [functie] mijn **taak** om [kerntaak 3] te doen	☐	☐	☐	☐	☐	☐
6.	Ik ben **gemotiveerd** om het beweegprogramma goed uit te voeren	☐	☐	☐	☐	☐	☐
7.	Wanneer ik het beweegprogramma goed uitvoer heeft dit tot **gevolg** dat [doelstelling 1]	☐	☐	☐	☐	☐	☐
8.	Wanneer ik het beweegprogramma goed uitvoer heeft dit tot **gevolg** dat [doelstelling 2]	☐	☐	☐	☐	☐	☐
9.	Wanneer ik het beweegprogramma goed uitvoer heeft dit tot **gevolg** dat [doelstelling 3]	☐	☐	☐	☐	☐	☐
10.	Ik vind het goed uitvoeren van het beweegprogramma erg **plezierig**	☐	☐	☐	☐	☐	☐

Toelichting:

		1	2	3	4	5	nvt
11.	Ik heb er **vertrouwen** in dat het mij lukt om [kerntaak 1] te doen	☐	☐	☐	☐	☐	☐
12.	Ik heb er **vertrouwen** in dat het mij lukt om [kerntaak 2] te doen	☐	☐	☐	☐	☐	☐
13.	Ik heb er **vertrouwen** in dat het mij lukt om [kerntaak 3] te doen	☐	☐	☐	☐	☐	☐
14.	Ik heb er **vertrouwen** in dat het mij lukt om het beweegprogramma goed uit te voeren, zelfs wanneer er **barrières** zijn (bijv. weinig tijd, deelnemers zijn niet gemotiveerd)	☐	☐	☐	☐	☐	☐
15.	**Ik voel me goed** wanneer ik het beweegprogramma uitvoer (bijv. optimistisch, op mijn gemak, rustig, ontspannen, opgewekt, opgetogen)	☐	☐	☐	☐	☐	☐
16.	**Ik voel me vervelend** wanneer ik het beweegprogramma uitvoer (bijv. nerveus, somber, neerslachtig, gejaagd, triest, ongemakkelijk)	☐	☐	☐	☐	☐	☐
17.	**Andere werkzaamheden/ dingen die ik moet doen** staan de uitvoering van het beweegprogramma in de weg	☐	☐	☐	☐	☐	☐
18.	Ik heb voor mezelf **duidelijke plannen** gemaakt m.b.t. hoe ik het beweegprogramma goed uitvoer	☐	☐	☐	☐	☐	☐
19.	Ik heb voor mezelf **duidelijke plannen** gemaakt m.b.t. hoe ik het beweegprogramma goed uitvoer als er **barrières** zijn (bijv. weinig tijd, deelnemers niet gemotiveerd)	☐	☐	☐	☐	☐	☐
20.	Ik **ga regelmatig na** of ik wel alles doe m.b.t. het goed uitvoeren van het beweegprogramma	☐	☐	☐	☐	☐	☐
21.	Ik kan makkelijk **onthouden** wat ik moet doen om het beweegprogramma goed uit te voeren	☐	☐	☐	☐	☐	☐
22.	De uitvoering van het beweegprogramma is iets wat ik mij eigen heb gemaakt, een **gewoonte** voor mij	☐	☐	☐	☐	☐	☐
Omgeving en organisatie							
1.	Er zijn **voldoende financiële middelen beschikbaar** om het beweegprogramma goed uit te voeren	☐	☐	☐	☐	☐	☐
2.	Ik heb **voldoende tijd** om het beweegprogramma goed uit te voeren	☐	☐	☐	☐	☐	☐
3.	De uitvoering van het beweegprogramma is voor mij een **vrije keuze** (het is mij niet opgelegd)	☐	☐	☐	☐	☐	☐
4.	Ik ervaar de **samenwerking** m.b.t. de uitvoering van het beweegprogramma als positief (bijv. met collega's, andere betrokkenen)	☐	☐	☐	☐	☐	☐
5.	De **coördinatie** van het beweegprogramma is goed geregeld	☐	☐	☐	☐	☐	☐
6.	In mijn organisatie zijn **formele afspraken** over de uitvoering van het beweegprogramma (bijv. beleid, werkplannen etc.)	☐	☐	☐	☐	☐	☐
7.	In mijn organisatie is **voldoende personeel** om het beweegprogramma goed uit te voeren	☐	☐	☐	☐	☐	☐
8.	In mijn organisatie zijn **voldoende faciliteiten** om het beweegprogramma goed uit te voeren (bijv. apparatuur, materialen, ruimte)	☐	☐	☐	☐	☐	☐
9.	In mijn organisatie staan **andere veranderingen** de uitvoering van het beweegprogramma in de weg (bijv. reorganisaties, bezuinigingen, invoering andere innovaties)	☐	☐	☐	☐	☐	☐
10.	**Alle collega's** die met het beweegprogramma werken voeren het beweegprogramma goed uit	☐	☐	☐	☐	☐	☐
11.	Anderen **verwachten** van mij dat ik het beweegprogramma goed uitvoer (bijv. collega's, leidinggevende, andere betrokkenen)	☐	☐	☐	☐	☐	☐

Toelichting:

		1	2	3	4	5	nvt
12.	Ik kan op **voldoende steun** rekenen bij de uitvoering van het beweegprogramma (bijv. van collega's, leidinggevende, andere betrokkenen)	☐	☐	☐	☐	☐	☐
Deelnemers							
1.	In mijn organisatie is **voldoende instroom van deelnemers** aan het beweegprogramma	☐	☐	☐	☐	☐	☐
2.	Deelnemers zijn over het algemeen **positief** over het beweegprogramma	☐	☐	☐	☐	☐	☐
3.	Deelnemers zijn **gemotiveerd** om mee te werken aan het beweegprogramma	☐	☐	☐	☐	☐	☐
Innovatie strategieën							
1.	Ik heb behoefte aan (meer) **informatie** om het beweegprogramma goed uit te voeren	☐	☐	☐	☐	☐	☐
2.	Ik heb behoefte aan (meer) **training** om het beweegprogramma goed uit te voeren	☐	☐	☐	☐	☐	☐
3.	Ik heb behoefte aan (meer) **ondersteuning** om het beweegprogramma goed uit te voeren	☐	☐	☐	☐	☐	☐
4.	Ik word regelmatig **geïnformeerd** over het verloop/ de voortgang van het beweegprogramma	☐	☐	☐	☐	☐	☐
5.	Ik krijg **voldoende financiële vergoeding** voor de uitvoering van het beweegprogramma	☐	☐	☐	☐	☐	☐
6.	Ik krijg **voldoende waardering** voor de uitvoering van het beweegprogramma	☐	☐	☐	☐	☐	☐

Toelichting:

Het lukt mij om het beweegprogramma goed uit te voeren omdat…

Wat ik graag anders zou zien is…

Checklist belangrijke factoren voor de uitvoering beweegprogramma's: Handleiding

Inhoudsopgave

1. Toelichting checklist

1.1 Achtergrond
Veel eerstelijnszorgprofessionals zijn actief bezig met de uitvoering van interventies gericht op het bevorderen van beweging bij volwassenen (in het vervolg van het document samenvattend beweegprogramma's genoemd). De manier waarop beweegprogramma's worden uitgevoerd wordt beïnvloed door een groot aantal verschillende factoren. Deze kunnen worden onderverdeeld in factoren gerelateerd aan het *beweegprogramma*, de *uitvoerder* van en *deelnemers* aan het beweegprogramma, en de *organisatie* en *omgeving* waar het beweegprogramma wordt uitgevoerd en *innovatie strategieën*.

Een goede uitvoering van het beweegprogramma kan direct bijdragen aan het effect ervan. In de praktijk kunnen professionals knelpunten ervaren die het moeilijker maken om een beweegprogramma goed uit te voeren. Wanneer deze knelpunten in kaart worden gebracht, kan gericht worden bijgestuurd en ondersteuning worden geboden.

Vanaf 2009 hebben onderzoekers van de Faculteit Sociale Wetenschappen van de Universiteit Leiden, het Leids Universitair Medisch Centrum, TNO en GGD Hollands Midden onderzoek gedaan naar de verschillende factoren die van invloed zijn op de uitvoering van beweegprogramma's in de eerstelijnszorg. Hiervoor zijn onder andere de theoretische raamwerken van Fleuren et al. (2004) en Michie et al. (2005) gebruikt. Op basis van de resultaten van dit onderzoek en het Meetinstrument voor Determinanten van Innovaties (MIDI; Fleuren et al., 2012) is een *checklist* ontwikkeld waarmee knelpunten voor de uitvoering van een beweegprogramma in kaart kunnen worden gebracht.

1.2 Doel
De checklist is bedoeld voor coördinatoren van beweegprogramma's die de uitvoering van een bepaald beweegprogramma willen evalueren. De checklist geeft inzicht in wat goed gaat en wat beter kan, waardoor het mogelijk is om gericht te kunnen bijsturen of ondersteuning te kunnen bieden. De checklist wordt ingevuld door de professionals die het beweegprogramma uitvoeren (uitvoerders). De antwoorden kunnen nader worden uitgediept in de vorm van een individueel - of groepsgesprek, waarbij samen gezocht kan worden naar mogelijke oplossingen.

1.3 Gebruik
De checklist is geschikt voor de evaluatie van de uitvoering van beweegprogramma's in het algemeen. Voor een zo optimaal mogelijk gebruik van de checklist, zowel voor uitvoerders als coördinatoren, is het van belang dat de checklist wordt toegespitst op het specifieke beweegprogramma wat geëvalueerd wordt. Daarvoor zijn slechts enkele aanpassingen nodig: het invullen van de naam van het beweegprogramma en het concreet beschrijven van kerntaken en doelstellingen. Hoe de checklist precies aan te passen staat beschreven in hoofdstuk 2 van deze handleiding.

De checklist kan digitaal of op papier, individueel of in een groep worden verspreid. U kunt de checklist bijvoorbeeld via e-mail verspreiden (zie Bijlage 1 voor een voorbeeld e-mail) of uitvoerders vragen deze tijdens de lunch of een overleg in te vullen. Wanneer u de checklist digitaal verstuurt kunt u aan de uitvoerders vragen om de ingevulde checklist op te slaan onder een herkenbare naam. Het is belangrijk om te voorkomen dat uitvoerders zich persoonlijk beoordeeld voelen. Daarom is het van belang om aan uitvoerders uit te leggen dat de checklist bedoeld is om meer inzicht te krijgen in de uitvoering van het beweegprogramma, om vervolgens – waar nodig – bij te kunnen sturen of ondersteuning te kunnen bieden.

1.4 Resultaten checklist
De checklist bestaat uit 50 stellingen die zijn onderverdeeld in de categorieën 'Beweegprogramma', 'Uitvoerder', 'Omgeving en organisatie, 'Deelnemers' en 'Innovatie strategieën'. Iedere afzonderlijke stelling van de checklist geeft weer wat er goed gaat en wat beter kan m.b.t. de uitvoering van het beweegprogramma. De coördinator kan per stelling inventariseren of dit voor de uitvoerders van het beweegprogramma goed gaat of beter kan. Hij/zij kan dan met de uitvoerder(s) in gesprek gaan over de uitvoering van het beweegprogramma en waar kan worden bijgestuurd of ondersteuning kan worden geboden.

Voor de meeste stellingen geldt dat een hogere score weergeeft wat goed gaat m.b.t. de uitvoering van het beweegprogramma. Een lagere score geeft een knelpunt weer, d.w.z. iets wat beter zou kunnen m.b.t. de uitvoering van een beweegprogramma. Bijvoorbeeld: wanneer een uitvoerder aangeeft dat hij/zij het helemaal oneens is met de stelling 'Ik heb voldoende kennis over het beweegprogramma om het goed uit te voeren' (een score van 1), dan is kennis voor deze uitvoerder een knelpunt om het beweegprogramma goed uit te voeren. Wanneer een uitvoerder aangeeft dat hij/zij het eens is met de stelling 'Ik heb voldoende tijd om het beweegprogramma goed uit te voeren' (een score van 4), dan is tijd voor deze uitvoerder geen knelpunt.

De stellingen 16 en 17 van 'Uitvoerder' en 9 van 'Omgeving en organisatie' zijn gespiegeld geformuleerd. Voor deze stellingen geeft een hogere score een knelpunt weer, d.w.z. iets wat beter zou kunnen m.b.t. de uitvoering van een beweegprogramma. Een lagere score geeft dan juist weer wat goed gaat. Bijvoorbeeld: wanneer een uitvoerder aangeeft dat hij/zij het helemaal eens is met de stelling 'Andere werkzaamheden/dingen die ik moet doen staan de uitvoering van het beweegprogramma in de weg' (een score van 5), dan zijn andere werkzaamheden/dingen die gedaan moeten worden voor deze uitvoerder een knelpunt om het beweegprogramma goed uit te voeren. Wanneer een uitvoeder aangeeft dat hij/zij het oneens is met de stelling 'Ik voel me vervelend wanneer ik het beweegprogramma uitvoer (bijv. nerveus, somber, neerslachtig, gejaagd, triest, ongemakkelijk)' (een score van 2), dan is dit geen knelpunt voor deze uitvoerder.

Tot slot geeft een hogere score op de stellingen 1, 2 en 3 van 'Innovatie strategieën' aan dat de uitvoerder behoefte heeft aan (meer) informatie, training en/of ondersteuning. Een lagere score op deze stellingen geeft weer dat de uitvoerder voldoende informatie, training en/of ondersteuning heeft.

1.5 Hoe verder?
De meeste coördinatoren die de checklist gebruiken zullen iets met de resultaten willen doen. Als eerste stap kan de coördinator met de betrokken uitvoerder(s) in gesprek gaan over wat er goed gaat en wat er beter kan. In dit gesprek is het allereerst van belang dat wat goed gaat te bekrachtigen. Wat betreft de knelpunten die uitvoerders ervaren en/of de dingen die beter kunnen, is het in de meeste gevallen belangrijk om meer informatie te verzamelen. Het gaat bijvoorbeeld om achtergrondinformatie over wat uitvoeders precies als knelpunt ervaren en waar zij mogelijkheden zien voor verbetering. In hoofdstuk 3 van deze handleiding wordt dieper ingegaan op het verzamelen van meer informatie. Daarbij worden voorbeelden gegeven van hoe hierna tot actie kan worden over gegaan.

2. Aanpassen van de checklist

De checklist is geschikt om de uitvoering van beweegprogramma's (in het algemeen) te evalueren. Om de checklist toe te spitsen op een specifiek beweegprogramma zijn slechts enkele aanpassingen nodig.

Voor het aanpassen van de checklist is het belangrijk de checklist op te slaan onder een herkenbare naam (de papieren of digitale versie, afhankelijk van hoe de checklist zal worden verspreid). In Microsoft Word kan de introductie van de checklist en een aantal stellingen worden aangepast (zie rode tekst). De rest van de checklist is beveiligd. Na het aanpassen van de checklist is het belangrijk de checklist op te slaan. De checklist is nu gereed om op papier of digitaal onder de uitvoerders te verspreiden.

<u>Aanpassing 1.</u> Introductie van de checklist
In de introductie van de checklist is het belangrijk om aan te geven om welk beweegprogramma het gaat. Vul daarom de naam van het beweegprogramma in op de aangegeven plekken: [naam beweegprogramma] (bijv. beweegprogramma COPD; BOR).

<u>Aanpassing 2.</u> Taakopvatting (stellingen 3, 4 en 5)
Deze factor gaat over de mate waarin de uitvoerder het als zijn/haar taak ziet om de verschillende kerntaken van het beweegprogramma te doen:

3. Ik vind het als [functie] mijn **taak** om [kerntaak 1] te doen
4. Ik vind het als [functie] mijn **taak** om [kerntaak 2] te doen
5. Ik vind het als [functie] mijn **taak** om [kerntaak 3] te doen

[functie] Vul hier de functie van de betreffende uitvoerder in (bijv. fysiotherapeut, diëtist, huisarts, POH).
[kerntaak] Formuleer 3 kerntaken m.b.t. het uitvoeren van het beweegprogramma (voor de specifieke uitvoerder), en vul deze in.

Voorbeeld 1:
Een coördinator vraagt aan een groep fysiotherapeuten om de checklist in te vullen. In het beweegprogramma dat ze uitvoeren hebben zij drie kerntaken:

I. De intake
II. Begeleiding van deelnemer bij de training
III. Evaluatie van training

Na de aanpassingen zien de stellingen 3, 4 en 5 van het blok 'Uitvoerder' er dan als volgt uit:

3. Ik vind het als fysiotherapeut mijn **taak** om de intake te doen
4. Ik vind het als fysiotherapeut mijn **taak** om de begeleiding van de deelnemer bij de training te doen
5. Ik vind het als fysiotherapeut mijn **taak** om de evaluatie van de training te doen

Voorbeeld 2:
Een coördinator vraagt aan een groep huisartsen om de checklist in te vullen. In het beweegprogramma dat ze uitvoeren hebben zij drie kerntaken:

IV. Potentiële deelnemers van het beweegprogramma identificeren
V. Potentiële deelnemers naar het beweegprogramma verwijzen
VI. Navragen of patiënten geweest zijn en hoe het is verlopen

Na de aanpassingen zien de stellingen 3, 4 en 5 van het blok 'Uitvoerder' er dan als volgt uit:

3. Ik vind het als huisarts mijn **taak** om potentiële deelnemers van het beweegprogramma te identificeren
4. Ik vind het als huisarts mijn **taak** om potentiële deelnemers naar het beweegprogramma te verwijzen
5. Ik vind het als huisarts mijn **taak** om na te vragen of patiënten geweest zijn en hoe het is verlopen

<u>Aanpassing 3.</u> Uitkomstverwachting (stellingen 7, 8 en 9)
Deze factor gaat over de mate waarin de uitvoerder verwacht dat het uitvoeren van het beweegprogramma leidt tot het bereiken van de belangrijkste doelstellingen.

7. Wanneer ik het beweegprogramma goed uitvoer, heeft dit tot **gevolg** dat [doelstelling 1]
8. Wanneer ik het beweegprogramma goed uitvoer, heeft dit tot **gevolg** dat [doelstelling 2]
9. Wanneer ik het beweegprogramma goed uitvoer, heeft dit tot **gevolg** dat [doelstelling 3]

[doelstelling] Formuleer de 3 belangrijkste doelstellingen van het beweegprogramma en vul deze in.

Voorbeeld:
Een coördinator vraagt aan een aantal uitvoerders om de checklist in te vullen. Het beweegprogramma dat ze uitvoeren heeft drie doelstellingen:

I. Deelnemers hebben plezier in bewegen
II. Deelnemers gaan meer bewegen
III. De gezondheid van deelnemers verbetert

Na de aanpassingen zien de stellingen 7, 8 en 9 van het blok 'Uitvoerder' zien er dan als volgt uit:

7. Wanneer ik het beweegprogramma goed uitvoer, heeft dit tot **gevolg** dat deelnemers plezier hebben in bewegen
8. Wanneer ik het beweegprogramma goed uitvoer, heeft dit tot **gevolg** dat deelnemers meer gaan bewegen
9. Wanneer ik het beweegprogramma goed uitvoer, heeft dit tot **gevolg** dat de gezondheid van deelnemers verbetert

<u>Aanpassing 4.</u> Geloof in eigen kunnen (stellingen 11, 12 en 13)
Deze factor gaat over de mate waarin de uitvoerder er vertrouwen in heeft dat het hem/haar lukt om de kerntaken uit te voeren.

11. Ik heb er **vertrouwen** in dat het mij lukt om [kerntaak 1] te doen
12. Ik heb er **vertrouwen** in dat het mij lukt om [kerntaak 2] te doen
13. Ik heb er **vertrouwen** in dat het mij lukt om [kerntaak 3] te doen

[kerntaak] Vul de 3 kerntaken m.b.t. het uitvoeren van het beweegprogramma in.

Op basis van het voorbeeld waren deze:

I. De intake
II. Begeleiding van deelnemer bij de training
III. Evaluatie van training

De stellingen 11, 12 en 13 van het blok 'Uitvoerder' zien er dan als volgt uit:

11. Ik heb er **vertrouwen** in dat het mij lukt om de intake te doen
12. Ik heb er **vertrouwen** in dat het mij lukt om de begeleiding van de deelnemer bij de training te doen
13. Ik heb er **vertrouwen** in dat het mij lukt om de evaluatie van de training te doen

6

3. Meer informatie verzamelen en actie ondernemen

3.1 Informatie verzamelen
Het verzamelen van informatie kan aan de hand van een één-op-één gesprek tussen de coördinator en (een ieder van) de betrokken uitvoerder(s), of een groepsgesprek.

- Een voordeel van een één-op-één gesprek is dat u tot in detail in kunt gaan op de beleving van de individuele uitvoerder.
- Een voordeel van een groepsgesprek is dat uitvoerders elkaar kunnen aanvullen en elkaar vragen kunnen stellen, waardoor in veel gevallen een completer beeld ontstaat. Bovendien kunnen uitvoerders elkaar stimuleren en van elkaar leren; bijvoorbeeld door de uitvoering van het beweegprogramma in het algemeen te bespreken, maar ook hoe anderen het doen, en welke oplossingen anderen hebben gevonden voor bepaalde problemen.

Voor zowel een één-op-één gesprek als een groepsgesprek is het belangrijk dat de sfeer open is. Het is hiervoor belangrijk dat de coördinator benoemt dat alle meningen en ideeën welkom zijn. Dit moet ook letterlijk zo zijn; uitvoerders moeten veel ruimte krijgen om hun meningen en ideeën naar voren te brengen. Om te voorkomen dat uitvoerders zich persoonlijk beoordeeld voelen en zij weinig input zullen geven is het ook belangrijk om het doel van het gesprek (nogmaals) te benoemen: het verkrijgen van meer informatie over de ervaringen van uitvoerders met de uitvoering van het beweegprogramma en waar (en hoe) zij denken dat kan worden bijgestuurd of ondersteuning kan worden geboden.

3.1.1 Eén-op-één gesprek
Een één-op-één gesprek kan als doel hebben:

1. De gegeven antwoorden beter te begrijpen. Hiervoor kunnen de volgende vragen worden gesteld: Waarom heeft iemand een 3 als antwoord gegeven en niet een 5? Wat heeft iemand met een bepaald antwoord bedoeld? Als iemand bijvoorbeeld heeft aangegeven dat hij/zij niet voldoende kennis heeft om het programma goed uit te voeren: welk soort kennis ontbreekt hem/haar dan op dit moment, enz.?
2. Samen na te gaan welke knelpunten het meest belangrijk zijn en hoe kan worden bijgestuurd en/of ondersteuning kan worden geboden.

3.1.2 Groepsgesprek
Voor een groepsgesprek is het handig om op voorhand een duidelijke structuur vast te leggen (eventueel gezamenlijk overeengekomen) om te zorgen dat iedereen voldoende ruimte krijgt om zijn/haar meningen en ideeën naar voren te brengen, en dat mensen elkaar niet in de rede vallen. U kunt daarbij een vorm kiezen die een dergelijk open proces ondersteunt, bijvoorbeeld de volgende techniek die bij brainstormsessies wordt gebruikt:

> De coördinator stelt aan de uitvoerders een aantal specifieke vragen en laat ze hier voor zichzelf een antwoord op formuleren (bijv. Wat zijn volgens u de drie belangrijkste knelpunten m.b.t. de uitvoering van het beweegprogramma? Waar kunt u vooral ondersteuning bij gebruiken? Hoe denkt u dat kan worden bijgestuurd?, etc.). Deze antwoorden kunnen in subgroepen worden besproken en/of verder worden uitgewerkt, om ze vervolgens plenair te bespreken. Post-its en/of flipovers kunnen gebruikt worden om de verschillende gedachten samen te vatten en te presenteren.

3.2. Van informatie tot actie

Als de coördinator een voldoende beeld heeft van de belangrijkste knelpunten en hoe kan worden bijgestuurd of ondersteuning kan worden geboden, kan als vervolgstap gerichte actie ter verbetering worden ondernomen.

Knelpunten kunnen gerelateerd zijn aan de uitvoerder zelf, het beweegprogramma, of de context waarin het beweegprogramma wordt uitgevoerd (deelnemers, organisatie en omgeving). Knelpunten kunnen op verschillende manieren worden aangepakt. Het is moeilijk om aan te geven welke aanpak de beste is, omdat dit per knelpunt en per situatie zal verschillen. Daarbij is het onmogelijk om alle mogelijke manieren om bij te sturen en/of ondersteuning te bieden hier te beschrijven. Ter inspiratie worden hieronder enkele van de mogelijkheden beschreven. Het is belangrijk in overweging te nemen dat de mogelijkheden die door uitvoerders zijn geopperd en breed gedragen worden de grootste kans van slagen hebben.

3.2.1 Knelpunten bij uitvoerders

<u>Knelpunt 1.</u> Uitvoerders hebben onvoldoende kennis om het beweegprogramma goed uit te voeren

Er is sprake van onvoldoende kennis als een uitvoerder niet weet wat hij/zij precies moet doen om het beweegprogramma goed uit te voeren en wanneer een uitvoerder aangeeft dat hij/zij behoefte heeft aan (meer) informatie om het beweegprogramma goed uit te kunnen voeren (stelling 1 van 'Beweegprogramma', stelling 1 van 'Uitvoerder', stelling 1 van 'Innovatie strategieën).

Coördinatoren kunnen verschillende dingen doen om de kennis van de uitvoerder te vergroten, bijvoorbeeld:

Informatie
Coördinatoren kunnen een groepsgesprek organiseren waarin informatie wordt uitgewisseld over de uitvoering van het beweegprogramma. Hierbij kan ter ondersteuning gebruik gemaakt worden van PowerPoint presentaties en/of filmpjes. Eventueel kan ook schriftelijke informatie worden uitgedeeld (bijv. een draaiboek/ protocol/ informatiemap over het beweegprogramma en de uitvoering daarvan).

Tips:

- Het is belangrijk dat de uitvoerders actief betrokken worden. Dit kan bijvoorbeeld door uitvoerders zelf informatie te laten zoeken en ze mini-presentaties voor elkaar te laten houden.
- De informatie moet bondig, helder en aantrekkelijk zijn (denk aan foto's of plaatjes) en aansluiten bij de kennis en ervaring van de uitvoerder.
- Belangrijke punten worden gemakkelijker onthouden wanneer ze meerdere keren herhaald worden.

<u>Knelpunt 2.</u> Uitvoerders hebben een negatieve houding t.o.v. en/of negatieve uitkomstverwachtingen m.b.t. het beweegprogramma

Er is sprake van een negatieve houding t.o.v. en/of negatieve uitkomstverwachtingen m.b.t. het beweegprogramma als een uitvoerder zich er niet verantwoordelijk voor voelt om de taken van het beweegprogramma uit te voeren, niet verwacht dat de effecten van het beweegprogramma positief zijn, de uitvoering van het beweegprogramma niet plezierig vindt en weinig positieve en veel negatieve emoties ervaart bij het uitvoeren van het beweegprogramma (bijv. stelling 3, 7, 10, 15 van 'Uitvoerder'). Dit kan leiden tot een lage motivatie om het beweegprogramma goed uit te voeren (stelling 6 van 'Uitvoerder').

Coördinatoren kunnen verschillende dingen doen om de negatieve houding en/of negatieve uitkomstverwachtingen van de uitvoerder te beïnvloeden, bijvoorbeeld:

Argumenten
Coördinatoren geven verschillende argumenten aan de uitvoerders waarom het belangrijk is om het beweegprogramma goed uit te voeren en wat de voordelen van het beweegprogramma zijn. Het is ook mogelijk dat uitvoerders dit aan elkaar vertellen. Dit kan worden gedaan aan de hand van ervaringen met het beweegprogramma en de resultaten die zijn behaald. Eventueel kan gebruik gemaakt worden van beschrijvingen van uitvoerders en/of van deelnemers (zogenaamde "testimonials") die over het belang van en de voordelen van het beweegprogramma gaan.

Ander perspectief
Coördinatoren kunnen uitvoerders stimuleren om vanuit een ander perspectief naar het beweegprogramma te kijken, bijvoorbeeld vanuit het perspectief van de ontwikkelaar van het beweegprogramma, het perspectief dat er geen enkel knelpunt is om het beweegprogramma goed uit te voeren of het perspectief dat ze stoppen met de uitvoering van het beweegprogramma. Vervolgens is het de bedoeling dat uitvoerders argumenten bedenken waarom het belangrijk is om het beweegprogramma goed uit te voeren en voordelen van het beweegprogramma bedenken.

Tips:
- Het is belangrijk dat de uitvoerder gelooft in de argumenten die worden gegeven.
- De argumenten moeten nauw aansluiten bij de belevingswereld van de uitvoerder en de ervaren (on)mogelijkheden van de uitvoerder.
- Degene die de argumenten overbrengt moet door de uitvoerder als betrouwbaar worden gezien.
- Voor de beschrijvingen van andere uitvoerders is het van belang dat uitvoerders zich met deze mensen kunnen identificeren (bijv. een fysiotherapeut als de uitvoerders een groep fysiotherapeuten betreft).

<u>Knelpunt 3.</u> Uitvoerders hebben weinig geloof in eigen kunnen
Er is sprake van weinig geloof in eigen kunnen als een uitvoerder weinig vertrouwen heeft in zijn vaardigheden om het beweegprogramma (en de taken die hierbij horen) goed uit te voeren en/of als een uitvoerder weinig vertrouwen heeft in zijn vaardigheden om het beweegprogramma goed uit te voeren als er barrières zijn (bijv. stelling 11 en 14 van 'Uitvoerder'). Dit kan leiden tot een lage motivatie om het beweegprogramma goed uit te voeren (stelling 6 van 'Uitvoerder').

Coördinatoren kunnen verschillende dingen doen om het geloof in eigen kunnen van de uitvoerder te beïnvloeden, bijvoorbeeld:

Vaardigheden in kaart brengen
Uitvoerders kunnen bijhouden wat ze allemaal doen m.b.t. de uitvoering van het beweegprogramma en de taken die daarbij horen (eventueel door gebruik te maken van film- of geluidsopnames). Dit geeft inzicht in welke vaardigheden ze al bezitten en welke progressie ze maken over de tijd heen.

Training
Coördinatoren kunnen met uitvoerders bespreken welke vaardigheden ze al bezitten en welke vaardigheden ze zouden willen verbeteren m.b.t. de uitvoering van het beweegprogramma. Vervolgens kunnen deze vaardigheden (bijv. gesprekstechnieken) worden getraind tijdens een workshop (eventueel gegeven door een externe partij). Hierbij kan gebruik gemaakt worden van rollenspellen waarin vaardigheden worden geoefend en geëvalueerd. Ook kan gebruik gemaakt worden van filmpjes waarin rolmodellen de benodigde vaardigheden demonstreren. Hierbij is het belangrijk dat de rolmodellen aangeven dat ze barrières (bijv. weinig tijd, deelnemers niet gemotiveerd) hebben ervaren en dat ze laten zien hoe zij hiermee zijn omgegaan.

Tips:
- Het is belangrijk dat duidelijk is welke vaardigheden moeten worden getraind.
- Wanneer het complexe vaardigheden betreft is een stapsgewijze benadering gewenst, waarbij de vaardigheden geleidelijk aan worden uitgebreid.
- Tijdens de training is belangrijk om uitvoerders direct feedback te geven over hoe het gaat (op een positieve en constructieve manier).
- Wanneer gebruik gemaakt wordt van rolmodellen is het van belang dat uitvoerders zich met deze mensen kunnen identificeren (bijv. een huisarts als de uitvoerders een groep huisartsen betreft).
- Tijdens de training mogen uitvoerders fouten maken. Dit geeft informatie over wanneer het moeilijk is om het beweegprogramma goed uit te voeren.

<u>Knelpunt 4.</u> Uitvoerders zijn gemotiveerd maar slagen er niet in het beweegprogramma goed uit te voeren
Wanneer uitvoeders gemotiveerd zijn om het beweegprogramma goed uit te voeren, maar hier niet in slagen kan dit komen doordat ze de uitvoering van het beweegprogramma en de taken die hierbij horen nog niet volledig eigen hebben gemaakt (het nog geen gewoonte is) of doordat op het moment van uitvoering barrières worden ervaren (bijv. stelling 21 en 22 van 'Uitvoerder').

Coördinatoren kunnen verschillende dingen doen om uitvoerders te helpen om de uitvoering van het beweegprogramma eigen te maken (een gewoonte laten worden), bijvoorbeeld:

Plannen
Coördinatoren kunnen uitvoerders stimuleren om plannen te maken m.b.t. de uitvoering van het beweegprogramma en de taken die hierbij horen. Deze plannen moeten specifiek zijn voor waar, wanneer en hoe ze het beweegprogramma en de taken die hierbij horen uitvoeren. Ook kunnen plannen gemaakt worden hoe met barrières om te gaan (bijv. weinig tijd, deelnemers zijn niet gemotiveerd).

Reminder cues
Uitvoerders kunnen voor zichzelf signalen in de omgeving creëren die ervoor zorgen dat het voorgenomen gedrag m.b.t. de uitvoering van het beweegprogramma wordt herinnerd. Hierbij kan worden gedacht aan een post-it op het computerscherm, een poster aan de muur, het dragen van een bepaalde armband of schoenen. Ook kan worden gedacht aan het klaarleggen van de juiste materialen.

Tips:
- Het is belangrijk dat plannen gemaakt zijn voor **waar**, **wanneer** en **hoe** uitvoerders het beweegprogramma en de taken die hierbij horen gaan uitvoeren.
- Uitvoerders moeten inzicht hebben in welke barrières voor hun een rol spelen om af te wijken van het voorgenomen gedrag m.b.t. het beweegprogramma.

3.2.2 Knelpunten in de context

<u>Knelpunt 1.</u> Knelpunten m.b.t. het beweegprogramma en de context
De oplossingen voor de knelpunten gerelateerd aan de omgeving en organisatie, deelnemers en/of innovatie strategieën zullen in de meeste gevallen niet direct binnen de invloedsfeer van de coördinator en/of de uitvoerder(s) liggen. Voorbeelden hiervan zijn de beschikbaarheid van financiële middelen en van deelnemers aan het beweegprogramma. Coördinatoren kunnen er desondanks voor kiezen om deze knelpunten met de uitvoerders te bespreken. Zo wordt duidelijk hoe over deze knelpunten en mogelijke oplossingen hiervoor wordt gedacht.

Referenties

Bartholomew LK, Parcel GS, Kok G, Gottlieb NH, Fernández ME. Planning Health promotion programs. Third Edition. Jossey-Bass: San Francisco, USA; 2011.

Fleuren MAH, Wiefferink K, Paulussen TGWM. Determinants of innovation within health care organizations. *International Journal for Quality in Health Care* 2004;16:107-123.

Fleuren MAH, Paulussen TGWM, van Dommelen P, van Buuren S. Meetinstrument voor Determinanten van Innovaties (MIDI). TNO; 2012.

Michie S, Johnston M, Abraham C, Lawton R et al. Making psychological theory useful for implementing evidence based practice: a consensus approach. *Quality & Safety in Health Care* 2005;14:26-33.

Michie S, Johnston M, Francis J, Hardeman, Eccles M. From theory to intervention: mapping theoretically derived behavioural determinants to behaviour change techniques. *Applied Psychology* 2008;57:660-680.

Bijlage 1 Voorbeeld e-mail

Beste [naam uitvoerder],

Je bent alweer een tijdje bezig met de uitvoering van [naam beweegprogramma]. Ik zou graag van je horen wat er goed gaat en waar je eventueel tegenaan loopt. Hiervoor gebruik ik een checklist, deze vind je in de bijlage.

Verschillende dingen kunnen het moeilijk maken om een beweegprogramma goed uit te voeren. Je kunt hierbij denken aan gebrek aan tijd of ongemotiveerde deelnemers. Met behulp van deze checklist wil ik er achter komen wat jou helpt en wat het jou moeilijk maakt om [naam beweegprogramma] goed uit te voeren. In de checklist worden vragen gesteld over wat jij vindt van [naam beweegprogramma], hoe jij vindt dat de uitvoering van jouw taken in het programma gaat, wat je vindt van de deelnemers, en wat je vindt van de organisatie en de omgeving waarin je werkt. Het is fijn om te weten wat er goed gaat. Dat houden we natuurlijk graag zo. Als uit de checklist blijkt dat je ergens tegenaan loopt wil ik hier graag met je over doorpraten. We kunnen dan samen zoeken naar oplossingen en manieren om het uitvoeren van [naam beweegprogramma] makkelijker te maken.

Ik wil je vragen om de checklist in te vullen en terug te sturen per mail. Je kunt ervoor kiezen om de checklist anoniem of op naam in te vullen. Als je de checklist op naam invult wil ik je ook vragen om je naam bij het opslaan van de checklist in de documentnaam te zetten. Alvast bedankt!

Groeten,

[Naam coördinator]

References

1. Glasgow RE, Lichtenstein E, Marcus AC. Why don't we see more translation of health promotion research to practice? Rethinking the efficacy-to-effectiveness transition. *American Journal of Public Health* 2003;93:1261–1267.
2. Harris J, Mason J, Spalding J, et al. *A review of the cost-effectiveness of individual level behaviour change interventions*. Liverpool: North West Public Health Observatory; 2011.
3. Glasgow R, Klesges L, Dzewaltowski DA, et al. The future of physical activity behavior change research: what is needed to improve translation of research into health promotion practice? *Annals of Behavioral Medicine* 2004;27:3–12.
4. Grimshaw JM, Eccles MP, Lavis JN, et al. Knowledge translation of research findings. *Implementation Science* 2012;7:50.
5. Grol R, Wensing M, Eccles M. *Improving patient care: the implementation of change in clinical practice*. Oxford: Elsevier; 2005.
6. Eccles M, Grimshaw J, Walker A, et al. Changing the behavior of healthcare professionals: the use of theory in promoting the uptake of research findings. *Journal of Clinical Epidemiology* 2005;58:107–112.
7. Grol R, Grimshaw J. From best evidence to best practice: effective implementation of change in patients' care. *Lancet* 2003;362:1225–1230.
8. Damschroder LJ, Aron DC, Keith RE, et al. Fostering implementation of health services research findings into practice: a consolidated framework for advancing implementation science. *Implementation Science* 2009;4:50.
9. Green LW, Kreuter MW. *Health promotion planning: an educational and environmental approach*. 3rd ed. Mayfield: Mountain View; 1999.
10. Glasgow RE, Bull SS, Gilette C, et al. Behavior change intervention research in healthcare settings: a review of recent reports with emphasis on external validity. *American Journal of Preventive Medicine* 2002;23:62–69.
11. Wandersman A, Duffy J, Flaspohler P, et al. Bridging the gap between prevention research and practice: the interactive systems framework for dissemination and implementation. *American Journal of Community Psychology* 2008;41:171–181.
12. Dzewaltowski DA, Estabrooks PA, Glasgow RE. The future of physical activity behavior change research: what is needed to improve translation of research into health promotion practice? *Exercise and Sport Sciences Reviews* 2004;32:57–63.
13. Aarons GA, Wells RS, Zagursky K, et al. Implementing evidence-based practice in community mental health agencies: a multiple stakeholder analysis. *American Journal of Public Health* 2009;99:2087–2095.
14. Eakin EG, Brown WJ, Marshall AL, et al. Physical activity promotion in primary care: bridging the gap between research and practice. *American Journal of Preventive Medicine* 2004;27:297–303.
15. Bartholomew KL, Parcel GS, Kok G, et al. *Planning health promotion programs: an intervention mapping approach*. 3rd ed. San Fransisco: Jossey-Bass; 2011.
16. Carroll C, Patterson M, Wood S, et al. A conceptual framework for implementation fidelity. *Implementation Science* 2007;2:40.
17. Fleuren M, Wiefferink K, Paulussen T. Determinants of innovation within health care organizations: literature review and Delphi study. *International Journal for Quality in Health Care* 2004;16:107–123.

18. Fixsen DL, Naoom SF, Blase KA, et al. *Implementation research: a synthesis of the literature*. Tampa: University of South Florida; 2005.
19. Glasgow R, Vogt T, Boles S. Evaluating the public health impact of health promotion interventions: the RE-AIM framework. *American Journal of Public Health* 1999;89:1322–1327.
20. Paulussen TGWM, Wiefferink K, Mesters I. *Invoering van effectief gebleken interventies*. In: Brug J, van Asseman P, Lechner L, editors. Gezondheidsvoorlichting en gedragsverandering. Assen: van Gorcum; 2007. pp. 151-172.
21. Durlak JA, DuPre EP. Implementation matters: a review of research on the influence of implementation on program outcomes and the factors affecting implementation. *American Journal of Community Psychology* 2008;41:327–350.
22. Grol RPTM, Bosch MC, Hulscher MEJL, et al. Planning and studying improvement in patient care: the use of theoretical perspectives. *Milbank Quarterly* 2007;85:93–138.
23. Tabak RG, Khoong EC, Chambers DA, et al. Bridging research and practice: models for dissemination and implementation research. *American Journal of Preventive Medicine* 2012;43:337–350.
24. Rogers EM. *Diffusion of innovations*. 3rd ed. New York: The Free Press; 1983.
25. Grol R. Implementing guidelines in general practice care. *Quality in Health Care* 1992;1:184–191.
26. Grol R, Wensing M. What drives change? Barriers to and incentives for achieving evidence-based practice. *Medical Journal of Australia* 2004;180:S57–60.
27. Greenhalgh T, Robert G, Macfarlane F, et al. Diffusion of innovations in service organizations: systematic review and recommendations. *Milbank Quarterly* 2004;82:581–629.
28. Pathman DE, Konrad TR, Freed GL, et al. The awareness-to-adherence model of the steps to clinical guideline compliance. The case of pediatric vaccine recommendations. *Medical Care* 1996;34:873–889.
29. Davis D, Taylor-Vaisey A. Translating guidelines into practice: a systematic review of theoretic concepts, practical experience and research evidence in the adoption of clinical practice. *Canadian Medical Association Journal* 1997;157:408-416.
30. Cane J, O'Connor D, Michie S. Validation of the theoretical domains framework for use in behaviour change and implementation research. *Implementation Science* 2012;7:37.
31. Michie S, Johnston M, Abraham C, et al. Making psychological theory useful for implementing evidence based practice: a consensus approach. *Quality & Safety in Health Care* 2005;14: 26–33.
32. Francis JJ, Stockton C, Eccles MP, et al. Evidence-based selection of theories for designing behaviour change interventions: using methods based on theoretical construct domains to understand clinicians' blood transfusion behaviour. *British Journal of Health Psychology* 2009;14:625–646.
33. Eccles MP, Hawthorne G, Johnston M, et al. Improving the delivery of care for patients with diabetes through understanding optimised team work and organisation in primary care. *Implementation Science* 2009;4:22.
34. Foy R, Eccles M, Grimshaw J. Why does primary care need more implementation research? *Family Practice* 2001;18:353–355.
35. French SD, Green SE, O'Connor DA, et al. Developing theory-informed behaviour change interventions to implement evidence into practice: a systematic approach using the Theoretical Domains Framework. *Implementation Science* 2012;7:38.

36. Michie S, Johnston M, Francis J, et al. From theory to intervention: mapping theoretically derived behavioural determinants to behaviour change techniques. *Applied Psychology* 2008;57:660–680.
37. Presseau J, Johnston M, Francis J, et al. Theory-based predictors of multiple clinician behaviors in the management of diabetes. *Journal of Behavioral Medicine* 2013; epub ahead of print.
38. Flottorp SA, Oxman AD, Krause J, et al. A checklist for identifying determinants of practice: a systematic review and synthesis of frameworks and taxonomies of factors that prevent or enable improvements in healthcare professional practice. *Implementation Science* 2013;8:35.
39. Bartholomew LK, Mullen PD. Five roles for using theory and evidence in the design and testing of behavior change interventions. *Journal of Public Health Dentistry* 2011;71:S20–S33.
40. de Veer AJE, Fleuren MAH, Bekkema N, et al. Successful implementation of new technologies in nursing care: a questionnaire survey of nurse-users. *BMC Medical Informatics and Decision Making* 2011;11:67.
41. Rosman AN, Vlemmix F, Fleuren MAH, et al. Patients' and professionals' barriers and facilitators to external cephalic version for breech presentation at term, a qualitative analysis in the Netherlands. *Midwifery* 2013;1–7.
42. Fleuren M, Dusseldorp E, van den Bergh S, et al. Implementation of a shared care guideline for back pain: effect on unnecessary referrals. *International Journal for Quality in Health Care* 2010;22:415–420.
43. Francis JJ, Tinmouth A, Stanworth SJ, et al. Using theories of behaviour to understand transfusion prescribing in three clinical contexts in two countries: development work for an implementation trial. *Implementation Science* 2009;4:70.
44. Patey AM, Islam R, Francis JJ, et al. Anesthesiologists' and surgeons' perceptions about routine pre-operative testing in low-risk patients: application of the Theoretical Domains Framework (TDF) to identify factors that influence physicians' decisions to order pre-operative tests. *Implementation Science* 2012;7:52.
45. McSherry LA, Dombrowski SU, Francis JJ, et al. "It"s a can of worms': understanding primary care practitioners' behaviours in relation to HPV using the theoretical domains framework. *Implementation Science* 2012;7:73.
46. Amemori M, Michie S, Korhonen T, et al. Assessing implementation difficulties in tobacco use prevention and cessation counselling among dental providers. *Implementation Science* 2011;6:50.
47. Beenstock J, Sniehotta FF, White M, et al. What helps and hinders midwives in engaging with pregnant women about stopping smoking? A cross-sectional survey of perceived implementation difficulties among midwives in the northeast of England. *Implementation Science* 2012;7:36.
48. Taylor N, Parveen S, Robins V, et al. Development and initial validation of the Influences on Patient Safety Behaviours Questionnaire. *Implementation Science* 2013;8:81.
49. Cheater F, Baker R, Gillies C, et al. Tailored interventions to overcome identified barriers to change: effects on professional practice and health care outcomes. *Cochrane Database Systematic Reviews* 2005;3.
50. Fallon EA, Wilcox S, Laken M. Health care provider advice for African American adults not meeting health behavior recommendations. *Preventing Chronic Disease* 2006;3:1–12.

51. Glasgow RE, Eakin EG, Fisher EB, et al. Physician advice and support for physical activity: results from a national survey. *American Journal of Preventive Medicine* 2001;21:189–196.
52. VanWormer JJ, Pronk NP, Kroeninger GJ. Clinical counseling for physical activity: translation of a systematic review into care recommendations. *Diabetes Spectrum* 2009;22:48–55.
53. Verheijden MW, Bakx JC, Delemarre ICG, et al. GPs' assessment of patients' readiness to change diet, activity and smoking. *British Journal of General Practice* 2005;55:452–457.
54. Helmink JHM, Meis JJM, de Weerdt I, et al. Development and implementation of a lifestyle intervention to promote physical activity and healthy diet in the Dutch general practice setting: the BeweegKuur programme. *International Journal of Behavioral Nutrition and Physical Activity* 2010;7:49.
55. Barrett EM, Darker CD, Hussey J. Promotion of physical activity in primary care: knowledge and practice of general practitioners and physiotherapists. *Journal of Public Health* 2012.
56. Swinkels ICS, van den Ende CHM, van den Bosch W, et al. Physiotherapy management of low back pain: does practice match the Dutch guidelines? *Australian Journal of Physiotherapy* 2005;51:35–41.
57. van der Wees PJ, Hendriks EJM, Jansen MJ, et al. Adherence to physiotherapy clinical guideline acute ankle injury and determinants of adherence: a cohort study. *BMC Musculoskeletal Disorders 2007*;8:45.
58. Eakin EG, Smith BJ, Bauman AE. Evaluating the population health impact of physical activity interventions in primary care: are we asking the right questions? *Journal of Physical Activity and Health* 2005;2:197–215.
59. Estabrooks PA, Glasgow RE. Translating effective clinic-based physical activity interventions into practice. *American Journal Preventive Medicine* 2006;31:S45–S56.
60. Tulloch H, Fortier M, Hogg W. Physical activity counseling in primary care: who has and who should be counseling? *Patient Education Counseling* 2006;64:6–20.
61. Eakin EG, Glasgow RE, Riley KM. Review of primary care-based physical activity intervention studies. *Journal of Family Practice* 2000;49:158–168.
62. Orrow G, Kinmonth A-L, Sanderson S, et al. Effectiveness of physical activity promotion based in primary care: systematic review and meta-analysis of randomised controlled trials. *BMJ* 2012;344:e1389.
63. Sørensen JB, Skovgaard T, Puggaard L. Exercise on prescription in general practice: a systematic review. *Scandinavian Journal of Primary Health Care* 2006;24:69–74.
64. Chaudoir SR, Dugan AG, Barr CHI. Measuring factors affecting implementation of health innovations: a systematic review of structural, organizational, provider, patient, and innovation level. *Implementation Science* 2013;8:22.
65. Hébert ET, Caughy MO, Shuval K. Primary care providers' perceptions of physical activity counselling in a clinical setting: a systematic review. *British Journal of Sports Medicine* 2012;46:625–631.
66. Orwin RG. *Evaluation coding decisions*. In: Cooper H, Hedges L, editors. The handbook of research synthesis. New York: Russel Sage Foundation; 1994. pp. 139-162.
67. Arai L, Britten N, Popay J, et al. Testing methodological developments in the conduct of narrative synthesis: a demonstration review of research on the implementation of smoke alarm interventions. *Evidence & Policy* 2007;3:361–383.
68. Braun V, Clarke V. Using thematic analysis in psychology. *Qualitative Research in Psychology* 2006;3:77–101.

69. Patel A, Schofield GM, Kolt GS, et al. General practitioners' views and experiences of counselling for physical activity through the New Zealand Green Prescription program. *BMC Family Practice* 2011;12:119.
70. Swinburn BA, Walter LG, Arroll B,et al. Green prescriptions: attitudes and perceptions of general practitioners towards prescribing exercise. *British Journal of Genenal Practice* 1997;47:567–569.
71. Tompkins TH, Belza B, Brown M-A. Nurse practitioner practice patterns for exercise counseling. *Journal of the American Academy of Nurse Practitioners* 2009;21:79–86.
72. Bull FCL, Schipper ECC, Jamrozik K, et al. Beliefs and behaviour of general practitioners regarding promotion of physical activity. *American Journal of Public Health* 1995;19:300–304.
73. Abramson S, Stein J, Schaufele M, et al. Personal exercise habits and counseling practices of primary care physicians: a national survey. *Clinical Journal of Sport Medicine* 2000;10:40–48.
74. Ackermann RT, Deyo RA, LoGerfo JP. Prompting primary providers to increase community exercise referral for older adults: a randomized controlled trial. *Journal of the American Geriatrics Society* 2005;53:283–289.
75. Allenspach EC, Handschin M, Kutlar Joss M, et al. Patient and physician acceptance of a campaign approach to promoting physical activity: the "Move for Health" project. *Swiss Medical Weekly 2007*;137:292–299.
76. Almeida FA, Smith-Ray RL, van den Berg R, et al. Utilizing a simple stimulus control strategy to increase physician referrals for physical activity promotion. *Journal of Sport & Exercise Psychology* 2005;27:505–514.
77. Al-Shahri MZ, Al-Almaei, Sameeh M. Promotion of physical exercise by primary health care physicians in Riyadh city. *Saudi Medical Journal* 1998;19:67–69.
78. Bize R, Cornuz J, Martin B. Opinions and attitudes of a sample of Swiss physicians about physical activity promotion in a primary care setting. *Swiss Medical Weekly* 2007;55:97–100.
79. Bull FC, Milton KE. A process evaluation of a "physical activity pathway" in the primary care setting. *BMC Public Health* 2010;10:463.
80. Burns KJ, Camaione DN, Chatterton CT. Prescription of physical activity by adult nurse practitioners: a national survey. *Nursing Outlook* 2000;48:28–33.
81. Croteau K, Schofield G, McLean G. Physical activity advice in the primary care setting: results of a population study in New Zealand. *Australian New Zealand Journal of Public Health* 2006;30:262–267.
82. Damush TM, Stewart AL, Mills KM, et al. Prevalence and correlates of physician recommendations to exercise among older adults. *Journal of Gerontology* 1999;54A:M423–M427.
83. Dauenhauer JA, Podgorski CA, Karuza J. Prescribing exercise for older adults. *Gerontology & Geriatrics Education* 2008;26:81–99.
84. Douglas F, Torrance N, van Teijlingen E, et al. Primary care staff's views and experiences related to routinely advising patients about physical activity. A questionnaire survey. *BMC Public Health* 2006;6:138.
85. Douglas F, van Teijlingen E, Torrance N, et al. Promoting physical activity in primary care settings: health visitors' and practice nurses' views and experiences. *Journal of Advanced Nursing* 2006;55:159–168.
86. Eakin E, Brown W, Schofield G, et al. General practitioner advice on physical activity: who gets it? *American Journal of Health Promotion* 2007;21:225–228.

87. Eckstrom E, Hickam DH, Lessler DS, et al. Changing physician practice of physical activity counseling. *Journal of General Internal Medicine* 1999;14:376–378.
88. Epel OB, Regev Z. Quality and correlates of physical activity counseling by health care providers in Israel. *Preventive Medicine* 2000;31:618–626.
89. Goodman C, Davies S, Dinan S, et al. Activity promotion for community dwelling older people: a survey of the contribution of primary care nurses. *British Journal of Community Nursing* 2011;16:12–17.
90. Graham RC, Dugdill L, Cable NT. Health professionals' perspectives in exercise referral: implications for the referral process. *Ergonomics* 2005;48:1411–1422.
91. Gribben B, Goodyear-smith F, Grobbelaar M, et al. The early experience of general practitioners using Green Prescription. *New Zealand Medical Journal* 2000;113:372–373.
92. Harrison RA, McNair F, Dugdill L. Access to exercise referral schemes: a population based analysis. *Journal of Public Health* 2005;27:326–330.
93. Hinrichs T, Moschny A, Klaassen-Mielke R, et al. General practitioner advice on physical activity: analyses in a cohort of older primary health care patients (getABI). *BMC Family Practice* 2011;12:26.
94. Huang N, Sims J, Pietsch J, et al. The Victorian Active Script Programme: promising signs for general practitioners, population health, and the promotion of physical activity. *British Journal of Sports Medicine* 2004;38:19–25.
95. James DVB, Johnston LH, Crone D, et al. Factors associated with physical activity referral uptake and participation. *Journal of Sports Sciences* 2008;26:217–224.
96. Johnson ST, Bates H, Fitzpatrick J, et al.. Promotion of physical activity by Canadian registered dietitians in daily practice. *Journal of Human Nutrition and Dietetics* 2007;20:37–40.
97. Kennedy MF, Meeuwisse WH. Exercise counselling by family physicians in Canada. *Preventive Medicine* 2003;373:226–232.
98. Lawlor DA, Keen S, Neal RD. Increasing population levels of physical activity through primary care: GPs' knowledge, attitudes and self-reported practice. *Family Practice* 1999;16:250–254.
99. Leijon ME, Bendtsen P, Nilsen P, et al. Physical activity referrals in Swedish primary health care: prescriber and patient characteristics, reasons for prescriptions, and prescribed activities. *BMC Health Services Research* 2008;8:201.
100. Märki A, Bauer GB, Angst F, et al. Systematic counselling by general practitioners for promoting physical activity in elderly patients: a feasibility study. *Swiss Medical Weekly* 2006;136:482–488.
101. McDowell N, McKenna J, Naylor P-J. Factors that influence practice nurses to promote physical activity. *British Journal of Sports Medicine* 1997;31:308–313.
102. McKenna J, Naylor P-J, McDowell N. Barriers to physical activity promotion by general practitioners and practice nurses. *British Journal of Sports Medicine* 1998;32:242–247.
103. McKenna J, Henderson L, Baic S. A survey to assess physical activity promotion by registered dietitians. *Journal of Human Nutrition and Dietetics* 2004;17:63–69.
104. McKenna J, Vernon M. How general practitioners promote "lifestyle" physical activity. *Patient Education and Counseling* 2004;54:101–106.
105. Morrato EH, Hill JO, Wyatt HR, et al. Are health care professionals advising patients with diabetes or at risk for developing diabetes to exercise more? *Diabetes Care* 2006;29:543–548.
106. Patel NK, Parchman ML. The Chronic Care Model and exercise discussions during primary care diabetes encounters. *Journal of the American Board of Family Medicine* 2011;24:26–32.

107. Petrella RJ, Wight D. An office-based instrument for exercise counseling and prescription in primary care. The Step Test Exercise Prescription (STEP). *Archives of Family Medicine* 2000;9:339–344.
108. Pinto BM, Goldstein MG, DePue JD, et al. Acceptability and feasibility of physician-based activity counseling. The PAL project. *American Journal of Preventive Medicine* 1998;15:95–102.
109. Podl TR, Goodwin MA, Kikano GE, et al. Direct observation of exercise counseling in community family practice. *American Journal of Preventive Medicine* 1999;17:207–210.
110. Puig Ribera A, McKenna J, Riddoch C. Attitudes and practices of physicians and nurses regarding physical activity promotion in the Catalan primary health-care system. *European Journal of Public Health* 2005;15:569–575.
111. Puig Ribera A, McKenna J, Riddoch C. Physical activity promotion in general practices of Barcelona: a case study. *Health Education Research* 2006;21:538–548.
112. Robertson R, Jepson R, Shepherd A, et al. Recommendations by Queensland GPs to be more physically active: which patients were recommended which activities and what action they took. *Australian and New Zealand Journal of Public Health* 2011;35:537–542.
113. Sassen B, Kok G, Vanhees L. Predictors of healthcare professionals' intention and behaviour to encourage physical activity in patients with cardiovascular risk factors. *BMC Public Health* 2011;11:246.
114. Schmid M, Egli K, Brian MW, et al. Health promotion in primary care: evaluation of a systematic procedure and stage specific information for physical activity counselling. *Swiss Medical Weekly* 2009;139:665–671.
115. Sherman SE, Hershman WY. Exercise counseling: how do general internists do? *Journal of General Internal Medicine* 1993;8:243–248.
116. Shirley D, van der Ploeg HP, Bauman AE. Physical activity promotion in the physical therapy setting: perspectives from practitioners and students. *Physical Therapy* 2010;90:1311–1322.
117. Smith PA, Gould MM, See Tai S, et al. Exercise as therapy? Results from group interviews with general practice teams involved in an inner-London "prescription for exercise" scheme. *Health Education Journal* 1996;55:439–446.
118. Sowden SL, Breeze E, Barber J, et al. Do general practices provide equitable access to physical activity interventions? *British Journal of General Practice* 2008;e1–8.
119. van der Ploeg HP, Smith BJ, Stubbs T, et al. Physical activity promotion: are GPs getting the message? *Australian Family Physician* 2007;36:871–874.
120. van Sluijs EMF, van Poppel MNM, Stalman WAB, et al. Feasibility and acceptability of a physical activity promotion programme in general practice. *Family Practice* 2004;21:429–436.
121. Walsh JM, Swangard DM, Davis T, et al. Exercise counseling by primary care physicians in the era of managed care. *American Journal of Preventive Medicine* 1999;16:307–313.
122. Wee CC, McCarthy EP, Davis RB, et al. Physician counseling about exercise. *JAMA* 1999;282:1583–1588.
123. Williford HN, Barfield BR, Lazenby RB, et al. A survey of physicians' attitudes and practices related to exercise promotion. *Preventive Medicine* 1992;21:630–636.
124. Wilson DM, Ciliska D, Singer J, et al. Family physicians and exercise counseling: can they be influenced to provide more? *Canadian Family Physician* 1992;38:2003–2010.
125. Winzenberg T, Reid P, Shaw K. Assessing physical activity in general practice: a disconnect between clinical practice and public health? *British Journal of General Practice* 2009;59:e359–367.

126. Palinkas LA, Aarons GA, Horwitz S, et al. Mixed method designs in implementation research. *Administration and Policy in Mental Health* 2011;38:44–53.
127. Fleuren MAH, Vrijkotte S, Jans MP, et al. The implementation of the functional task exercise programme for elderly people living at home. *BMC Musculoskeletal Disorders* 2012;13:128.
128. ATLAS.ti. *ATLAS.ti. software, version 5.2.0*. Berin: Scientific Software Development GmbH; 2013.
129. Green LW, Ottoson JM, Garcia C, et al. Diffusion theory and knowledge dissemination, utilization, and integration in public health. *Annual Review of Public Health* 2009;30:151–174.
130. Huijg JM, Gebhardt WA, Verheijden MW, et al. Factors influencing primary health care professionals' physical activity promotion behaviors: a systematic review. *International Journal of Behavioral Medicine* 2014;Epub ahead of print.
131. Huijg JM, van der Zouwe N, Crone M, et al. Factors influencing the introduction of physical activity interventions in primary health care: a qualitative study. *International Journal of Behavioral Medicine* 2014;Epub ahead of print.
132. Qualtrics. *Qualtrics software, version 45433*. Provo, Utah, USA: Qualtrics; 2013.
133. Linstone HA, Turoff M. *The Delphi Method: Techniques and Applications (digital version)* [http://is.njit.edu/pubs/delphibook/].
134. Jones J, Hunter D. Qualitative Research: consensus methods for medical and health services research. *BMJ* 1995;311:376–380.
135. van Stralen MM, Lechner L, Mudde AN, et al. Determinants of awareness, initiation and maintenance of physical activity among the over-fifties: a Delphi study. *Health Education Research* 2010;25:233–247.
136. IBM Corp. *IBM SPSS Statistics for Windows, version 19.0.* Armonk, NY: IBM Corp.; 2010.
137. Carlfjord S, Lindberg M, Bendtsen P, et al. Key factors influencing adoption of an innovation in primary health care: a qualitative study based on implementation theory. *BMC Family Practice* 2010;11:60.
138. Ajzen I. The theory of planned behavior. *Organizational Behavior and Human Decision Processes* 1991;50:179–211.
139. Bandura A. Health promotion from the perspective of social cognitive theory. *Psychology & Health* 1998;13:623–649.
140. Custer RL, Scarcella JA, Stewart BR. The modified Delphi technique: a rotational modification. *Journal of Vocational and Technical Education* 1999;15.
141. Haines A, Kuruvilla S, Borchert M. Policy and Practice Bridging the implementation gap between knowledge and action for health. *Bulletin of the World Health Organization* 2004;82:724-732.
142. Petrella RJ, Lattanzio CN. Does counseling help patients get practice? Systematic review of the literature. *Canadian Family Physician* 2002;48:72–80.
143. Craig P, Dieppe P, Macintyre S, et al. Developing and evaluating complex interventions: the new Medical Research Council guidance. *BMJ* 2008;337.
144. Francis J, Johnston M, Bonetti D. Health psychology research advances theory by addressing problems: illustrations from theory-based studies of health professional behaviour. *The European Health Psychologist* 2007;21–26.
145. Rothman AJ. "Is there nothing more practical than a good theory?": Why innovations and advances in health behavior change will arise if interventions are used to test and refine theory. *International Journal of Behavioral Nutrition and Physical Activity* 2004;1:11.

146. Fishbein M. *Attitude and the prediction of behavior*. In: Fishbein M, editor. Readings atttiude theory Measurement. New York: Wiley; 1967. p. 477–492.
147. Lynn MR. Determination and quantification of content validity. *Nursing Research* 1986; 382-385.
148. Rubio DM, Berg-Weger M, Tebb SS, et al. Objectifying content validity: conducting a content validity study in social work research. *Social Work Research* 2003;27:94–104.
149. Huijg JM, Crone MR, Verheijden MW, et al. Factors influencing the adoption, implementation, and continuation of physical activity interventions in primary health care: a Delphi study. *BMC Family Practice* 2013;14:142.
150. Maes S, Karoly P, de Gucht C, et al. *The self regulation skills battery (SRSB)*. Leiden/Phoenix (AZ): Leiden University/Arizona State University; 2006.
151. Sniehotta FF, Schwarzer R, Scholz U, et al. Action planning and coping planning for long-term lifestyle change: theory and assessment. *European Journal of Social Psychology* 2005;35:565–576.
152. Gardner B, Abraham C, Lally P, et al. Towards parsimony in habit measurement: Testing the convergent and predictive validity of an automaticity subscale of the Self-Report Habit Index. *International Journal of Behavioral Nutrition and Physical Activity* 2012;9:102.
153. Goldberg DP, Blackwell B. Psychiatric illness in general practice: a detailed study using a new method of case identification. *British Medical Journal* 1970;1:439–443.
154. Thompson ER. Development and Validation of an Internationally Reliable Short-Form of the Positive and Negative Affect Schedule (PANAS). *Journal of Cross-Cultural Psychology* 2007;38:227–242.
155. Frese M. Social support as a moderator of the relationship between work stressors and psychological dysfunctioning: a longitudinal study with objective measures. *Journal of Occupational Health Psychology* 1999;4:179–192.
156. Derryberry D, Reed MA. Anxiety-related attentional biases and their regulation by attentional control. *Journal of Abnormal Psychology* 2002;111:225–236.
157. Scheier MF, Carver CS, Bridges MW. Distinguishing optimism from neuroticism (and trait anxiety, self-mastery, and self-esteem): a reevaluation of the Life Orientation Test. *Journal of Personality and Social Psychology* 1994;67:1063–1078.
158. Cialdini R, Kallgren C, Reno R. A focus theory of normative conduct: a theoretical refinement and reevaluation of the role of norms in human behavior. *Advances in Experimental Social Psychology* 1991;24:201–234.
159. Dixon D, Pollard B, Johnston M. What does the chronic pain grade questionnaire measure? *Pain* 2007;130:249–253.
160. Dixon D, Johnston M, McQueen M, et al. The Disabilities of the Arm, Shoulder and Hand Questionnaire (DASH) can measure the impairment, activity limitations and participation restriction constructs from the International Classification of Functioning, Disability and Health (ICF). *BMC Musculoskeletal Disorders* 2008;9:114.
161. American Psychological Association (APA). *APA Dictionary of Psychology*. Washington, DC: American Psychological Association; 2007.
162. Benjamini Y, Hochberg Y. Controlling the false discovery rate: a practical and powerful approach to multiple testing. *Journal of the Royal Statistical Society. Series B (Methodological)* 1995;57:289–300.

163. Conger A. Integration and generalization of kappas for multiple raters. *Psychological Bulletin* 1980;88:322–328.
164. Landis JR, Koch GG. The measurement of observer agreement for categorical data. *Biometrics* 1977;33:159–174.
165. R Development Core Team R. *R: a language and environment for statistical computing*. Vienna, Austria: R Foundation for Statistical Computing; 2012.
166. Falissard B. *Psy: various procedures used in psychometry*. R Package Version 1.1; 2012.
167. Taylor N, Lawton R, Conner M. Development and initial validation of the determinants of physical activity questionnaire. *International Journal of Behavioral Nutrition and Physical Activity* 2013;10:74.
168. Stevens J. *Applied multivariate statistics for the social sciences*. 2nd edition. Hillsdale, NJ: Lawrence Erlbaum; 1992.
169. Taylor N, Lawton R, Slater B, et al. The demonstration of a theory-based approach to the design of localized patient safety interventions. *Implementation Science* 2013;8:123.
170. Dyson J, Lawton R, Jackson C, et al. Development of a theory-based instrument to identify barriers and levers to best hand hygiene practice among healthcare practitioners. *Implementation Science* 2013;8:111.
171. Dyson J, Lawton R, Jackson C, et al. Does the use of a theoretical approach tell us more about hand hygiene behaviour? The barriers and levers to hand hygiene. *Journal of Infection Prevention* 2011;12:17–24.
172. Bonetti D, Johnston M, Clarkson JE, et al. Applying psychological theories to evidence-based clinical practice: identifying factors predictive of placing preventive fissure sealants. *Implementation Science* 2010;5:25.
173. Huijg JM, Gebhardt WA, Dusseldorp E, et al. Measuring determinants of implementation behavior: psychometric properties of a questionnaire based on the Theoretical Domains Framework. *Implementation Science* 2014;9:33.
174. Davies P, Walker AE, Grimshaw JM. A systematic review of the use of theory in the design of guideline dissemination and implementation strategies and interpretation of the results of rigorous evaluations. *Implementation Science* 2010;5:14.
175. Grimshaw JM, Thomas RE, MacLennan G, et al. Effectiveness and efficiency of guideline dissemination and implementation strategies. *Health Technology Assessment* 2004 ;8:1–72.
176. Eccles MP, Armstrong D, Baker R, et al. An implementation research agenda. *Implementation Science 2009*;4:18.
177. Grimshaw JM, Shirran L, Thomas R, et al. Changing provider behavior: an overview of systematic reviews of interventions. *Medical Care* 2001;39:II2–45.
178. The Improved Clinical Effectiveness through Behavioural Research Group (ICEBeRG). Designing theoretically-informed implementation interventions. *Implementation Science* 2006;1:4.
179. Islam R, Tinmouth AT, Francis JJ, et al. A cross-country comparison of intensive care physicians' beliefs about their transfusion behaviour: a qualitative study using the Theoretical Domains Framework. *Implementation Science* 2012;7:93.
180. Curran JA, Brehaut J, Patey AM, et al. Understanding the Canadian adult CT head rule trial: use of the theoretical domains framework for process evaluation. *Implementation Science* 2013;8:25.

181. Mazza D, Chapman A, Michie S. Barriers to the implementation of preconception care guidelines as perceived by general practitioners: a qualitative study. *BMC Health Services Research* 2013;13:36.
182. Michie S, Pilling S, Garety P, et al. Difficulties implementing a mental health guideline: an exploratory investigation using psychological theory. *Implementation Science* 2007;2:8.
183. Huijg JM, Gebhardt WA, Crone MR, et al. Discriminant content validity of a Theoretical Domains Framework questionnaire for use in implementation research. *Implementation Science* 2014;9:11.
184. van Veldhoven M, Meijman T, Broersen J, et al. *Handleiding VBBA*. Amsterdam: SKB Vragenlijst Services; 2002.
185. Stuive I, Kiers HAL, Timmerman ME, et al. The empirical verification of an assignment of items to subtests: the oblique multiple group method versus the confirmatory common factor method. *Educational and Psychological Measurement* 2008;68:923–939.
186. Holzinger K. A simple method of factor analysis. *Psychometrika* 1944;9:257–262.
187. Stuive I, Kiers HAL, Timmerman ME. Comparison of methods for adjusting incorrect assignments of items to subtests: oblique multiple group method versus confirmatory common factor method. *Educational and Psychological Measurement* 2009;69:948–965.
188. Jöreskog K. A general approach to confirmatory maximum likelihood factor analysis. *Psychometrika* 1969;34:183–202.
189. Jöreskog K. Testing a simple structure hypothesis in factor analysis. *Psychometrika* 1966;31:165-178.
190. Hotelling H. Analysis of a complex of statitical variables into principal components. *Journal of Educational Psychology* 1933;24:417–441.
191. Cronbach L. Coefficient alpha and the internal structure of tests. *Psychometrika* 1951;16: 297–333.
192. Campbell D, Fiske D. Convergent and discriminant validation by the multitrait-multimethod matrix. *Psychological Bulletin* 1959;59:257–272.
193. Anderson JC, Gerbing DW. Structural equation modeling in practice: a review and recommended two-step approach. *Psychological Bulletin* 1988;103:411–423.
194. Spearman C. The proof and measurement of association between two things. *American Journal of Psychology* 1904;15:72–101.
195. Timmerman M, Stuive I, Kiers H. *MGM macro [SPSS macro]* 2007. Available from: http://www.rug.nl/research/heymans-institute/research/psychometrics and statistics/software/
196. Cohen J. *Statistical power analysis for the behavioral sciences.* 2nd edition. New Jersey: Lawrence Erlbaum; 1988.
197. Wännström I, Peterson U, Asberg M, et al. Psychometric properties of scales in the General Nordic Questionnaire for Psychological and Social Factors at Work (QPS): confirmatory factor analysis and prediction of certified long-term sickness absence. *Scandinavian Journal of Psychology* 2009;50:231–244.
198. Watson D, Clark LA, Tellegen A. Development and validation of brief measures of positive and negative affect: the PANAS scales. *Journal of Personality and Social Psychology* 1988;54:1063–1070.

199. Crawford JR, Henry JD. The positive and negative affect schedule (PANAS): construct validity, measurement properties and normative data in a large non-clinical sample. *British Journal of Clinical Psychology* 2004;43:245–265.
200. Wood W, Neal DT. The habitual consumer. *Journal of Consumer Psychology* 2009;19:579–592.
201. Deci E, Ryan R. *Intrinsic motivation and self-determination in human behavior*. New York: Plenum Publishing Co.; 1985.
202. Maslach C, Jackson SE. The measurement of experienced burnout. *Journal of Organizational Behavior* 1981;2:99–113.
203. Dannapfel P, Peolsson A, Nilsen P. What supports physiotherapists' use of research in clinical practice? A qualitative study in Sweden. *Implementation Science* 2013;8:31.
204. Forsman H, Rudman A, Gustavsson P, et al. Nurses' research utilization two years after graduation-a national survey of associated individual, organizational, and educational factors. *Implementation Science* 2012;7:46.
205. van der Wees PJ, Zagers CA, de Die SE, et al. Developing a questionnaire to identify perceived barriers for implementing the Dutch physical therapy COPD clinical practice guideline. *BMC Health Services Research* 2013;13:159.
206. Elley CR, Kerse N, Arroll B, et al. Effectiveness of counselling patients on physical activity in general practice: cluster randomised controlled trial. *BMJ* 2003;326:793–799.
207. Haskell WL, Blair SN, Hill JO. Physical activity: health outcomes and importance for public health policy. *Preventive Medicine* 2009;49:280–282.
208. Warburton DER, Nicol CW, Bredin SSD. Health benefits of physical activity: the evidence. *Canadian Medical Association Journal* 2006;174:801–809.
209. World Health Organization. *Physical inactivity: a global public health problem*. Available from: http://www.who.int/dietphysicalactivity/factsheet inactivity/en/index.html
210. Wendel-Vos G. Hoeveel mensen zijn voldoende lichamelijke actief? In: Volksgezondheid Toekomst Verkenning, Nationaal Kompas Volksgezondheid. Bilthoven: RIVM; 2013. Available from: http://www.nationaalkompas.nl/gezondheidsdeterminanten/leefstijl/lichamelijke-activiteit/hoeveel-mensen-zijn-voldoende-lichamelijk-actief/
211. CBS Statline. *Gezondheidsmonitor, regio, 2012, bevolking van 19 jaar of ouder*. Available from: http://statline.cbs.nl/StatWeb/publication/?DM=SLNL&PA=82166ned&D1=39&D2=a&D3=0&D4=0,16,19,128,133,158,192,197,215,223,348,415-443&D5=l&HDR=T,G2&STB=G1,G3,G4&CHART-TYPE=1&VW=T
212. Hildebrandt VH, Bernaards CM, Stubbe JH. *Trendrapport Bewegen en Gezondheid* 2010/2011. Leiden: TNO; 2013.
213. Garrett S, Elley C, Rose S, et al. Are physical activity interventions in primary care and the community cost-effective? A systematic review of the evidence. *British Journal of General Practice* 2011;125–133.
214. Bessems KMHH, van Assema P, Martens MK, et al. Appreciation and implementation of the Krachtvoer healthy diet promotion programme for 12- to 14- year-old students of prevocational schools. *BMC Public Health* 2011;11:909.
215. Verhagen E, Engbers L. The physical therapist's role in physical activity promotion. *British Journal of Sports Medicine* 2009;43:99–101.
216. Iles R, Davidson M. Evidence based practice: a survey of physiotherapists' current practice. *Physiotherapy Research International* 2006;11:93–103.

217. Bernhardsson S, Johansson K, Nilsen P, et al. Determinants of guideline use in primary care physical therapy: A cross-sectional survey of attitudes, knowledge, and behavior. *Physical Therapy* 2014; 94:343-354.
218. van der Wees PJ, Hendriks EJM, Veldhuizen R. Quality assurance in the Netherlands: from development to implementation and evaluation. *Dutch Journal of Physiotherapy* 2003;113:8–11.
219. van der Wees PJ, Hendriks EJM, Custers JWH, et al. Comparison of international guideline programs to evaluate and update the Dutch program for clinical guideline development in physical therapy. *BMC Health Services Research* 2007;7:191.
220. Royal Dutch Society for Physical Therapy (KNGF). *KNGF evidence-based clinical practice guidelines*. Available from: https://www.fysionet-evidencebased.nl/index.php/kngf-guidelines-in-english
221. Royal Dutch Society for Physical Therapy (KNGF). *Beweeginterventies*. Available from: http://www.fysionet-evidencebased.nl/index.php/beweeginterventies
222. Michie S, Johnston M. Theories and techniques of behaviour change: developing a cumulative science of behaviour change. *Health Psychology Review* 2012;6:37–41.
223. Hox J. *Multilevel analysis: Techniques and applications*. New York: Routledge; 2010.
224. Raudenbush S, Bryk A. *Hierarchical linear models*. Second edition. Thousand Oaks, CA: SAGE; 2002.
225. Peugh JL. A practical guide to multilevel modeling. *Journal of School Psychology* 2010;48: 85–112.
226. Maes S, Karoly P. Self-regulation assessment and intervention in physical health and illness: a review. *Applied Psychology* 2005;54:267–299.
227. Lally P, Gardner B. Promoting habit formation. *Health Psychology Review* 2013;7:S137–S158.
228. Godin G, Bélanger-Gravel A, Eccles M, et al. Healthcare professionals' intentions and behaviours: a systematic review of studies based on social cognitive theories. *Implementation Science* 2008;3:36.
229. Michie S, Richardson M, Johnston M, et al. The behavior change technique taxonomy (v1) of 93 hierarchically clustered techniques: building an international consensus for the reporting of behavior change interventions. *Annals of Behavioral Medicine* 2013.
230. U.S. Department of Health and Human Services. *Healthy People 2020*. 2010. Available from: http://www.healthypeople.gov/2020/default.aspx
231. Jacobson DM, Strohecker L, Compton MT, et al. Physical activity counseling in the adult primary care setting: position statement of the American College of Preventive Medicine. *American Journal of Preventive Medicine* 2005;29:158–162.
232. Michie S, van Stralen MM, West R. The behaviour change wheel: A new method for characterising and designing behaviour change interventions. *Implementation Science* 2011;6:42.
233. Scott SD, Plotnikoff RC, Karunamuni N, et al. Factors influencing the adoption of an innovation: an examination of the uptake of the Canadian Heart Health Kit (HHK). *Implementation Science* 2008;3:41.
234. Curran GM, Sullivan G, Mendel P, et al. Implementation of the CALM intervention for anxiety disorders: a qualitative study. *Implementation Science*;7:14.
235. West R. Time for a change : putting the Transtheoretical (Stages of Change) Model to rest. *Addiction* 2005;100:1036–1039.

236. Hrisos S, Eccles MP, Francis JJ, et al. Are there valid proxy measures of clinical behaviour? A systematic review. *Implementation Science* 2009;4:37.
237. Green ME, Hogg W, Savage C, et al. Assessing methods for measurement of clinical outcomes and quality of care in primary care practices. *BMC Health Services Research* 2012;12:214.
238. Dusenbury L, Brannigan R, Falco M, et al. A review of research on fidelity of implementation: implications for drug abuse prevention in school settings. *Health Education Research* 2003;18:237–256.
239. Fleuren M, Paulussen T, van Dommelen P, et al. *Meetinstrument voor Determinanten van Innovaties (MIDI)*. TNO; 2012.
240. Baker R, Camosso-Stefinovic J, Gilles C, et al. Tailored interventions to overcome identified barriers to change: effects on professional practice and health care outcomes. *Cochrane Database of Systematic Reviews* 2010;3.
241. Wensing M, Oxman A, Baker R, et al. Tailored Implementation For Chronic Diseases (TICD): a project protocol. *Implementation Science* 2011;6:103.
242. Armstrong R, Waters E, Dobbins M, et al. Knowledge translation strategies to improve the use of evidence in public health decision making in local government: intervention design and implementation plan. *Implementation Science* 2013;8:121.
243. Sinnema H, Terluin B, Wensing M, et al. Systematic tailoring for the implementation of guideline recommendations for anxiety and depressive disorders in general practice: perceived usefulness of tailored interventions. *BMC Family Practice* 2013;14:94.
244. Haskell WL, Lee I-M, Pate RR, et al. Physical activity and public health: updated recommendation for adults from the American College of Sports Medicine and the American Heart Association. *Medicine and Science in Sports and Exercise* 2007;39:1423–1434.
245. Bauman A. Updating the evidence that physical activity is good for health: an epidemiological review 2000–2003. *Journal of Science and Medicine in Sport* 2004;7:6-19.
246. Centraal Bureau voor de Statistiek. *Gezondere leefstijl blijkt voor velen moeilijk haalbaar*. Available from: http://www.cbs.nl/nl-NL/menu/themas/gezondheid-welzijn/publicaties/artikelen/archief/2010/2010-017-pb.htm
247. Center for Disease Control and Prevention. *U.S. Physical Activity Statistics*. Available from: http://apps.nccd.cdc.gov/PASurveillance/StateSumResultV.asp?CI=&Year=2007&State=1#data
248. van Bakel A. *Lichamelijke activiteit samengevat*. In: Volksgezondheid Toekomst Verkenning, Nationaal Kompas Volksgezondheid. Bilthoven: RIVM; 2012. Available from: http://www.nationaalkompas.nl/gezondheidsdeterminanten/leefstijl/lichamelijke-activiteit/lichamelijke-activiteit-samengevat/
249. British Heart Foundation Health Promotion Research Group. *Physical activity statistics 2012*. Oxford: British Heart Foundation; 2012.
250. Kahn E, Ramsey L, Brownson R, et al. The effectiveness of interventions to increase physical activity: a systematic review. *American Journal of Preventive Medicine* 2002;22:73-107.
251. Foster C, Hillsdon M, Thorogood M, et al. Interventions for promoting physical activity. *Cochrane Database of Systemtic reviews* 2005;1.
252. Whitlock E, Orleans CT, Pender N, et al. Evaluating primary care behavioral counseling interventions. *American Journal of Preventive Medicine* 2002;22:267–284.
253. Godin G, Shephard RJ. An evaluation of the potential role of the physician in influencing community exercise behavior. *American Journal of Health Promotion* 1990;4:255–259.

254. Wallace PG, Brennan PJ, Haines AP. Are general practitioners doing enough to promote healthy lifestyle ? Findings of the Medical Research Council's general practice research framework study on lifestyle and health. *Britisch Medical Journal* 2000;294:940–942.
255. Stott NC, Pill RM. 'Advise yes, dictate no'. Patients' views on health promotion in the consultation. *Family Practice* 1990;7:125–131.
256. World Health Organization. *Health 2020: a European policy framework and strategy for the 21st century*. Available from: http://issuu.com/whoeurope/docs/health2020 policyframework strategy.

Nederlandse Samenvatting

Lichamelijke activiteit

Regelmatige lichamelijke activiteit heeft een gunstig effect op de mentale en fysieke gezondheid. Het bevordert de kwaliteit van leven [206] en vermindert het risico op de ontwikkeling van chronische ziekten, zoals diabetes, hart- en vaatziekten, hypertensie, osteoporose, verschillende vormen van kanker en depressie [207,208,244,245]. Ondanks de positieve effecten van lichamelijke activiteit, voldoen veel mensen niet aan de internationale beweegnorm van ten minste 30 minuten matige tot intensive lichamelijke activiteit per dag [246–249]. In Nederland beweegt 40% van de algemene bevolking [210–212] en 50% van de mensen met een chronische aandoening onvoldoende [212].

Bewegingsstimulering in de eerstelijnszorg

In de laatste decennia is een groot aantal interventies ontwikkeld om lichamelijke activiteit te bevorderen [250,251]. Een belangrijke setting waarin deze interventies worden aangeboden is de eerstelijnszorg [60]. Voorbeelden van dit soort interventies in Nederland zijn de BeweegKuur, Bewegen Op Recept, Samen Sportief Afvallen en SLIMMER. De eerstelijnszorg is erg geschikt om de algemene bevolking te stimuleren om meer te gaan bewegen [60,116,213,252], omdat de meerderheid van de algemene bevolking ten minste één keer per jaar een eerstelijnszorgprofessional bezoekt [213] en positief is over het ontvangen van beweegadvies van deze professionals [253–255]. Daarbij vinden eerstelijnszorgprofessionals, zoals huisartsen, praktijkverpleegkundigen en fysiotherapeuten, bewegingsstimulering belangrijk en een onderdeel van hun werk [55,65,116,215].

Onderzoek heeft uitgewezen dat eerstelijnszorgbeweeginterventies, zoals het geven van beweegadvies, het voorschrijven van beweging en het trainen van patiënten in beweegprogramma's, effectief zijn in het bevorderen van beweging [60–63]. Derhalve wordt eerstelijnszorgprofessionals aanbevolen deze interventies aan hun patiënten aan te bieden [231,244,256]; zowel aan patiënten met (een verhoogd risico op) chronische ziekten [230] als aan gezonde patiënten die niet voldoen aan de beweegnorm [230,231].

De introductie van beweeginterventies in de eerstelijnszorg

Ondanks deze aanbevelingen en de veelbelovende bevindingen over de effectiviteit van eerstelijnszorgbeweeginterventies verloopt de introductie van deze interventies in de praktijk niet optimaal. Eerstelijnszorgprofessionals stimuleren hun patiënten onvoldoende om meer te gaan bewegen [50–52] en beweeginterventies worden niet uitgevoerd zoals bedoeld door interventieontwikkelaars [1,9,53–57]. Uit hun systematisch literatuur review concludeerden VanWormer et al. [52] dat 30-50% van de Amerikaanse huisartsen hun patiënten regelmatig over beweging adviseert. In de uitvoering van beweeginterventies lukt het eerstelijnszorgprofessionals niet goed om de motivatie van hun patiënten met betrekking gedragsverandering in te schatten [53], behandeldoelen omtrent bewegen op te stellen [56], beweeginterventies aan te passen aan doelen en de fase van gedragsverandering van de patiënt en vervolgafspraken aan te bieden [55]. Deze kloof tussen onderzoek en praktijk vermindert de impact van eerstelijnszorgbeweeginterventies op de publieke gezondheid [1,10–16]. Met andere woorden, wanneer beweeginterventies niet (goed) worden uitgevoerd in de praktijk, dan zullen ze er niet optimaal voor zorgen dat mensen meer gaan bewegen.

Het introductieproces

De afstand tussen onze kennis over beweeginterventies vanuit het onderzoek en de uitvoering van deze interventies in de praktijk van de eerstelijnszorg kan deels worden verklaard door de complexiteit van de introductie van innovaties (waar beweeginterventies een voorbeeld van zijn) in de gezondheidszorg [5,15,17–22]. Verschillende theoretische raamwerken beschrijven dit proces van introductie (voor een overzicht van raamwerken zie Damschroder et al. [8], Tabak et al. [23], en Grol et al. [22]). Een aantal van deze raamwerken indiceert dat het introductieproces uit verschillende fasen bestaat en dat het proces wordt beïnvloed door een verscheidenheid aan factoren (e.g., [17,24–29]).

Met als doel verschillende prominente theorieën en modellen over de introductie van innovaties in de gezondheidszorg te integreren, hebben Fleuren et al. [17] een raamwerk ontwikkeld waarin de belangrijkste fasen van het introductieproces en gerelateerde categorieën van beïnvloedende factoren zijn opgenomen. Volgens dit raamwerk moeten gezondheidszorgorganisaties en professionals zich eerst bewust worden van een innovatie (de disseminatiefase), waarna ze de beslissing kunnen nemen om met de innovatie te werken (de adoptiefase). Vervolgens voeren ze de innovatie uit, al dan niet zoals bedoeld (de implementatiefase), en kunnen ze dit voor een langere periode doen, waarin werken met de innovatie routine kan worden (de continueringsfase). De verschillende categorieën van factoren die van invloed zijn op het gehele introductieproces worden door het raamwerk samengevat als gerelateerd aan kenmerken van de 1. innovatie, 2. sociaal-politieke context, 3. organisatie, 4. adopterende professional en 5. innovatie strategie.

Het gedrag van gezondheidszorgprofessionals

Het gedrag van gezondheidszorgprofessionals en de factoren die hierop van invloed zijn spelen een belangrijke rol in de effectieve introductie van innovaties in de gezondheidszorg. Immers, gezondheidszorgprofessionals zijn degenen die innovaties moeten adopteren, uitvoeren zoals bedoeld en volhouden voor langere tijd. Het veranderen van het gedrag van gezondheidszorgprofessionals is daarom essentieel voor de verbetering van het introductieproces. Om het gedrag van gezondheidszorgprofessionals te veranderen is het belangrijk om te weten welke factoren het gedrag van gezondheidszorgprofessionals beïnvloeden [6,30–32].

Individuele gedragsveranderingstheorieën kunnen bijdragen aan het identificeren van factoren die van invloed zijn op het gedrag van gezondheidszorgprofessionals [6,30–32]. In het Theoretical Domains Framework (hierna TDF raamwerk) [30,31] zijn constructen van een groot aantal verschillende gedragsveranderingstheorieën geïntegreerd tot een lijst met 12 domeinen. Deze lijst omvat zo een volledige reeks van verklaringen voor menselijk gedrag. Volgens de originele versie van het raamwerk [31] kunnen de factoren die potentieel van invloed zijn op het gedrag van gezondheidszorgprofessionals worden samengevat in de domeinen Kennis, Vaardigheden, Sociale/professionele rol en identiteit, Geloof in eigen kunnen, Uitkomstverwachtingen, Motivatie en doelen, Geheugen, aandacht en besluitvormingsprocessen, Omgeving en hulpbronnen, Sociale invloed, Emotie, Gedragsregulatie, en de Aard van het gedrag.

Doel van het proefschrift

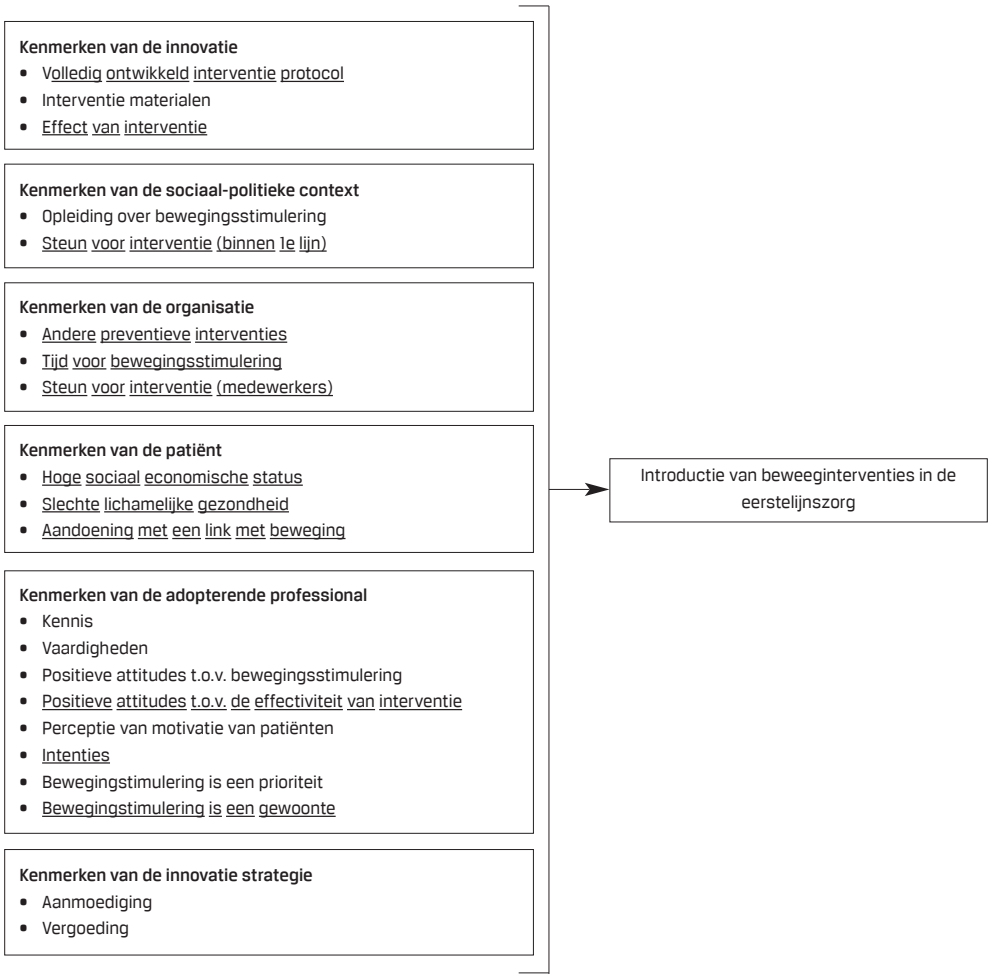
Kennis over de factoren die van invloed zijn op de introductie van innovaties in de gezondheidszorg is cruciaal om effectieve introductiestrategieën te ontwikkelen [1,6,7,17,22,33–39]. Factoren kunnen

variëren voor verschillende innovaties, adopterende professionals en toepassingsgebieden, wat maakt dat het belangrijk is om factoren te identificeren die de introductie van een specifieke innovatie in een specifieke context beïnvloeden [38,49]. Als een eerste stap om de kloof tussen onze wetenschappelijke kennis over beweeginterventies en de uitvoering van deze interventies in de praktijk te verkleinen was het doel van dit proefschrift om te onderzoeken welke factoren van invloed zijn op de introductie van beweeginterventies in de eerstelijnszorg. Het eerste deel van dit proefschrift beschrijft de factoren die van invloed zijn op de adoptie, implementatie en continuering van beweeginterventies door eerstelijnszorgorganisaties en professionals. Voor het identificeren van deze factoren is gebruik gemaakt van het raamwerk van Fleuren et al. [17] met de verschillende fasen en gerelateerde categorieën van beïnvloedende factoren. Het tweede deel gaat specifiek over de implementatiefase van het introductieproces en beschrijft het onderzoek naar de factoren die van invloed zijn op eerstelijnszorgprofessionals' uitvoering van beweeginterventies zoals bedoeld. Voor het exploreren van deze factoren is gebruik gemaakt van het TDF raamwerk [30,31].

Belangrijkste bevindingen

In *Hoofdstuk 2* is een systematisch literatuuronderzoek uitgevoerd om inzicht te krijgen in de factoren die in de wetenschappelijke literatuur worden beschreven als van invloed op bewegingsstimulering door eerstelijnszorgprofessionals. Ook de methoden die gebruikt zijn om deze factoren te identificeren werden onderzocht. Analyse van 59 artikelen gepubliceerd in de afgelopen 20 jaar resulteerde in een groot aantal potentieel beïnvloedende factoren. De factoren werden beschreven als potentieel van invloed, omdat voor slechts een klein deel van de factoren significante relaties met bewegingsstimulering door eerstelijnszorgprofessionals werden gevonden. De meeste factoren werden door stakeholders van eerstelijnszorgbeweeginterventies genoemd als van invloed op bewegingsstimulering. Voor enkele van deze factoren werd wèl een significante relatie met bewegingsstimulering gevonden. De meest belangrijke potentiële invloeden op bewegingsstimulering staan in Figuur 1.

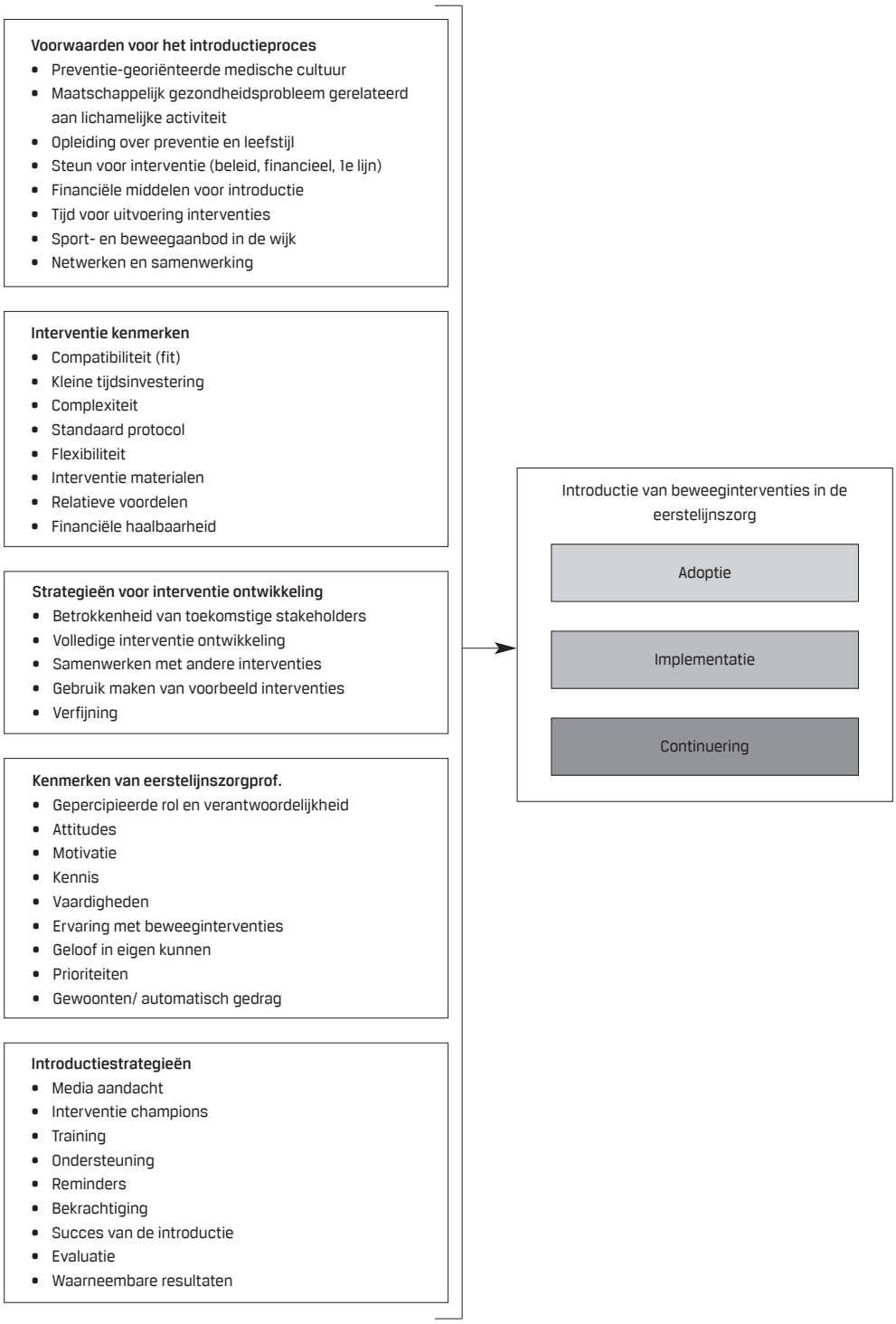
Hoofdstuk 3 beschrijft een kwalitatief onderzoek naar de factoren die van invloed zijn op de introductie van beweeginterventies in de eerstelijnszorg. Op de volgende onderzoeksvragen werd in deze studie een antwoord gezocht: 1. welke factoren worden door stakeholders gezien als van invloed op de introductie van deze beweeginterventies in de eerstelijnszorg, en 2. worden factoren gezien als belangrijk voor een specifieke fase van het introductieproces (adoptie, implementatie, continuering)? Om deze vragen te beantwoorden werden 28 semigestructureerde interviews gehouden met coördinatoren, uitvoerders, verwijzers en eerstelijnszorgadviseurs van vijf verschillende eerstelijnszorgbeweeginterventies. De stakeholders werden bevraagd over hun ervaringen met de introductie van hun specifieke beweeginterventie in de eerstelijnszorg. Daarbij werd gevraagd naar hun perceptie van de belemmerende en bevorderende factoren voor de verschillende fasen van het introductieproces (adoptie, implementatie en continuering). Stakeholders rapporteerden een groot aantal potentieel beïnvloedende factoren. Deze konden worden ingedeeld in de volgende categorieën: voorwaarden voor de introductie van beweeginterventies in de eerstelijnszorg, kenmerken van beweeginterventies en eerstelijnszorg-professionals, en strategieën voor de ontwikkeling van beweeginterventies en hun introductie in de eerstelijnszorg (zie Figuur 2). De meerderheid van de factoren werd genoemd met betrekking tot één of twee van de fasen van het introductieproces. De resultaten suggereren dat voorwaarden voor het introductieproces (bijv. preventie-georiënteerde medische cultuur, opleiding over



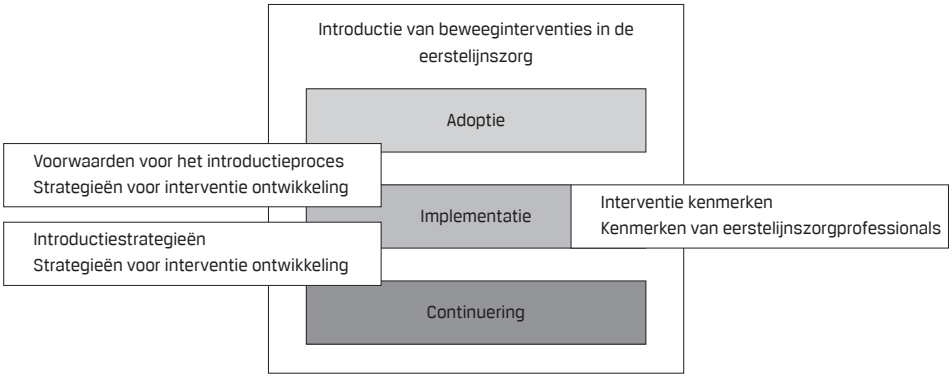
Figuur 1. **Meest belangrijke potentiële factoren in de literatuur beschreven als positief van invloed op bewegingsstimulering door eerstelijnszorgprofessionals**

Noot. Onderstreepte factoren zijn gepercipieerde beïnvloedende factoren waarvoor een significante relatie met bewegingsstimulering was gevonden, de andere factoren zijn meest geciteerde gepercipieerde beïnvloedende factoren

preventie en leefstijl) het meest
belangrijk zijn voor de adoptie en implementatie van beweeginterventies, dat interventie kenmerken (bijv. compatibiliteit, flexibiliteit) en kenmerken van eerstelijnszorgprofessionals (bijv. kennis, geloof in eigen kunnen) voornamelijk een rol spelen tijdens de implementatiefase, en dat introductiestrategieën (bijv. training, bekrachtiging) de meeste invloed hebben op de implementatie- en continueringsfase. Wat betreft de ontwikkeling van beweeginterventies lijken sommige strategieën vooral belangrijk in het begin van het proces (bijv. betrokkenheid van toekomstige stakeholders, volledige interventie ontwikkeling), terwijl anderen juist later van belang zijn (bijv. gebruik van voorbeeld interventies, verfijning) (zie Figuur 3).



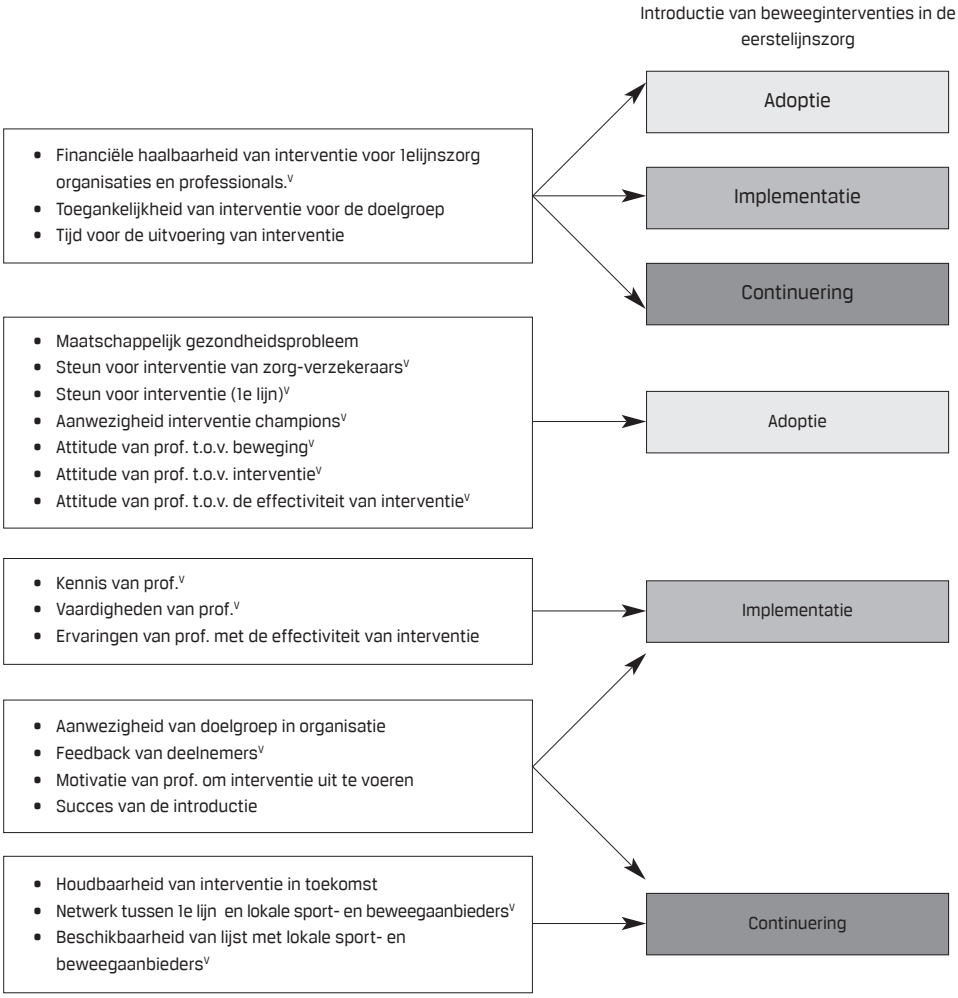
Figuur 2. **Factoren door stakeholders gezien als van invloed op de introductie van beweeginterventies in de eerstelijnszorg**



Figuur 3. **Categorieën van factoren en de verschillende fases van het introductieproces**

Het systematische literatuuronderzoek en het kwalitatieve onderzoek resulteerden in een uitvoerige lijst met factoren die potentieel van invloed zijn op de introductie van beweeginterventies in de eerstelijnszorg. Het doel van het onderzoek beschreven in *Hoofdstuk 4* was om consensus tussen experts te bereiken over de relevantie (belangrijkheid en veranderbaarheid) van deze factoren voor het introductieproces. In de eerste ronde van het onderzoek scoorden 44 experts op het gebied van de introductie van beweeginterventies in de eerstelijnszorg de factoren op hun belangrijkheid voor de adoptie-, implementatie- en continueringsfase. Daarbij scoorden ze ook de veranderbaarheid van de factoren. In de tweede ronde selecteerden 37 van deze experts een top-10 van meest belangrijke factoren voor iedere fase en scoorden ze weer de veranderbaarheid van de factoren. Aan de hand van deze zogenaamde Delphi methode werden zowel de meest belangrijke factoren voor het gehele introductieproces als de meest belangrijke factoren voor iedere specifieke fase geïdentificeerd. Factoren gerelateerd aan tijd en geld werden door experts belangrijk gevonden voor alle fasen, terwijl andere factoren belangrijk werden gevonden voor een specifieke fase van het proces. Voorbeelden van deze laatste groep belangrijke factoren zijn de aanwezigheid van interventie 'champions' in de organisatie voor de adoptiefase, de kennis van de uitvoerder van de interventie voor de implementatiefase en de houdbaarheid van de interventie voor de toekomst voor de continueringsfase (voor een overzicht van factoren en hun belang voor het introductieproces zie Figuur 4).

Het tweede deel van dit proefschrift beschrijft het onderzoek naar de factoren die van invloed zijn op de uitvoering van beweeginterventies door eerstelijnszorgprofessionals (de implementatiefase). Hiervoor is op basis van eerder onderzoek (Hoofdstuk 3 en Hoofdstuk 4) en het TDF raamwerk [30,31] een vragenlijst ontwikkeld waarmee de factoren die potentieel van invloed zijn op het implementatiegedrag van gezondheidszorgprofessionals kunnen worden gemeten. Hoofdstuk 5 en Hoofdstuk 6 beschrijven de ontwikkeling en eerste validatie van deze vragenlijst. Het belangrijkste doel van *Hoofdstuk 5* was om een algemene vragenlijst te ontwikkelen waarmee de 14 domeinen van beïnvloedende factoren uit de laatste versie van het TDF raamwerk [30] kunnen worden gemeten. Daarbij werd de validiteit van de vragenlijst onderzocht. De vragenlijst werd ontwikkeld op basis van eerder gepubliceerde vragenlijsten, items werden aangepast op basis van resultaten van eerder onderzoek (Hoofdstuk 3 en Hoofdstuk 4) en nieuwe items werden ontwikkeld. De validatie van de vragenlijst hield in dat 19 beoordelaars (experts op het gebied van gedragsverandering,

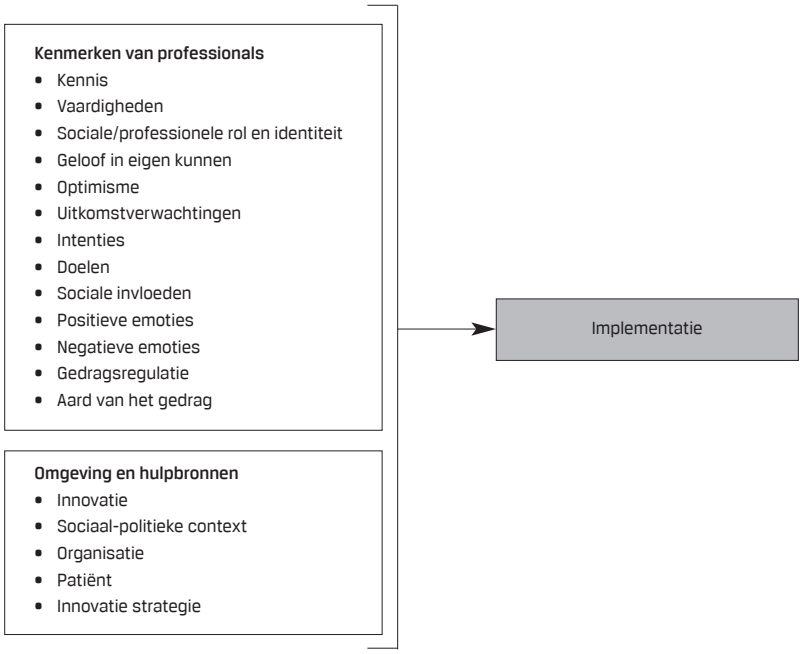


Figuur 4. **Factoren meest belangrijk voor de adoptie, implementatie en continuering van beweeginterventies in de eerstelijnszorg**

Noot. v, veranderbare factoren

gedragsveranderingsinterventies en/of de implementatie van deze interventies in de zorg) de 79 items van de ontwikkelde vragenlijst toewezen aan het domein dat zij denken dat het item meet. Daarbij scoorden ze de mate waarin ze vertrouwen hadden in de toewijzingen. Dit resulteerden in 32 items die werden beoordeeld 11 van de 14 domeinen te meten. De domeinen Bekrachtiging, Doelen en Gedragsregulatie konden niet worden gemeten met de ontwikkelde vragenlijst, omdat beoordelaars deze items toewezen aan een combinatie van domeinen. De vragenlijst is aan de hand van deze resultaten aangepast, en vormde vervolgens een belangrijke basis voor het meetinstrument dat gebruikt is in de twee laatste empirische studies van dit proefschrift.

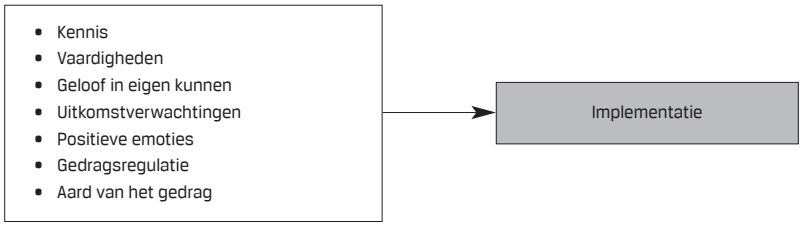
In *Hoofdstuk 6* wordt de ontwikkeling van de vragenlijst op basis van het originele TDF raamwerk met 12 domeinen (in plaats van 14) beschreven. In dit onderzoek werden de psychometrische kernmerken van de vragenlijst in een sample van gezondheidszorgprofessionals onderzocht. Voor de validatie van deze vragenlijst, genaamd de Determinants of Implementation Behavior Questionnaire (hierna DIBQ vragenlijst), werden de volgende onderzoeksvragen geformuleerd: 1. ondersteunt confirmatieve factoranalyse de vooropgestelde structuur van de TDF vragenlijst (constructvaliditeit), 2. meet de vragenlijst de domeinen van het TDF raamwerk op een betrouwbare manier (betrouwbaarheid), en 3. zijn de domeinen van de vragenlijst voldoende onderscheidend van elkaar te meten (discriminante validiteit)? De DIBQ vragenlijst werd ontwikkeld op basis van eerder gepubliceerde vragenlijsten, waarvan de items werden aangepast op basis van resultaten van eerder onderzoek (Hoofdstuk 3 en Hoofdstuk 4). Daarbij werden items gebruikt uit de vragenlijst in Hoofdstuk 5 en werden nieuwe items ontwikkeld. Er werd veel aandacht besteed aan het ontwikkelen van een vragenlijst die de volledige breedte van TDF domeinen en eerder geïdentificeerde factoren potentieel van invloed op de implementatie van beweeginterventies in de eerstelijnszorg omvat. De vragenlijst werd toegespitst op de implementatie van beweeginterventies door eerstelijnszorgprofessionals en een groep fysiotherapeuten werd gevraagd om de vragenlijst in te vullen. Analyse van de 270 ingevulde vragenlijsten resulteerde in een vragenlijst met 93 items en 18 onderliggende domeinen van factoren potentieel van invloed op het implementatiegedrag van gezondheidszorgprofessionals (zie Figuur 5). De belangrijkste aanpassing met betrekking tot de structuur van de vragenlijst op basis van de resultaten was het opsplitsen van het domein Omgeving en hulpbronnen in vijf verschillende omgevingsgerelateerde domeinen: Innovatie,



Figuur 5. **18 domeinen van factoren potentieel van invloed op implementatiegedrag**

Sociaal-politieke context, Organisatie, Patiënt en Innovatie strategie. Daarbij werden sommige domeinen van elkaar gescheiden (Geloof in eigen kunnen en Optimisme, Intenties en Doelen, en Positieve emoties en Negatieve emoties) en anderen juist bij elkaar gevoegd (Geheugen, aandacht en besluitvormingsprocessen en Aard van het gedrag). De laatste versie van de vragenlijst bleek in deze eerste studie naar de psychometrische kenmerken over een goede constructvaliditeit te beschikken (op basis van confirmatieve factor analyse) en de meerderheid van de domeinen kon met de vragenlijst betrouwbaar en onderscheidend van elkaar worden gemeten.

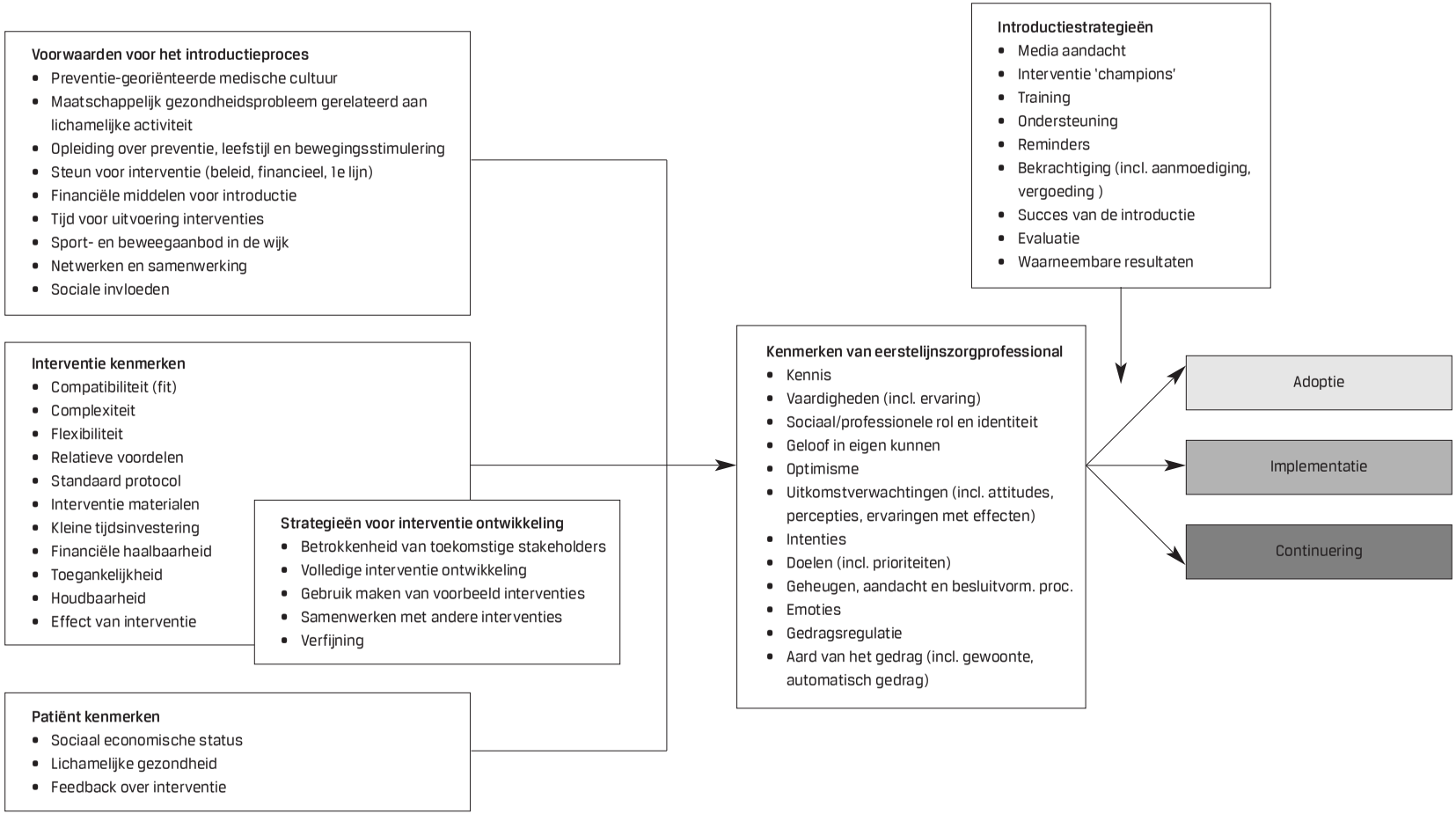
In *Hoofdstuk 7* is de DIBQ vragenlijst gebruikt om te onderzoeken welke TDF domeinen geassocieerd zijn met de implementatie van beweeginterventies door fysiotherapeuten. Het doel van dit onderzoek was om te onderzoeken in hoeverre fysiotherapeuten beweeginterventies uitvoeren zoals bedoeld en welke factoren geassocieerd zijn met implementatietrouw. De vragen waarop in dit onderzoek een antwoord werd gezocht waren als volgt: 1. in welke mate voeren fysiotherapeuten alle kernelementen van beweeginterventies bij al hun patiënten uit (mate van uitvoering), 2. hoe goed voeren fysiotherapeuten beweeginterventies uit, en 3. welke TDF domeinen zijn geassocieerd met de mate en kwaliteit van uitvoering van beweeginterventies door fysiotherapeuten? Implementatietrouw werd geoperationaliseerd als de mate waarin de beweeginterventie wordt uitgevoerd zoals bedoeld en de kwaliteit van de uitvoering. Een groep van 268 fysiotherapeuten vulden een online versie van de DIBQ vragenlijst in. Vragen over de mate en kwaliteit van uitvoering werden gebaseerd op de kernelementen van beweeginterventies (de intake, het trainingsprogramma, de evaluatie, aandacht voor het behouden van beweging en contact met de verwijzende professional) en de taken die hieronder vallen zoals beschreven in de Standaarden Beweeginterventies door het Koninklijk Nederlands Genootschap voor Fysiotherapie (KNGF; [221]). Fysiotherapeuten rapporteerden dat ze beweeginterventies zoals bedoeld uitvoeren bij een kleine meerderheid van de deelnemers en dat ze redelijk tevreden zijn met de kwaliteit die ze bieden. Dit betekent dat hoewel hun implementatietrouw redelijk goed is, er ook ruimte is voor verbetering. Op basis van de meest belangrijke factoren die geassocieerd bleken met de mate en kwaliteit van uitvoering is het plausibel dat implementatietrouw zou kunnen worden verbeterd door specifieke implementatiestrategieën te ontwikkelen. Deze strategieën zouden dan vooral gericht moeten zijn op het verhogen van de kennis, vaardigheden, geloof in eigen kunnen, uitkomstverwachtingen en positieve emoties van fysiotherapeuten met betrekking tot de implementatie van beweeginterventies, op het verbeteren van de kwaliteit van hun implementatieplannen en de mate waarin het uitvoeren van beweeginterventies zoals bedoeld een gewoonte is (Figuur 6).



Figuur 6. **Meest belangrijke factoren geassocieerd met de uitvoering van beweeginterventies door fysiotherapeuten**

In *Hoofdstuk 8* worden de belangrijkste bevindingen van dit proefschrift samengevat en vergeleken met de literatuur. Daarbij worden de sterke en minder sterke kanten van het proefschrift beschreven en is er aandacht voor het gebruik van theorie. Het hoofdstuk wordt afgesloten met aanbevelingen voor toekomstig onderzoek.

Samengevat kan gezegd worden dat de resultaten van de studies beschreven in dit proefschrift bevestigen dat de introductie van beweeginterventies in de eerstelijnszorg kan worden verbeterd. Om dit te bereiken levert dit proefschrift inzicht in de factoren die van invloed kunnen zijn op de introductie van beweeginterventies in de eerstelijnszorg. Hierbij is aandacht besteed aan het belang van factoren voor de verschillende fasen van het proces. Het overzicht van factoren waarin het proefschrift heeft geresulteerd (zie Figuur 7) kan voorafgaand aan de introductie van beweeginterventies in de eerstelijnszorg worden geraadpleegd om het proces zo effectief mogelijk te laten verlopen. Het belang van specifieke factoren voor de verschillende fasen van het introductieproces geeft aanleiding om te verwachten dat met verschillende specifieke factoren rekening gehouden moet worden tijdens de adoptie-, implementatie- en continueringsfase en dat er fase-specifieke strategieën nodig zijn om de verschillende fasen positief te beïnvloeden. Het relatieve belang van de beïnvloedende factoren kan variëren voor verschillende adopterende professionals, settingen en landen [38,49]. Dit indiceert het belang om voorafgaand aan de introductie van een beweeginterventie in de eerstelijnszorg belemmerende en bevorderende factoren voor de specifieke beweeginterventie in kaart te brengen. De ontwikkeling van de DIBQ vragenlijst, waarmee de factoren die potentieel van invloed zijn op het implementatiegedrag van gezondheidszorgprofessionals kunnen worden gemeten, draagt bij aan de kennis over factoren die van invloed zijn op het implementatiegedrag van gezondheidszorgprofessionals en theorie en methoden in implementatie onderzoek. Een eerste studie naar de psychometrische kenmerken van de vragenlijst wijst op een acceptabele betrouwbaarheid en validiteit, hoewel deze kenmerken nader moeten worden onderzocht. De vragenlijst is het startpunt geweest voor de ontwikkeling van een op het TDF raamwerk gebaseerde kortere checklist waarmee de praktijk (mensen verantwoordelijk voor de implementatie van beweeginterventies, bijv. coördinatoren van beweeginterventies, zorgadviseurs) de uitvoering van beweeginterventies systematisch in kaart kan brengen. Deze wordt op dit moment nader onderzocht. Eerste resultaten geven aan dat coördinatoren en uitvoerders positief zijn over de checklist en het doel van de checklist. Ze vinden de checklist relevant, praktische toepasbaar, makkelijk, compact en compleet. Bovendien geven ze aan dat de checklist inzicht geeft in de bevorderende en beperkende factoren en zijn veel coördinatoren van plan om hiertoe actie te ondernemen. Tot slot denken coördinatoren en uitvoerders dat actie ondernemen op basis van de ingevulde checklists positieve resultaten zal opleveren.



Figuur 7. Overzicht van factoren die potentieel van invloed zijn op de introductie van beweeginterventies in de eerstelijnszorg

Curriculum Vitae

Josanne Huijg was born on the 25th of September in 1984 in Leiderdorp, the Netherlands. After completing her secondary school education at Visser 't Hooft Lyceum, Leiden, in 2002, she left for the South of France to study the French language. In 2003 she started her Bachelor in Psychology at Leiden University from which she graduated in 2006. Next, Josanne pursued a Master's degree in Clinical Psychology at Leiden University, graduating from this program in 2009. Under the supervision of Dr. J.F. Brosschot, she wrote her Master thesis entitled 'Cardiovascular recovery after experimental worry with or without distraction: testing a theory of unconscious worrying'. During her Master studies, Josanne spent six months in Australia to study Organizational behavior at the University of Sydney. In addition, she worked as a freelance psychologist at a penitentiary psychiatric hospital in Amsterdam. In December 2009 she commenced her PhD on the introduction of physical activity interventions in primary health care in the department of Clinical, Health and Neuropsychology at Leiden University. At the moment, Josanne is working on the translation of her research findings into practice. Most recently, she started working as a program officer at The Netherlands Organisation of Health Research and Development (ZonMw).

List of Publications and Presentations

Publications

Articles in peer reviewed journals

Huijg JM, Dusseldorp E, Gebhardt WA, Verheijden MW, van der Zouwe N, Middelkoop BJC, Duijzer G, Crone MR. Factors associated with physical therapists' implementation of physical activity interventions in the Netherlands. *Physical Therapy*. Revision submitted.

Huijg JM, van der Zouwe N, Crone MR, Verheijden MW, Middelkoop BJC, Gebhardt WA. Factors influencing the introduction of physical activity interventions in primary health care: a qualitative study. *International Journal of Behavioral Medicine* 2014;Epub ahead of print. DOI: 10.1007/s21529-014-9411-9.

Huijg JM, Gebhardt WA, Verheijden MW, van der Zouwe N, de Vries JD, Middelkoop BJC, Crone MR. Factors influencing primary health care professionals' physical activity promotion behaviors: a systematic review. *International Journal of Behavioral Medicine* 2014;Epub ahead of print. DOI: 10.1007/s12529-014-9398-2.

Huijg JM, Gebhardt WA, Dusseldorp E, Verheijden MW, van der Zouwe N, Middelkoop BJC, Crone MR. Measuring determinants of implementation behavior: psychometric properties of a questionnaire based on the Theoretical Domains Framework. *Implementation Science* 2014;9:33.

Huijg JM, Gebhardt WA, Crone MR, Dusseldorp E, Presseau J. Discriminant content validity of a Theoretical Domains Framework Questionnaire for use in implementation research. *Implementation Science* 2013;9:11.

Huijg JM, Crone MR, Verheijden MW, van der Zouwe N, Middelkoop BJC, Gebhardt WA. Factors influencing the adoption, implementation, and continuation of physical activity interventions in primary health care: a Delphi study. *BMC Family Practice* 2013;14:142.

Article in the official bulletin of the European Health Psychology Society

Huijg JM, Presseau J. Health psychology and implementation science in tandem: developing questionnaires to assess theoretical domains and multiple goal pursuit. *The European Health Psychologist* 2013;15:17-21.

Abstracts in peer reviewed journals

Huijg JM, Gebhardt WA, Dusseldorp E, Verheijden MW, van der Zouwe N, Middelkoop BJC, Crone MR. Physiotherapists' physical activity intervention implementation and associated factors [abstract]. *Psychology & Health* 2013;28(S11):106-107.

Huijg JM, Gebhardt WA, Crone MR, Dusseldorp E, Presseau J. Discriminant content validation of a questionnaire for implementation research based on the theoretical domains framework [abstract]. *Psychology & Health* 2013;28(S11):230-231.

Huijg JM, Gebhardt WA, Crone MR, Verheijden MW, van der Zouwe N, Middelkoop BJC. Factors influencing the adoption, implementation, and continuation of physical activity interventions in primary health care: a Delphi study [abstract]. *International Journal of Behavioral Medicine* 2012;19(S1-S3):41.

Huijg JM, van der Zouwe N, Gebhardt WA, Crone MR, Verheijden MW, Middelkoop, BJC. Introducing physical activity interventions in primary health care: a qualitative study of perceived facilitators and barriers [abstract]. *International Journal of Behavioral Medicine* 2012;19(S1-S3):41.

Huijg JM, de Regt LC, Gebhardt WA. Multiple goals and physical activity in an overweight population. Multiple goals and physical activity in an overweight population [abstract]. *Psychology & Health* 2011;26(S2):138.

Huijg JM, van der Zouwe N, Gebhardt WA, Crone MR, Verheijden MW, Paulussen TGWM, Middelkoop BJC, Martens AG. Stakeholders' perspectives on factors influencing the dissemination of physical activity interventions in primary health care [abstract]. *Psychology & Health* 2011;26(S2):139.

Huijg JM, Gebhardt WA, Crone MR, Verheijden MW, Paulussen TGWM, Middelkoop BJC, van der Zouwe N, Martens AG. Factors influencing the dissemination of physical activity interventions in primary health care: a systematic review [abstract]. *Psychology & Health* 2011;26(S2):138.

Huijg JM, Gebhardt WA, Crone MR, Verheijden MW, Paulussen TGWM, Middelkoop BJC. Preconditions for effective implementation of physical activity interventions in primary health care in the Netherlands [abstract]. *Psychology & Health* 2010;25(S1):238-239.

Presentations

Huijg JM, Gebhardt WA, Dusseldorp E, Verheijden MW, van der Zouwe N, Middelkoop BJC, Crone MR. De implementatie van beweeginterventies in de eerstelijnszorg. June 2014, Meeting Longrevalidatie Netwerk Amsterdam, Amsterdam (oral presentation).

Huijg JM, Gebhardt WA, Dusseldorp E, Verheijden MW, van der Zouwe N, Middelkoop BJC, Crone MR. De ontwikkeling van een implementatiechecklist. June 2014, WEON Preconference focus group, Leiden (oral presentation).

Huijg JM, Gebhardt WA, Dusseldorp E, Verheijden MW, van der Zouwe N, Middelkoop BJC, Crone MR. Physiotherapists' physical activity intervention implementation and associated factors. July 2013, 27th Conference of the European Health Psychology Society, Bordeaux (oral presentation).

Huijg JM, Gebhardt WA, Crone MR, Dusseldorp E, Presseau J. Discriminant content validation of a questionnaire for implementation research based on the theoretical domains framework. July 2013, 27th Conference of the European Health Psychology Society, Bordeaux (poster presentation).

Huijg JM, Gebhardt WA, Crone MR, Verheijden MW, van der Zouwe N, Middelkoop BJC. The introduction of physical activity interventions in primary health care. October 2012, AGORA Masterclass: Public health interventions in real-life settings, Wageningen Universiteit, Wageningen (oral presentation).

Huijg JM, van der Zouwe N, Gebhardt WA, Crone MR, Verheijden MW, Middelkoop BJC. Introducing physical activity interventions in primary health care: a qualitative study of perceived facilitators and barriers. August 2012, 12th International Congress of Behavioral Medicine, Budapest (oral presentation).

Huijg JM, Gebhardt WA, Crone MR, Verheijden MW, van der Zouwe N, Middelkoop BJC. Factors influencing the adoption, implementation, and continuation of physical activity interventions in primary health care: a Delphi study. August 2012, 12th International Congress of Behavioral Medicine, Budapest (oral presentation).

Huijg JM, van der Zouwe N, Gebhardt WA, Crone MR, Verheijden MW, Paulussen TGWM, Middelkoop BJC, Martens AG. Stakeholders' perspectives on factors influencing the implementation of physical activity interventions in primary health care. October 2011, *Bridging the gap between science and practice: 3rd conference and 7th annual meeting of the HEPA Europe* (poster presentation).

Huijg JM, Gebhardt WA, Crone MR, Verheijden MW, Paulussen TGWM, Middelkoop BJC, van der Zouwe N, Martens AG. Factors influencing the dissemination of physical activity interventions in primary health care: A systematic review. September 2011, 25th Conference of the European Health Psychology Society, Chersonissos (poster presentation).

Huijg JM, van der Zouwe N, Gebhardt WA, Crone MR, Verheijden MW, Paulussen TGWM, Middelkoop BJC, Martens AG. Stakeholders' perspectives on factors influencing the dissemination of physical activity interventions in primary health care. September 2011, 25th Conference of the European Health Psychology Society, Chersonissos (poster presentation).

Huijg JM, de Regt LC, Gebhardt WA. Multiple goals and physical activity in an overweight population. September 2011, 25th Conference of the European Health Psychology Society, Chersonissos (poster presentation).

Huijg JM, Gebhardt WA, Crone MR, Verheijden MW, Paulussen TGWM,
Middelkoop BJC. Preconditions for effective implementation of physical activity interventions in primary health care in the Netherlands. September 2010, 24th Conference of the European Health Psychology Society, Cluj, Romania (poster presentation).

Huijg JM, Gebhardt WA, Crone MR, Verheijden MW, Paulussen TGWM, Middelkoop BJC. Preconditions for effective implementation of physical activity interventions in primary health care in the Netherlands (research protocol). May 2010, Eight Conference on Psychology and Health, Lunteren (poster presentation).

Stellingen behorende bij het proefschrift

Towards the effective introduction of physical activity interventions in primary health care

Johanna M. Huijg

1. The effectiveness of physical activity interventions depends on the degree to which health care professionals deliver the intervention as intended (following the protocol)
2. Guidelines for health behavior change interventions should allow for tailoring to the patients' and health care professionals' needs
3. An introduction plan should be part of the development of a physical activity intervention, rather than the consequence of it
4. The introduction of physical activity interventions in health care settings should follow a stage-approach (i.e., adoption, implementation, continuation)
5. A tailored approach is essential for the development of effective introduction strategies
6. Any research on the introduction of health behavior change interventions in health care practice needs qualitative and quantitative research
7. Individual behavior change theories should guide the development of strategies to influence health care professionals' behaviors
8. Health behavior change interventions that are not evaluated should not be introduced in health care practice
9. Advice on lifestyle changes in primary health care focuses too much on disease prevention and not enough on health promotion
10. Real happiness is more related to the process than to the product
11. The best way to increase your own physical activity is to promote it to others
12. Writing a thesis helps to reduce doubts about yourself and increases doubts about others
13. Never give up

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Happiness is only real when shared – Into the wild

Josanne