

Factors Associated With Physical Therapists' Implementation of Physical Activity Interventions in the Netherlands

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Background. Physical therapists play an important role in the promotion of physical activity (PA) and the effectiveness of PA interventions. However, little is known about the extent to which they implement PA interventions following the intervention protocol and about the factors influencing their implementation behaviors.

Objective. The study objective was to investigate physical therapists' implementation fidelity regarding PA interventions, including completeness and quality of delivery, and influencing factors with a Theoretical Domains Framework-based questionnaire.

Design. The study was based on a cross-sectional design.

Methods. A total of 268 physical therapists completed the Determinants of Implementation Behavior Questionnaire. Questions about completeness and quality of delivery were based on components and tasks of PA interventions as described by the Royal Dutch Society for Physical Therapy. Multilevel regression analyses were used to identify factors associated with completeness and quality of delivery.

Results. High implementation fidelity was found for the physical therapists, with higher scores for completeness of delivery than for quality of delivery. Physical therapists' knowledge, skills, beliefs about capabilities and consequences, positive emotions, behavioral regulation, and the automaticity of PA intervention delivery were the most important predictors of implementation fidelity. Together, the Theoretical Domains Framework accounted for 23% of the variance in both total completeness and total quality scores.

Limitations. The cross-sectional design precluded the determination of causal relationships. Also, the use of a self-report measure to assess implementation fidelity could have led to socially desirable responses, possibly resulting in more favorable ratings for completeness and quality.

Conclusions. This study enhances the understanding of how physical therapists implement PA interventions and which factors influence their behaviors. Knowledge about these factors may assist in the development of strategies to improve physical therapists' implementation behaviors.

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Although physical activity (PA) plays an important role in disease prevention, health promotion, and quality of life,¹⁻³ many people are not sufficiently active.⁴ In the Netherlands, 40% of adults aged 18 to 65 years fail to achieve the national recommendation of at least 30 minutes of moderately intense PA on at least 5 days a week.⁵⁻⁷ Moreover, about 50% of adults with a chronic disease do not meet this norm.⁷ Primary health care (PHC) is an ideal setting in which to promote PA in the general population.^{8,9} Most adults visit a PHC professional at least once per year,⁸ and these professionals perceive PA promotion as an important part of their role.¹⁰ Furthermore, PHC-based PA interventions (eg, counseling about PA, prescribing PA, referral to a PA training program) are successful in increasing PA, at least in the short term.¹¹⁻¹⁴

However, the public health impact of efficacious PHC-based PA interventions is strongly dependent on how they are implemented in practice.¹⁵⁻¹⁷ *Implementation fidelity* refers to the extent to which an intervention is delivered as intended (also known as adherence, compliance, or integrity),^{16,18} including both quantity or completeness of delivery (ie, how many of the intervention components are delivered)^{16,18-20} and quality of delivery (ie, how well the intervention components are delivered).^{16,18,20,21} Although the efficacy of PHC-based PA interventions has been well studied, less attention has been paid to PHC professionals' implementation of evidence-based interventions in practice.^{21,22} 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 the accurate interpretation

of intervention outcomes,^{16,18} for example, by providing information on why interventions are (or are not) effective.²³

Because of their training and experience, physical therapists are PHC professionals who play an important role in PA promotion and, through implementation fidelity, have a strong potential to increase the effectiveness of PA interventions.^{9,24,25} Moreover, they are an important group of health care professionals delivering PA interventions in Dutch PHC.²⁶ During the past 2 decades, evidence-based practice has become important in physical therapy.^{27,28} In the Netherlands, the Royal Dutch Society for Physical Therapy (KNGF) has developed evidence-based protocols for the delivery of PA interventions to people with a variety of conditions, such as chronic obstructive pulmonary disease (COPD), diabetes, arthritis, and obesity.²⁹ These PA intervention protocols provide general information on PA and background information on the specific condition a protocol addresses and describe how physical therapists can promote PA in an evidence-based way. Furthermore, the protocols summarize the core components of PA interventions (intake, training program, evaluation, attention to maintenance of PA, and contact with the referring professional) and their underlying tasks (eg, determine goals and set up a training program with the right content and intensity). The KNGF recommends the use of these general evidence-based PA intervention protocols to guide the development of local PA intervention protocols. Furthermore, in the past decade, many Dutch physical therapists have been trained to deliver KNGF-based PA interventions to their patients.²⁶

Despite the promising findings related to the efficacy of PHC-based PA interventions,¹¹⁻¹⁴ PA interven-

tions are frequently not delivered as intended by the intervention developers.^{30,31} Furthermore, research has indicated that physical therapists' evidence-based practices can be improved.^{25,28,32,33} These situations may be due (in part) to the complexity of behaviors involved in providing patient care and delivering behavior change interventions (eg, PA interventions) as well as the many different potential determinants of such behaviors, including factors related to innovation, social setting, organizational context, innovation strategy, patient, and intervention provider.^{15,34-36} Indeed, qualitative studies have indicated that similar factors are important for PHC professionals' implementation of PA interventions³⁷ and physical therapists' evidence-based practices.³⁸ However, only limited data on physical therapists' implementation of PA interventions and factors that influence their behaviors are available. Such knowledge is a prerequisite for the development of effective strategies to enhance physical therapists' implementation behaviors.^{15,23,39-42}

Given the range of potential factors associated with health care professionals' implementation behaviors, many researchers have advocated the use of theory to guide the selection of factors to investigate.^{23,41,43-45} First, behavior change interventions that are based on theory are likely to be more effective than those that are not^{41,46-48}; the same also may be true for interventions aimed at changing health care professionals' implementation behaviors, that is, implementation strategies. Second, through assessment of the importance of theory-based factors, theoretical constructs that affect patterns of care and, therefore, may be targeted by implementation strategies can be identified.^{23,40,41} However, the heterogeneity of theories and frameworks that guide implementation research

has led to challenges in measuring theory-based factors underlying health care professionals' behaviors.^{44,45,48,49}

The Theoretical Domains Framework^{50,51} (TDF) can be used to develop a measurement instrument able to assess determinants of health care professionals' implementation of behavior change interventions.^{52,53} In the original TDF,⁵¹ 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. The TDF can be used to identify suitable theories for further investigation of specific implementation behaviors.⁵⁴ Furthermore, the TDF links influencing factors to behavior change techniques that can be used in implementation strategies.^{40,50} Huijg et al⁵⁵ developed a TDF-based questionnaire to assess potential behavioral determinants in a theory-based way. In the initial investigation of its psychometric properties, the Determinants of Implementation Behavior Questionnaire was suggested to have acceptable construct validity (based on confirmatory factor analysis), and most of the TDF domains appeared to be reliably and discriminately measurable.⁵⁵

The aim of the present study was to investigate the extent to which physical therapists deliver PA interventions with high fidelity (ie, following the intervention protocol) and which TDF domains⁵¹ are associated with completeness and quality of delivery. The 3 specific questions were: (1) To what extent do physical therapists deliver all PA intervention components to all of their patients (ie, completeness)? (2) How well do they deliver PA interventions (ie, quality)? and (3) Which TDF domains are associated with physical therapists' completeness and quality of delivery?

Method

Design and Respondents

This cross-sectional questionnaire study was conducted via the Internet with Qualtrics software (version 45433, Qualtrics, Provo, Utah).⁵⁶ Recruitment and data collection took place between June 2012 and March 2013. We recruited physical therapists delivering PA interventions to a variety of target groups to examine the association between the TDF domains and the implementation of PA interventions in general. The PA interventions under study were based on evidence-based PA intervention protocols recommended by the KNGF for COPD, diabetes, arthritis, and obesity²⁹ and were similar with regard to their core components (intake, training program, evaluation, attention to maintenance of PA, and contact with the referring professional).

The first strategy for recruiting physical therapists was to contact their professional associations and collaborations within the Netherlands. These associations and collaborations invest time and effort in the implementation of PA interventions by, for example, developing local PA intervention protocols, providing training, and organizing meetings. When associations and collaborations were willing to participate in the study, a questionnaire on the implementation of the specific PA intervention on which they chose to be evaluated was developed. Subsequently, member physical therapists were sent an e-mail including a 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 under study and if they were working in PHC. Because completing the questionnaire indicated consent, no separate consent was obtained. Individ-

ual physical therapists were rewarded with a €25 voucher for their participation. Associations and collaborations were provided with a summary of the results.

The second recruitment strategy was to identify physical therapists delivering PA interventions via the Internet and practice websites. The physical therapists were contacted by telephone or e-mail and invited to join the study. Therapists who were willing to participate were sent an e-mail including a link to the online questionnaire. After 1, 2, and 3 weeks, nonrespondents received a reminder; at the end of the study, nonrespondents were sent an e-mail with a questionnaire about their demographic characteristics and their reasons for not participating in the study.

Measurement

Demographic characteristics. Respondents and nonrespondents reported their sex, age, practice/workplace, and the socioeconomic status of most of the patients to whom they deliver interventions. Practice experience was reported in years. Experience with PA interventions was measured in a slightly different manner for the first group of recruited respondents than for nonrespondents or respondents recruited later on. Initially, the physical therapists were asked to how many patients in total they had delivered the intervention; later on, they were asked how many patients they had delivered the intervention to in the last 2 years. This change in questioning was based on respondents stating that it was difficult to report the total number of patients to whom they had delivered the intervention. Therefore, median scores were calculated for experience with PA interventions. Scores below the median indicated a shorter period of experience, and median scores and

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scores above the median indicated a longer period of experience.

Implementation fidelity. Physical therapists' implementation fidelity for PA interventions, including completeness and quality of delivery, was assessed with a self-report questionnaire. The content of the questionnaire was based on the core components of PA intervention protocols recommended by the KNGF for COPD, diabetes, arthritis, and obesity (intake, training program, evaluation, attention to maintenance of PA, and contact with the referring professional) and their underlying tasks (Appendix 1).

Completeness of delivery was assessed by asking physical therapists with how many patients receiving interventions they had performed a certain task. The completeness of delivery of different intervention components was assessed with multiple items. On average, intake completeness was measured with 12 items, training program completeness was measured with 9 items, evaluation completeness was measured with 5 items, and attention to maintenance of PA completeness and contact with the referring professional completeness were measured with 2 items each. A sample question was, "With how many of the patients 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, we calculated a total completeness score on the basis of the mean scores for all completeness items as well as a mean completeness score for each intervention component.

Specific PA intervention protocols were used to tailor completeness items to PA interventions concerning COPD, diabetes, arthritis, and

obesity. This approach resulted in questionnaires that were similar for all physical therapists with regard to the intervention components and tasks but that were slightly different for various PA interventions with regard to the assessment of completeness at the item level. For instance, questionnaires assessing intake completeness in the delivery of PA interventions to people with COPD included a score for the assessment of patients' breathlessness, but this score was not included in the diabetes, arthritis, and obesity questionnaires. Furthermore, physical therapists' measurement of waist circumference was included in questionnaires on diabetes and obesity PA interventions, but this task was not included in the other questionnaires.

Quality of delivery was assessed by asking physical therapists' about their satisfaction with the delivery of a specific intervention component (intake, training program, evaluation, attention to maintenance of PA, and contact with the referring professional). Thus, quality was assessed with 5 items in total. A sample 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, we calculated a total score for quality of delivery on the basis of the mean scores for all quality items.

TDF domains. The Determinants of Implementation Behavior Questionnaire⁵⁵ (Appendix 2) was used to assess which TDF domains were associated with 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 approach allowed us to assess one general behavior in relation to each domain instead of all of the different tasks involved in delivering PA interventions. To remind respondents about what this general behavior included for them, we presented them with the tasks that they would be required to perform if they were to deliver the specific PA intervention that they were using following the intervention protocol. A sample question was, "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 and 7=strongly agree). Mean scores were calculated for each of the 18 domains assessed in the questionnaire. For the domains organization and social influences, it was possible to use "not applicable" for some items; these scores were recorded as missing. To calculate the mean of the specific domains, we imputed data for items with missing values for each respondent separately by using the respondents' mean for the remaining items.

The questionnaire was pilot tested with 5 research colleagues and a sample of physical therapists (n=8). Pilot testing 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 their delivery.

Data Analysis

The target sample size was based on the recommendation of Stevens⁵⁷ for a minimum of 270 respondents in a multiple regression analysis with 18 predictors.

Questionnaires were exported from Qualtrics⁵⁶ to IBM SPSS Statistics for Windows (version 19.0, IBM Corp,

Armonk, New York)⁵⁸ for analyses. Differences in demographic characteristics between respondents and nonrespondents were analyzed with chi-square tests for categorical variables and independent *t* tests for continuous variables. Associations between domains were assessed with the Pearson correlation and were defined as small (.10), medium (.30), and large (.50), in accordance with the guidelines of Cohen.⁵⁹ Intra-class correlations were calculated to assess the proportion of the total variability in the outcome that was attributable to the different PA interventions.

To answer the third research question (associations between the 18 TDF domains and the outcome variables self-reported completeness of delivery and quality of delivery), we performed multilevel regression analyses⁶⁰ for each outcome variable separately. These multilevel analyses took into account the nonindependence of physical therapist scores (level 1) nested within the different PA interventions that they delivered (level 2). Two types of multilevel analyses were performed: a series of analyses including each domain separately as a predictor variable to assess (per domain) its univariate association with the outcome variable and an analysis including all domains together as predictor variables to identify the domains having the strongest unique association with the outcome variable (ie, adjusted for the influence of the other domains). Domains with strong univariate associations provide possible clues for targets of implementation strategies. Domains with the strongest unique association can be regarded as the most influential ones.

In the univariate multilevel analyses, the false discovery rate controlling procedure⁶¹ was used to correct for multiple testing. In the multivariate

Table 1.Demographic Characteristics of Respondents and Nonrespondents^a

Demographic Variable	Respondents (n=268)		Nonrespondents (n=68)	
	\bar{X} (SD)	No. (%)	\bar{X} (SD)	No. (%)
Sex				
Men		112 (41.8)		27 (38.6) ^b
Women		156 (58.2)		39 (55.7) ^b
Age, y	39.8 (12.3) ^c		45.6 (11.7) ^{c,d}	
Practice experience, y	15.0 (11.3) ^e		19.8 (11.8) ^{c,e}	
Experience with physical activity intervention (based on median scores)				
Short		121 (45.1)		26 (48.1) ^e
Long		147 (54.9)		28 (51.9) ^e
Type of practice/workplace				
Solo practice		7 (2.6)		3 (4.3) ^d
Duo practice		9 (3.4)		1 (1.4) ^d
Group practice		183 (68.3)		36 (51.4) ^d
Multidisciplinary health care center		61 (22.8)		11 (15.7) ^d
Other		8 (3.0)		4 (5.7) ^d
SES of patients receiving interventions				
Mostly high SES		6 (2.2)		4 (5.7) ^d
50:50		141 (52.6)		30 (42.9) ^d
Mostly low SES		121 (45.1)		21 (30.0) ^d

^a The results of chi-square tests and independent *t* tests are reported. SES=socioeconomic status.

^b n=66.

^c *P*<.05.

^d n=55.

^e n=54.

multilevel analyses, we computed the proportion of variance explained (R^2) at the first level, that is, the physical therapist level. The R^2 can be regarded as a measure of the total goodness of fit of the solution (ie, ranging from 0 to 1). The R^2 was calculated as the decrease in residual variance from the intercept-only model to the model of interest (see formula 4.8 in Hox,^{60(p71)} based on Raudenbush and Bryk⁶²).

Role of the Funding Source

This research was funded by ZonMw, the Netherlands Organisation of Health Research and Development.

Results

Characteristics of the Respondents

Of the 496 physical therapists invited for the study, 274 (55.2%) delivering 15 different PA interventions completed the questionnaire. Of the 274 questionnaires, 268 were used in the analyses. Reasons for removal were no experience with PA intervention delivery (n=4) and nonreliable completeness and quality scores (n=2). Table 1 shows the characteristics of the respondents and nonrespondents. Of the respondents, 58.2% (n=156) were women, their average age was 39.8 (SD=12.3) years, and they had an average of 15.0 (SD=11.3) years of practice experience. Most of the

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Table 2.

Completeness and Quality Scores and Intraclass Correlation Coefficients (ICCs) (n=268)^a

Intervention Component	Completeness				Quality			
	\bar{X} (SD)	Median	IQR	ICC	\bar{X} (SD)	Median	IQR	ICC
A. Intake	6.2 (0.7)	6.4	0.84	.11	5.5 (0.9)	5.0	1.00	.00
B. Training program	6.1 (0.7)	6.2	0.82	.12	5.4 (0.8)	5.0	1.00	.00
C. Evaluation	6.1 (1.1)	6.4	1.20	.15	5.1 (1.1) ^b	5.0 ^b	1.00 ^b	.00 ^b
D. Attention to maintenance of physical activity	6.0 (1.2)	6.0	1.00	.03	4.9 (1.2)	5.0	2.00	.04
E. Contact with the referring professional	5.6 (1.4) ^b	6.0 ^b	2.00 ^b	.10 ^b	4.9 (1.2) ^b	5.0 ^b	1.00 ^b	.01 ^b
Total	6.0 (0.7)	6.0	0.88	.04	5.2 (0.8)	5.2	0.87	.00

^a IQR=interquartile range.

^b n=255.

respondents worked in a group practice (68.3%, n=183), and most delivered PA interventions to equal percentages of patients with low and high socioeconomic status (52.6%, n=141) or, specifically, to patients with low socioeconomic status (45.1%, n=121). None of the demographic variables showed a significant correlation with total completeness and quality scores (data not shown).

Of the 222 nonrespondents, 68 (30.6%) completed the nonrespondent questionnaire. Comparisons between respondents and nonrespondents indicated that the latter were significantly older and had more practice experience. The main reasons for not filling out the questionnaire were lack of experience with the specific PA intervention addressed by the questionnaire (n=26), lack of experience delivering the PA intervention due to a lack of patients receiving the PA intervention (n=33), and lack of time to fill out the questionnaire (n=16).

Implementation Fidelity

Physical therapists' completeness and quality scores are shown in Table 2. Mean completeness scores ranged from 5.6 (SD=1.4; for contact with the referring professional) to 6.2 (SD=0.7; for intake), indicat-

ing that (on average) the respondents delivered PA interventions following the intervention protocol to more than half and almost all of the patients receiving interventions. Mean quality scores were lower but were still relatively high, ranging from 4.9 (SD=1.2; for attention to maintenance of PA) to 5.5 (SD=0.9; for intake). These data indicated that (on average) the respondents were satisfied with how they delivered PA interventions. Correlations between completeness and quality scores ranged from .36 to .68, indicating that these were indeed different outcome measures (data not shown).

Role of Different PA Interventions in the Data

Intraclass correlation coefficients (ICCs) are shown in Table 2. The ICCs for completeness were higher than the ICCs for quality, indicating that the influence of the different PA interventions was larger for how respondents reported the completeness of delivery than for how they reported the quality of delivery. The ICCs for intake, training program, and evaluation completeness were higher than .10, supporting the appropriateness of multilevel analyses.⁶³

Domains

Table 3 shows descriptive variables and correlations for all domains. The mean scores indicated that the physical therapists had generally favorable perceptions toward delivering PA interventions following the intervention protocol. The highest mean scores were found for the domains knowledge (\bar{X} =5.95, SD=0.84), organization (\bar{X} =5.82, SD=1.06), and skills (\bar{X} =5.80, SD=1.01). These data indicated that the respondents were positive about their knowledge and skills for delivering PA interventions following the intervention protocol and that the organizations at which they worked provided them with sufficient resources and support to deliver PA interventions following the intervention protocol. The lowest mean scores were found for the domains negative emotions (\bar{X} =1.68, SD=0.79), sociopolitical context (\bar{X} =3.05, SD=1.22), and innovation strategy (\bar{X} =4.16, SD=0.96). These data indicated that the respondents experienced few negative emotions while delivering the PA intervention; that they thought the medical culture and the availability of support in the sociopolitical context could be improved; and that they thought innovation strategies, such as training, material, and reimbursement, could be improved. Correlations between

Table 3. Correlations and Descriptive Statistics for All Domains (n = 268)

Domain or Parameter	Correlation for:																	
	D1	D2	D3	D4	D5	D6	D7	D8	D9	D10	D11	D12	D13	D14	D15	D16	D17	D18
D1: Knowledge		.72 ^a	.68 ^a	.34 ^a	.09	.37 ^a	.23 ^a	.17 ^a	.20 ^a	.05	.14 ^a	.14 ^b	.06	.16 ^a	.33 ^a	-.30 ^a	.28 ^a	.24 ^a
D2: Skills			.76 ^a	.38 ^a	.11	.43 ^a	.36 ^a	.19 ^a	.16 ^a	.03	.15 ^b	.22 ^a	.04	.24 ^a	.32 ^a	-.32 ^a	.35 ^a	.37 ^a
D3: Social/professional role and identity				.33 ^a	.08	.45 ^a	.41 ^a	.21 ^a	.15 ^b	.09	.11	.22 ^a	.11	.28 ^a	.25 ^a	-.26 ^a	.31 ^a	.33 ^a
D4: Beliefs about capabilities					.30 ^a	.50 ^a	.39 ^a	.27 ^a	.54 ^a	.14	.34 ^a	.29 ^a	.23 ^a	.43 ^a	.46 ^a	-.36 ^a	.63 ^a	.55 ^a
D5: Optimism						.23 ^a	.08	.07	.21 ^a	.09	.23 ^a	.18 ^a	.02	.16 ^a	.30 ^a	-.15 ^b	.21 ^a	.15 ^a
D6: Beliefs about consequences							.50 ^a	.35 ^a	.32 ^a	.14 ^b	.30 ^a	.40 ^a	.28 ^a	.46 ^a	.50 ^a	-.31 ^a	.50 ^a	.41 ^a
D7: Intentions								.35 ^a	.22 ^a	.17 ^a	.25 ^a	.37 ^a	.19 ^a	.43 ^a	.35 ^a	-.31 ^a	.46 ^a	.46 ^a
D8: Goals									.18 ^a	.07	.18 ^a	.25 ^a	.07	.27 ^a	.26 ^a	-.26 ^a	.30 ^a	.30
D9: Innovation										.29 ^a	.28 ^a	.20 ^a	.26 ^a	.34 ^a	.35 ^a	-.29 ^a	.42 ^a	.43 ^a
D10: Sociopolitical context											.17 ^a	.19 ^a	.16 ^b	.31 ^a	.28 ^a	-.26 ^a	.21 ^a	.21 ^a
D11: Organization												.19 ^a	.36 ^a	.24 ^a	.16 ^b	-.02	.18 ^a	.14 ^b
D12: Patient													.17 ^a	.43 ^a	.34 ^a	-.22 ^a	.34 ^a	.36 ^a
D13: Innovation strategy														.25 ^a	.17 ^a	-.02	.13 ^b	.09
D14: Social influences															.37 ^a	-.22 ^a	.48 ^a	.46 ^a
D15: Positive emotions																-.52 ^a	.48 ^a	.38 ^a
D16: Negative emotions																	-.40 ^a	-.33 ^a
D17: Behavioral regulation																		.51 ^a
D18: Nature of the behaviors																		
Cronbach alpha (no. of items)	.93 (4)	.85 (3)	.91 (3)	.84 (11)	.79 (3)	.83 (12)	.91 (3)	.88 (2)	.68 (5)	.72 (3)	.85 (4)	.74 (2)	.82 (7)	.86 (7)	.84 (6)	.85 (6)	.77 (6)	.86 (6)
\bar{X}	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

^a P < .01.
^b P < .05.

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Table 4.

Domains and Total Completeness and Quality of Delivery (n=268)^a

Domain	Univariate Analyses						Multivariate Analysis					
	Completeness			Quality			Completeness ^b			Quality ^b		
	b	95% CI	P	b	95% CI	P	b	95% CI	P	b	95% CI	P
D1: Knowledge	.20	0.11, 0.30	.000⁵	.30	0.19, 0.40	.000⁵						
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	.000¹	.60	0.48, 0.73	.000¹	.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	.000³	.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: Sociopolitical 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	.000⁴						
D16: Negative emotions				-.25	-0.37, -0.13	.000 ⁹						
D17: Behavioral regulation	.33	0.22, 0.45	.000²	.40	0.27, 0.53	.000²						
D18: Nature of the behaviors	.19	0.11, 0.27	.000⁴	.27	0.18, 0.36	.000³						

^a After the false discovery rate controlling procedure was used to correct for multiple testing, the overall *P* value was .05. Values printed in bold type were the most important predictors, as indicated by the corrected *P* values. Superscript numerals indicate ranks of *P* values. CI=confidence interval (note that *P* values were controlled for multiple testing but that CIs were not).

^b Model fit (*R*²)=.23.

domains were mostly small or medium; 11 correlations were large.

Domains and Implementation Fidelity

With regard to total completeness and total quality, univariate multilevel analyses revealed multiple significant predictors (Tab. 4). On the basis of ranked *P* values, the most important predictors of both total completeness and total 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. The multivariate analysis resulted in only one sig-

nificant predictor of both total completeness and total quality—beliefs about capabilities. Together, the TDF domains accounted for 23% (*P*<.001) of the variance in both total completeness of delivery and total quality of delivery.

The most important predictors of physical therapists' total completeness and quality scores were confirmed by univariate multilevel analyses of the completeness and quality of delivery of the different intervention components (Tabs. 5 and 6). Knowledge, skills, beliefs about capabilities, and behavioral regulation were significantly associated with the completeness of delivery and the 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 the quality of delivery but not with the completeness of delivery of all intervention components.

Domains unrelated to implementation fidelity outcomes were innovation strategy (ie, unrelated to total completeness and quality of delivery) and optimism, sociopolitical context, and negative emotions (ie, unrelated to total completeness) (Tab. 4). Furthermore, the domains innovation strategy and sociopolitical context were unrelated to the completeness of delivery of any of the intervention components (Tab. 5).

Table 5.Domains and Completeness of Delivery of Intervention Components (Univariate Analyses) (n=268)^a

Domain	A. Intake		B. Training Program		C. Evaluation		D. Attention to Maintenance of Physical Activity		E. Contact with the Referring Professional ^b		n
	b	95% CI	b	95% CI	b	95% CI	b	95% CI	b	95% 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: Sociopolitical context											0/5
D13: Innovation strategy											0/5

^a After the false discovery rate controlling procedure was used to correct for multiple testing, the overall *P* value was .05. CI=confidence interval (note that *P* values were controlled for multiple testing but that CIs were not).

^b n=255.

Discussion

Because of the increasing importance of physical therapists' evidence-based practices, we investigated physical therapists' completeness and quality of delivery of PA interventions. To our knowledge, this is the first study investigating physical therapists' implementation of PA interventions in general as well as factors associated with their implementation behaviors.

The data from the respondents indicated that they delivered PA interventions with high fidelity. The completeness and quality scores indicated that they delivered PA interventions following the intervention protocol to more than half and almost all of their patients and that they were satisfied with the quality

that they provided. The completeness scores appeared to be very good, particularly given that tailoring PA interventions to individual patients' needs may, at times, require deviation from the protocol.³³ The high completeness scores may be explained by the use of a self-report questionnaire to assess implementation fidelity (discussed further below). Given the range of satisfaction scores (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), our results suggested that physical therapists' quality of delivery of PA interventions could be improved. The findings seem to be in line with previous research on physical therapists' evidence-based practices, which sug-

gests that the majority of patients receives evidence-based care but that there is still room for improvement.^{25,28,32,33}

The results of the univariate multi-level analyses indicated that the most important domains associated with implementation fidelity were physical therapists' knowledge; skills; beliefs about capabilities to deliver PA interventions following the intervention protocol; beliefs about consequences of delivering PA interventions following the intervention protocol; positive emotions toward working with PA interventions; 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 the extent to which deliv-

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Table 6.

Domains and Quality of Delivery of Intervention Components (Univariate Analyses) (n=268)^a

Domain	A. Intake		B. Training Program		C. Evaluation ^b		D. Attention to Maintenance of Physical Activity		E. Contact with the Referring Professional ^b		n
	b	95% CI	b	95% CI	b	95% CI	b	95% CI	b	95% 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: Sociopolitical context			.11	0.02, 0.19							1/5
D13: Innovation strategy							.19	0.03, 0.34			1/5

^a After the false discovery rate controlling procedure was used to correct for multiple testing, the overall *P* value was .05. CI=confidence interval (note that *P* values were controlled for multiple testing but that CIs were not).

^b n=255.

ering PA interventions following the intervention protocol is an automatic behavior. The importance of these domains was previously reported in qualitative studies of health care professionals' behaviors.^{38,48,64-66} Furthermore, constructs related to the domains knowledge,²⁵ beliefs about capabilities (self-efficacy^{42,67} and perceived behavioral control^{42,67,68}), beliefs about consequences (outcome expectations^{42,67} and attitudes^{28,67,68}), behavioral regulation (action planning^{42,67} and coping planning⁴²), and nature of the behaviors (automaticity or habit^{42,67,68}) were found to predict health care professionals' behaviors in multiple quantitative studies. The findings suggest suitable theories for further investigation of physical therapists'

implementation of PA interventions, such as the Social Cognitive Theory,⁶⁹ the Theory of Planned Behavior,⁷⁰ and the Self-regulation Theory.⁷¹ Furthermore, they provide possible clues for targets of implementation strategies. For linking associated domains to techniques of behavior change,^{40,50} strategies for enhancing physical therapists' implementation fidelity may include discussion and elaboration of guidelines to enhance knowledge and beliefs about consequences,⁷² modeling and self-monitoring to enhance beliefs about capabilities and skills,⁷² forming implementation intentions to enhance planning,⁷² and self-monitoring and positive feedback to increase the automaticity of implementing PA interventions following the intervention protocol.⁷³ These

goals could be achieved through well-designed implementation strategies, such as the provision of workshops and conferences, and systems to register behaviors related to guidelines.

On the basis of the results of the multivariate multilevel analyses, beliefs about capabilities appeared to be the most influential domain, with the strongest unique association with implementation fidelity. Together, the domains accounted for 23% of the variance in both total completeness of delivery and total quality of delivery. Although Huijg et al⁵⁵ demonstrated discriminant validity of the domains of the Determinants of Implementation Behavior Questionnaire, the lower percentage of explained variance in the present

study may be attributable to the large correlations between some of the domains, implying that they were not independent. In addition, the fact that only one significant predictor was found in the multivariate analysis, whereas in the univariate analyses many domains were significantly associated with the outcome variable, indicates that domains explain more or less the same portion of variations in implementation behaviors.

This finding may 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. Therefore, the multivariate approach of exploring associations between domains and implementation behaviors 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 that relate to implementation behaviors are included, but they suggest that more effort is needed in formulating the paths through which domains influence behaviors. Moreover, the TDF may be used in a different approach, such as operationalizing different theories and comparing their predictive validities or operationalizing a specific theory (eg, the Theory of Planned Behavior⁷⁰) and investigating the integration of other theoretical domains (eg, 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 sociopolitical context and innovation strategy. The lack of effect of optimism and negative emotions may have been related to physical therapists' feedback on these

specific questionnaire items, indicating that emotions do not play a role in how they do their work; however, the domain positive emotions was significantly related to the outcome variables. Notably, domains unrelated to implementation fidelity mainly concerned the context, whereas the most important domains associated with implementation fidelity were related to the individual physical therapist. A possible explanation for the lack of effect of the context domains is that we included physical therapists who were already delivering PA interventions to their patients, as we were interested in physical therapists' implementation behaviors. Therefore, the contextual barriers usually encountered before delivery takes place (ie, in the adoption stage), such as lack of financial support from insurance companies and a consequent lack of PA intervention patients, did not play a role. Our results correspond to previous research reporting that contextual factors are more related to the adoption of innovations and less related to their implementation.^{74,75}

Some limitations of the present study should be considered in the interpretation of the results. First, we took the perspective that generally PHC-based interventions are effective when they are delivered as intended. However, we still need to identify the active ingredients within PA intervention components and the conditions under which interventions are effective.⁷⁶ Second, because of the cross-sectional design of the study, no causal relationships could be determined. One of the main limitations of the present study was the use of a self-report questionnaire to assess implementation fidelity; the possibility of socially desirable responses may have led to more favorable ratings of completeness and quality of delivery. Specifically, it might be problematic to ask phys-

ical therapists to rate the quality of their own practices, which, in this study, was operationalized by a series of satisfaction questions. Moreover, it may be difficult for physical therapists to recall their behaviors with regard to specific tasks (ie, recall bias). Researchers may want to use other methods, such as observation, medical records data, and patient self-report, to assess physical therapists' implementation behaviors. However, because all of these methods have their own advantages and disadvantages,⁷⁷ a comprehensive assessment of physical therapists' practices may require multiple data collection methods.⁷⁸ These issues emphasize the need for studies of instruments designed to reliably measure physical therapists' completeness and quality of delivery of PA interventions, including the use of a combination of data collection methods.

Another limitation is related to the 55.2% response rate, which suggests a potential selection bias of study recruitment. In addition, comparisons of respondents and nonrespondents indicated that the latter were significantly older and had more practice experience. Although the response rate is similar to those reported by Shirley et al⁹ and van der Wees et al,⁷⁹ our respondents may have been physical therapists who found it more important to deliver PA interventions following the intervention protocol. This possibility may explain the high scores for implementation fidelity and little variation between them, limiting the generalizability of our results. The sample used for the present study comprised physical therapists delivering PA interventions to people with COPD, diabetes, arthritis, and obesity. Although the study sample was a heterogeneous group, the PA interventions delivered to the patients may have been more similar to each other than other types of PA

interventions, such as those given to people with low back pain. Therefore, our findings should be interpreted with caution and cannot automatically be generalized to physical therapists delivering PA interventions to other target groups. Finally, we did not ask respondents about their reasons for not following the intervention protocol. We recommend inclusion of this question in future research, as deviation from the protocol may be valuable; for example, an intervention may need to be tailored to an individual patient's needs. In addition, deviations can provide information on how to improve existing guidelines.

To our knowledge, this is the first study 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 with a TDF-based questionnaire can help identify theories that can be used to further investigate the implementation of PA interventions.⁵⁴ Knowledge about which factors influence physical therapists' implementation fidelity can inform the development of strategies to promote the effective implementation of PA interventions, which, in turn, can enhance the public health impact of evidence-based PA interventions.^{15,23,39-42} With regard to the first and second research questions, respondents reported that they delivered PA interventions to most of the patients receiving interventions and that they were satisfied with the quality that they provided. On the basis of the most important TDF domains 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 con-

sequences, positive emotions, the quality of implementation plans, and the automaticity of delivery of PA interventions following the intervention protocol (ie, the third research question). Future studies should focus on investigating causal relationships between factors and implementation behaviors and should incorporate more objective measures of implementation fidelity. Finally, when theory-based determinants are targeted by implementation strategies, well-specified behavior change techniques should be used,⁷⁶ and their effectiveness should be investigated in randomized controlled trials.

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This study was approved by the Medical Ethics Committee of Leiden University Medical Center (reference no. NV/CME 09/081).

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Appendix 1.

Physical Activity (PA) Intervention Components, Tasks, and Sample Items Measuring Implementation Fidelity^a

PA Intervention Component	Tasks	Sample Items Measuring Completeness of Delivery	Items Measuring Quality of Delivery
A. Intake		With how many patients did you . . .	How satisfied are you with how you did the intake?
	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?	
B. Training program		For how many patients did you . . .	How satisfied are you with how you delivered the training program?
	Set up a 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 per week?	
	Do measurements	. . . regularly measure training parameters?	
	Report parameters	. . . report the parameter data following the reporting guidelines?	
C. Evaluation		With how many patients did you . . .	How satisfied are you with how you did the evaluation?
	Conduct evaluation session	. . . conduct an evaluation session?	
	Check goal achievement	. . . check whether goals were achieved?	
	Readminister questionnaires	. . . readminister 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?	
D. Attention to maintenance of PA		For how many patients did you . . .	How satisfied are you with how you gave attention to patients' maintenance of PA after the intervention was finished?
	Attention to maintenance of PA	. . . give attention to the maintenance of PA after the intervention was finished?	
E. Contact with the referring professional		For how many patients did you . . .	How satisfied are you with how you reported to the referring professional?
	Contact with the referring professional	. . . report to the referring professional on the course and results of the PA intervention?	

^a The questionnaire was developed in Dutch. For the purpose of this article, all items were translated into English. PAR-Q=Physical Activity Readiness Questionnaire, 6MWT=Six-Minute Walk Test. The core components (and their underlying tasks) of PA interventions shown in Appendix 1 are based on evidence-based protocols recommended by the Royal Dutch Society for Physical Therapy (KNGF) for the delivery of PA interventions to people with chronic obstructive pulmonary disease, diabetes, arthritis, and obesity.²⁹ The PA intervention protocols recommended by the KNGF provide general information on PA and background information on the specific condition the protocol addresses and describe how physical therapists can promote PA in an evidence-based way. Moreover, the KNGF has developed an additional document²⁹ that describes chronic conditions and health care in the Netherlands, PA in people with a chronic condition, and theories on changing PA behavior. Specifically, several important theories on behavior and behavior change are discussed. With regard to individual theories, the factors that influence PA behavior are described, and strategies that physical therapists can use to promote PA behavior are presented. Examples of factors and strategies to promote PA behavior are as follows:

a. Attitudes: It is important for physical therapists to know how their patients think about PA. Attitudes can be influenced by discussing advantages and disadvantages of PA so as to alter incorrect presumptions and reinforce correct presumptions.⁸⁰

b. Self-efficacy: Physical therapists should assess their patients' self-efficacy and to what extent this factor inhibits PA behavior change. Self-efficacy can be influenced by training skills, which can be provided to patients through graded tasks.⁸⁰

c. Motivation: Motivational interviewing can be used to influence patients' motivation to change their PA behavior. Goal setting, monitoring behavior, and the provision of feedback on goal achievement are important elements of motivational interviewing. Furthermore, expressing empathy about patients' ambivalence and developing discrepancy with regard to their old behaviors is an example of a motivational interviewing strategy.⁸¹

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Appendix 2.

Determinants of Implementation Behavior Questionnaire^a

Domain	Constructs (No. of Items)	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 delivering the intervention 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 in delivering [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 patients 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 patients' maintenance of PA behavior outside [PA intervention] is (very difficult – very easy)
		For me, reporting about [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

(Continued)

Appendix 2.

Continued

Domain	Constructs (No. of Items)	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, patients will be appreciative
		Delivering [PA intervention] following the intervention protocol will strengthen collaboration with professionals with whom I deliver [PA intervention]
		If I deliver [PA intervention] following the intervention protocol, I will feel satisfied
		Delivering [PA intervention] following the intervention protocol will help patients 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 patients
	D7: Intentions	Intention (3)
I will definitely deliver [PA intervention] following the intervention protocol in the next 3 months		
How strong is your intention to deliver [PA intervention] following the intervention protocol in the next 3 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 patients' 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
D10: Sociopolitical context	Sociopolitical 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 toward prevention

(Continued)

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Appendix 2.

Continued

Domain	Constructs (No. of Items)	Items
D11: Organization	Organizational resources and support (4)	In the organization at which I work, all necessary resources are available to deliver [PA intervention]
		I can count on support from the management of the organization at which I work, when delivering [PA intervention] following the intervention protocol is difficult
		The management of the organization at which I work is willing to listen to my problems with delivering [PA intervention] following the intervention protocol
		The management of the organization at which I work is helpful with delivering [PA intervention] following the intervention protocol
D12: Patient	Patient characteristics (2)	Patients receiving [PA intervention] are motivated
		Patients receiving [PA intervention] are positive about [PA intervention]
D13: Innovation strategy	Innovation strategies (7)	[Implementing organization] provides professionals with 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 peer support 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 that 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 delivering [PA intervention] following the intervention protocol is difficult
		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		
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

(Continued)

Appendix 2.
Continued

Domain	Constructs (No. of Items)	Items
D17: Behavioral regulation	Action planning (3)	I have a clear plan regarding how I will deliver [PA intervention] following the intervention protocol
		I have a clear plan regarding circumstances under which I will deliver [PA intervention] following the intervention protocol
		I have a clear plan regarding 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 patients 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
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

^a Reprinted with permission from: Huijg JM, Gebhardt WA, Dusseldorp E, et al. Measuring determinants of implementation behavior: psychometric properties of a questionnaire based on the Theoretical Domains Framework. *Implement Sci.* 2014;9:33. PA=physical activity, PT=physical therapist.

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