Diagnosis and Treatment in Physical Therapy: An Investigation of Their Relationship

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Diagnosis and Treatment in Physical Therapy: An Investigation of Their Relationship

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Background and Purpose. *The diagnosis made by a physical therapist gives direction to the selection of therapeutic interventions. Therefore, in an investigation, specific relationships between diagnoses and therapeutic interventions are expected. This study was designed to test whether such relationships exist.* **Subjects and Methods.** *Data on diagnosis, treatment goals, and interventions were gathered on 8,714 patients by 74 physical therapists. The diagnosis and treatment goals were defined in terms of impairments and disabilities.* **Results.** *Specific relationships were found to exist between those impairments and disabilities that were chosen as a basis for forming treatment goals and the application of interventions. These relationships are particularly marked at the impairment level.* **Conclusion and Discussion.** *It is concluded that the diagnostic categories validly predict which interventions are applied and that the selection of interventions depends on which treatment goals are pursued. [Dekker J, van Baar ME, Curfs EC, Kerssens JJ. Diagnosis and treatment in physical therapy: an investigation of their relationship. Phys Ther. 1993;73:568–580.]*

Key Words: *Classification, Diagnosis, Intervention, Physical therapy, Survey research.*

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The need for studies on the diagnoses made by physical therapists and the relationship of these diagnoses to treatment has only recently been recognized.[1-3] Although physical therapists evaluate their patients' dysfunctions to direct treatments accordingly, studies of the diagnostic process and categories do not seem to be available. Such studies could serve various purposes. A clear understanding of the diagnoses made by physical thera-

pists can facilitate communication about patients' dysfunctions and indications for treatment. Identification of homogeneous diagnostic groups may be required for rational management of personnel and financial resources. The professional status of physical therapy can be strengthened by the existence of a scientifically based diagnostic system. Finally, research can be facilitated by a valid diagnostic system.

Diagnosis by a physical therapist has been defined by Sahrmann:

> *Diagnosis* is the term that names the primary dysfunction toward which the physical therapist directs treatment. The dysfunction is identified by the physical therapist based on information obtained from the history, signs, symptoms, examination, and tests the therapist performs or requests.[2(p1705)]

In the literature, various approaches have been described for the identification and classification of these "primary dysfunctions." Both the International Classification of Impairments, Disabilities, and Handicaps (ICIDH)[4-6] and a model developed by Nagi[7] have been proposed as diagnostic frameworks of physical therapy. In the ICIDH, dysfunctions are defined at three levels: (1) impairment—the consequences of disease at the organ level, (2) disability—the conse-

Diagnosis	Treatment Goals	Treatment
All impairments and disabilities that are observed in a patient	Subset of impairments and disabilities chosen as a basis for forming treatment goals; the treatment is primarily aimed at alleviation of these impairments and disabilities	Application of interventions aimed at alleviation of the impairments and disabilities chosen as a basis for forming treatment goals

Figure. *The relationship among diagnosis, treatment goals, and treatment.*

quences at the level of the person, and (3) handicap—the consequences at the level of social roles. Because quite a number of diagnostic categories that are important to physical therapists do not occur in the ICIDH, a modification of the ICIDH has been developed by Heerkens et al.[8] Based on an earlier version of that work,[9] we have developed a survey questionnaire for the assessment of impairments and disabilities in survey research in physical therapy.[10] It should be noted, however, that the ICIDH framework is not without its critics. Guccione[7] has argued in favor of a model developed by Nagi. In our view, the modified ICIDH and Nagi's model are not dissimilar. Research should indicate which model is most appropriate.

As indicated by Sahrmann's definition,[2] the primary goal of the diagnosis should be to give direction to the therapeutic approach. The diagnosis provides information about the patient's impairments and disabilities, which the therapist uses to select interventions. Consequently, in an investigation, relationships should be found between the impairments and disabilities that are chosen as a basis for forming treatment goals and the interventions that are applied. The application of interventions should depend on the specific impairment or disability that is chosen as a treatment goal (Figure). If such relationships do not exist, one should seriously question whether the diagnostic categories have predictive validity for the treatment.

Our study was designed to test whether relationships exist between diagnosis and treatment in physical therapy. Data were gathered on diagnosis (as defined in our ICIDH-based survey questionnaire), as well as treatment goals and interventions. These data were used (1) to describe the relationship between diagnosis and treatment goals (eg, how often impairments and disabilities are used to form treatment goals) and (2) to examine the relationship between treatment goals and interventions (eg, whether relationships exist between treatment goals and interventions).

Method

Design

A survey on physical therapy in the Dutch primary health care system was conducted from 1989 to 1992. Physical therapists working in private practice in primary health care participated in the survey. Data from the survey on all patients applying for treatment in 1989 and 1990 were used in this study. Information about the general patient characteristics, indications for referral, diagnosis by physical therapists, and treatment was obtained using a standard survey questionnaire.

Physical Therapists

In the Dutch health care system, about 60% of all physical therapists work in private practice in primary health care. Seventy-four physical therapists, representing 30 primary

health care practices, participated in our study. A comparison of the data obtained for the participating therapists (n=74) with data obtained for all physical therapists working in primary health care practices (n=9,640)[11] indicated a good fit in terms of gender (55% versus 53% males) and postgraduate training (91% versus 90% had postgraduate training). In our study, physical therapists from the lower age groups were overrepresented (71% versus 50% were less than 35 years of age). Physical therapists with a contract with a health insurance company were somewhat underrepresented (58% versus 71% had a contract). Finally, practices consisting of three or fewer therapists were overrepresented (97% versus 73%). There is no particular reason, however, to expect that these deviations had a substantial effect on the results obtained.

Patients

All patients applying for treatment in 1989 and 1990 were eligible to participate in the study. A total of 8,714 patients participated. Table 1 shows the breakdown of patients by age and gender. All age groups were represented. The number of patients per age group increased gradually to 35 to 44 years of age and then decreased again. The patients were approximately equally divided by gender.

The indications for referral were established by the referring physicians and were classified according to the International Classification of Primary Care (ICPC).[12] A total of 13,105 indications for referral were established by the referring physicians (more than one indication could be established for each patient). Table 2 shows the 10 indications that were established most frequently. Symptoms, complaints, and injuries of the back, neck, shoulder, and knee region appeared most often as indications for referral.

Assessment

A standard survey questionnaire was used to obtain information on patients applying for treatment. The

Table 1. *Percentages of Patients by Age and Gender Applying for Treatment in the Participating Physical Therapy Practices During 1989 and 1990 (N=8,714)*

	Percentage of Patients
Age (y)[a]	
0–14	3.5
15–24	11.6
25–34	18.8
35–44	20.0
45–54	17.1
55–64	13.3
65–74	9.6
75+	6.1
Gender	
Male	46.8
Female	53.2
Total	100.0

[a]For 58 patients, the data on age were missing.

questionnaire consisted of three main categories. The first category concerned general patient characteristics, complaints, and the indication for referral established by the referring physician. The second category concerned the diagnosis by physical therapists, and the third category concerned the treatment goals and

interventions. The data concerning general patient characteristics, indication for referral, and the diagnosis by the physical therapist were obtained at each patient's first treatment session. At each following treatment session, the treatment goals and interventions were assessed. The therapists participating in the study were instructed both verbally (during a visit to the practice and by telephone) and in writing (in the form of a manual) about the use of the questionnaire.

The development of the questionnaire was based on the ICIDH and is described by van Triet et al.[10] The category concerning the diagnosis by physical therapists was subdivided into a section on impairments and a section on disabilities. An *impairment* is defined as "... any loss or abnormality of psychological, physiological, or anatomical structure or function."[4(p27)] A *disability* is defined as "... any restriction or lack (resulting from an impairment) of ability to perform an activity in the manner or within the range considered normal for a human being."[4(p28)] Tables 3 and 4 show the impairments and disabilities that were assessed with the questionnaire. The diagnosis of these impairments and disabilities was based on clinical observations. If the therapists diagnosed an impairment, it was speci-

fied in the impairments section of the questionnaire, together with the area of the body (eg, restriction in elbow or knee joint range of motion). The therapists also indicated whether pain occurred at rest, on movement, or during the transition from rest to movement. If the therapists diagnosed a disability, they specified the severity of that disability in the appropriate section of the questionnaire (three-point scale). Handicaps were not included in our questionnaire because assessment of handicaps (disorders of social roles) seems a less appropriate task for physical therapists.[13]

Van Triet et al[10] evaluated the interobserver reliability of diagnostic assessment of impairments and disabilities, based on clinical observations by four physical therapists working in two different practices. The results indicated that reliability was sufficiently high for most categories considered. The statistics used to evaluate interobserver reliability were the percentage of agreement (with a cutoff of 75%) and Cohen's kappa (with a cutoff of .40). The analysis was done on impairments and disabilities that were observed in at least 20% of the patients. With regard to impairments, a percentage of agreement of 75% or higher was found for pain, joint range of motion, muscle tone, muscle strength, posture, and swelling. In neither practice was the percentage of agreement lower than 75%. A kappa of .40 or higher was found for muscle tone and muscle strength. In one practice, the kappas for pain and joint range of motion were also higher than .40, whereas in the other practice, the kappas were below .40. With regard to disabilities, a percentage of agreement of 75% or higher was found for all disabilities. In addition, the kappas for disabilities were higher than .40.

The diagnosis of impairments and disabilities can give direction to the selection of interventions. The presence of a particular impairment or disability, however, does not necessarily imply that the physical therapist chooses it as a basis for forming a

Table 2. *Most Frequent Indications for Referral for Physical Therapy (N=8,714)*

Indication for Referral[a]	Occurrence[b] (%)
1. Low back complaints without radiation (L03)	14.6
2. Neck symptoms/complaints (L01)	13.9
3. Other diseases of musculoskeletal system (L99)	11.1
4. Lumbar disk lesion, back pain with radiating symptoms (L86)	9.6
5. Back symptoms/complaints (L02)	9.1
6. Shoulder symptoms/complaints (L08)	7.9
7. Syndromes of cervical spine (L83)	6.6
8. Shoulder syndrome (L92)	5.1
9. Knee symptoms/complaints (L15)	5.0
10. Acquired deformities of spine (L85)	4.0

[a]International Classification of Primary Care codes shown in parentheses.

[b]Percentage of patients with a particular indication.

Table 3. *Occurrence of Impairments and Treatment Goals Regarding Impairments (N=8,714)*

Impairment	Occurrence (%)	Treatment Goal	Occurrence[a] (%)			
			I	II	III	IV
Pain	92.2	Pain reduction	64.6	1.1	27.7	6.7
Restriction in joint range of motion	78.7	Recovery of joint range of motion	44.5	1.9	34.2	19.4
Increased or decreased muscle tone	68.0	Regulation of muscle tone	38.2	3.2	29.8	28.7
Diminished muscle strength	39.2	Improvement of muscle strength	16.3	4.8	22.9	56.0
Posture (kyphosis, lordosis, scoliosis)	40.4	Improvement of posture	12.2	2.1	28.2	57.6
Swelling	21.4	Reduction of swelling	9.9	1.2	11.5	77.4
Respiratory problems	4.8	Reduction of respiratory problems	2.5	0.2	2.4	95.0
Other impairments	38.3	Alleviation of other impairments	18.7	14.4	19.5	47.3

[a]I: treatment goal indicated, prior diagnosis; II: treatment goal indicated, no prior diagnosis; III: treatment goal not indicated, prior diagnosis; IV: treatment goal not indicated, no prior diagnosis.

treatment goal. From all impairments and disabilities that are diagnosed, certain impairments or disabilities are chosen as a basis for forming treatment goals (Figure). In each session, the therapist indicated the treatment goals, up to a maximum of four. The treatment goals at the level of impairments and disabilities are listed in Tables 3 and 4.

The therapists indicated which intervention was applied and which treatment goal was pursued with the particular intervention. Table 5 shows the categories of physical therapy interventions. For each treatment goal, the therapists could specify one intervention. The therapists, for example, indicated that one treatment goal was pain reduction, which was pursued by means of massage therapy.

Data Analysis

If the physical therapists diagnosed an impairment, they indicated its location (area of the body). They also indicated the circumstances of pain (at rest, on movement, or during the transition from rest to movement). For reasons of simplicity, however, the data on location and circumstances of pain were not used in this study. In addition, the data on the severity of the disabilities were reduced to a two-point scale: disability present or absent.

The percentage of patients with a given impairment or disability was calculated. Next, the percentage of patients for which an impairment or disability was actually used to form the treatment goal was calculated. In all instances, the base of the percentages was the total number of patients. A treatment goal most often coincided with a prior diagnosis. In some instances, however, it appeared that impairments or disabilities were used to form treatment goals, although they had not been diagnosed in the first session. Apparently, these impairments or disabilities were diagnosed in a later session and were subsequently used to form treatment goals. For this reason, four percentages were calculated: the percentages of patients with a particular treatment goal indicated at least once, with (I) or without (II) a prior diagnosis of the relevant impairment/disability in the first session, and the percentages

of patients without a particular treatment goal, with (III) or without (IV) a relevant prior diagnosis.

The main analysis in our study was concerned with the relationship between treatment goals (reduction of impairments and disabilities) and interventions. The analysis was performed in three steps. First, the data on goals and interventions, which had been gathered at the level of sessions, were reduced to the level of patients. In each treatment session, the therapists had indicated goals and interventions. For example, if a patient was treated in 10 sessions and in each session improvement of muscle strength was pursued by means of exercise therapy, the therapist had indicated this relationship 10 times. To reduce these repeated observations to data at the level of a patient, the relative contribution of interventions to the treatment aimed at a specific goal was calculated for each patient. In one patient, for example, improvement of muscle strength was indicated 10 times as a treatment goal; in 8 instances, exercise therapy was used to pursue this goal, and in the other 2 instances, the patient received instruction on home exercises. Thus, in this particular patient, the relative contribution of exercise therapy and instructions was 80% and 20%, respectively. Because other interventions were not used, the relative contribution of these interventions was 0%. In this way, the relative contribution of the interventions to the treatment was calculated for each patient. These relative contributions were subsequently analyzed.

In the second step of the analysis, we determined whether specific relationships between goals and interventions exist. Because the distributions were not normal, a nonparametic Kruskal-Wallis one-way analysis of variance was used.[14] In overall tests, we determined whether the application of interventions differed, depending on the treatment goals. This test was performed, separately for each intervention, for both impairments and disabilities that were used to form treatment goals. With this analysis, the

Table 4. Occurrence of Disabilities and Treatment Goals Regarding Disabilities (N=8,714)

Disability	Disability Occurrence (%)	Treatment Goal Occurrence[a] (%)			
		I	II	III	IV
Self-care					
Washing	15.0	1.0	0.1	14.0	84.8
Dressing	19.6	2.3	0.1	17.3	80.3
Using lavatory	7.2	0.1	0.1	7.2	92.7
Eating	4.4	0.2	0.1	4.2	95.5
Physical control					
Sitting	19.3	2.6	0.3	16.7	80.4
Standing	24.8	2.2	0.2	22.6	75.0
Kneeling	25.6	1.2	0.2	24.4	74.2
Bending	34.0	4.2	0.1	29.8	65.8
Keeping balance	13.0	0.8	0.1	12.2	86.9
Mobility					
Getting in and out of bed	24.2	1.7	0.0	22.6	75.7
Walking	35.9	16.7	1.1	19.2	63.0
Climbing stairs	33.2	3.3	0.1	29.9	66.7
Cycling	22.6	1.3	0.1	21.3	77.3
Driving a car	20.6	1.5	0.1	19.0	79.3
Household and professional activities					
Shopping	26.4	1.1	0.1	25.3	73.6
Preparing meals	12.8	0.4	0.1	12.5	87.1
Changing beds	21.5	0.4	0.0	21.0	78.5
Doing housework	25.4	2.7	0.1	22.8	74.4
Caring for other household members	10.5	0.9	0.2	9.5	89.4
Using telephone	3.1	0.0	0.0	3.0	96.9
Standing long periods	39.8	4.4	0.2	35.4	59.9
Sitting long periods	30.6	6.0	0.4	24.6	69.0
Lifting	51.3	8.7	0.3	42.7	48.4
Maintaining a normal tempo during work	51.7	25.5	1.5	26.1	46.8
Stress resistance	17.6	4.2	0.5	13.4	81.9
Sports/hobbies					
Sports	25.4	7.5	0.3	17.9	74.3
Hobbies	13.7	1.4	0.3	12.2	86.1
Other activities	12.6	0.5	1.7	12.1	85.7

[a]I: treatment goal indicated, prior diagnosis; II: treatment goal indicated, no prior diagnosis; III: treatment goal not indicated, prior diagnosis; IV: treatment goal not indicated, no prior diagnosis.

significance level was set at .05. Next, multiple comparisons among treatment goals were made. For all pairs of goals, we tested whether the relative contribution of an intervention differed significantly, again using the Kruskal-Wallis test. Because of the large number of multiple comparisons, Bonferroni's correction to the

significance level was applied. With impairments, the significance level was set at .05/28=0.002; with disabilities, the significance level was set at .05/231=0.0002. In the third step of the analysis, the strength of the relationship between goals and interventions was determined. Kendall's tau-b statistic was used to measure the

strength of the relationship.[15] For each pair of goals, tau-b was calculated.

It should be noted that the therapist could indicate more than one treatment goal for a patient. Therefore, to a certain extent, the comparison of treatment goals was based on observations derived from the same patients; that is, the observations were not entirely independent. Because the frequency of such dependent observations was very low, however, the observations were treated as independent. With only 18 out of 308 comparisons of impairments used to form treatment goals, 1% or more of the patients had dependent observations, with a maximum of 9% in one comparison (for each intervention, 28 comparisons were made; with 11 categories of interventions, this resulted in 308 comparisons). Similarly, with only 1 out of 2,541 comparisons of disabilities used to form treatment goals, 1% or more of the patients had dependent observations, the maximum being exactly 1% (231 comparisons were made for each intervention; with 11 interventions, this resulted in 2,541 comparisons).

Results

Diagnosis

Table 3 shows the occurrence of impairments. Pain was reported very often, in about 90% of all patients. Restricted joint range of motion and increased or decreased muscle tone were reported in about 80% and 70% of the patients, respectively. Diminished muscle strength and postural impairments were reported in about 40% of the patients.

Table 3 also indicates how often impairments were used to form treatment goals. Pain was most frequently used to form treatment goals. In 64.6% of all patients, pain was both diagnosed in the first treatment session and subsequently used to form treatment goals. In an additional 1.1% of the patients, pain was used to form treatment goals, although no diagnosis of pain was made in the first treat-

Table 5. *Application of Interventions[a]*

Treatment	Percentage	SD
Massage therapy	24.3	23.5
Exercise therapy	20.0	24.0
Manual therapy	11.6	21.1
Ultrasound therapy	7.2	14.8
Interferential therapy	7.1	15.0
Shortwave therapy (diathermy)	3.7	11.1
Heat and cryotherapy	3.3	10.3
Diadynamic currence[b]	0.8	5.6
Instruction (home exercise)	8.2	13.4
Advice (living rules)	2.0	6.3
Others	11.9	16.6

[a]The entries in the table are mean relative contributions of interventions to the treatment.

[b]*Diadynamic currence* is a form of electrical stimulation.[16]

ment session. Thus, overall, pain reduction was indicated as a goal in 65.7% of all patients. The least frequently chosen goal was reduction of respiratory problems (in 2.7% of the patients).

The phenomenon of a treatment goal without a prior diagnosis occurred most frequently with the improvement of muscle strength. In 4.8% of the patients, improvement of muscle strength was chosen as a goal, although no diagnosis of diminished muscle strength was made in the first treatment session. Apparently, the therapists frequently made this diagnosis in a later session. This phenomenon also occurred rather frequently with regulation of muscle tone, improvement of posture, and recovery of joint range of motion (in 3.2%, 2.1%, and 1.9% of the patients, respectively). With pain reduction, reduction of swelling, and reduction of respiratory problems, the phenomenon of "late" diagnosis occurred in 1.2% or less of the patients.

Table 4 shows the occurrence of disabilities. Frequently diagnosed disabilities concern bending, walking, climbing stairs, standing and sitting for long periods, lifting, and maintaining a normal tempo during work.

Table 4 also shows the occurrence of treatment goals regarding disabilities. Disability in maintaining a normal tempo during work was frequently used to form treatment goals, as was disability in walking. Disabilities in sports, lifting, and sitting for long periods were also frequently used to form treatment goals.

A comparison of Tables 3 and 4 shows that impairments were much more frequently used to form treatment goals than were disabilities. The overall frequencies of impairments used to form treatment goals ranged from 65.7% to 2.7%. The overall frequencies of disabilities used to form treatment goals ranged from 27.0% to 0.0%. Sixteen out of 28 disabilities were used to form treatment goals less frequently than 2.7%, which was the lowest frequency with impairments.

Treatment

Table 5 shows the application of physical therapy interventions. The table shows the mean relative contribution of interventions to the treatment of patients, irrespective of treatment goals. For example, averaged over all patients, the relative contribution of massage to the treatment was 24.3%. Massage, exercise therapy, and manual therapy were the most frequently

applied treatments, each with a relative contribution of more than 10%.

Table 6 shows the relationship between impairments used to form treatment goals and the application of interventions. The entries in the table are mean relative contributions of interventions to the treatment for a specific goal. For example, averaged over all patients treated for pain, the relative contribution of massage to the treatment of pain was 37%. In overall tests, we determined whether the application of interventions differed, depending on the treatment goals (these tests were performed columnwise). All overall test results were significant (Tab. 6). Thus, the relative contribution of massage to the treatment was dependent on which treatment goal was pursued. This finding also applies to all other interventions.

Subsequently, multiple comparisons were made among the treatment goals (these were pair-wise comparisons within columns). Table 6 shows that all comparisons for massage were significant. This finding indicates a very specific relationship. For each goal, there was a different relative contribution of massage to the treatment. As shown in Table 6, the same finding also applies to exercise therapy: All comparisons were significant. This means that the relative contribution of exercise therapy was different for each goal. With manual therapy, most comparisons of the relative contributions were significant (21 out of 28 comparisons). Seven comparisons were not significant; 6 of these comparisons involved goals for which manual therapy was not used (ie, 0% relative contributions). Apparently, these goals were irrelevant with regard to manual therapy. With regard to the physical applications, between one half and three quarters of the comparisons were significant (ranging from 14 to 21 out of 28). The nonsignificant comparisons were mostly among goals for which the application concerned was not used. With instructions and advice, 25 and 19 of the comparisons, respectively, were significant.

Table 6. *Treatment Goals Regarding Impairments and the Application of Interventions[a]*

Treatment Goal	Intervention[b]										
	MS	EX	MA	US	IF	SW	HE	DD	IN	AD	OA
Pain reduction	37	4	2	13	22	6	5	2	2	2	5
Reduction of swelling	8	2	0	38	13	27	4	1	2	1	3
Recovery of range of motion	24	40	21	1	0	0	0	0	11	1	2
Regulation of muscle tone	69	8	0	2	2	4	9	0	4	1	1
Improvement of muscle strength	1	63	0	0	0	0	0	0	32	1	1
Reduction of respiratory problems	59	22	0	0	0	0	0	0	10	2	6
Improvement of posture	2	45	1	0	0	0	0	0	38	9	3
Alleviation of other impairments	20	33	11	7	2	2	1	0	15	2	7
Significance of overall Kruskal-Wallis test[c]	*	*	*	*	*	*	*	*	*	*	*
Number of significant comparisons, out of a total of 28 comparisons	28	28	21	21	19	21	19	14	25	19	21
Average tau	.33	.28	.18	.20	.14	.16	.10	.05	.22	.10	.08

[a]The entries in the table are mean relative contributions of interventions to the treatment for specific goals. Each row of relative contributions adds to 100%, not counting rounding errors.

[b]MS=massage therapy, EX=exercise therapy, MA=manual therapy, US=ultrasound therapy, IF=interferential therapy, SW=shortwave therapy (diathermy), HE=heat and cryotherapy, DD=diadynamic currence (a form of electrical stimulation[16]), IN=instruction (home exercise), AD=advice (living rules), OA=other applied treatment.

[c]Asterisk indicates $P<.000$.

In addition to the significance, the strength of the relationship was determined. For each comparison, the strength of the relationship was expressed as a value for tau. With each intervention, these tau values were averaged (Tab. 6). Not surprisingly, the strength of the relationship roughly corresponded to the number of significant comparisons. The highest tau values were found with massage and exercise therapy, the lowest with diadynamic currence.*

Interesting relationships between goals and interventions are shown in Table 6. For example, the relative contribution of massage to the treatment was highest for the regulation of muscle tone and lowest for the improvement of muscle strength. The relative contribution of exercise therapy was highest for the improvement of muscle strength and lowest for reduction of swelling. As discussed earlier, manual therapy and physical applications were applied only for a subset of goals. With other goals, such as improvement of muscle strength and reduction of respiratory problems, these interventions were not used. In addition, Table 6 can be interpreted in the other direction. Pain reduction mainly relied on massage and to a lesser degree on ultrasound and interferential therapy. Improvement of muscle strength almost exclusively relied on exercise therapy and instructions. Similar relationships are shown for the other treatment goals.

Overall, the results shown in Table 6 indicate specific relationships between impairments that were used to form treatment goals and the application of interventions. Depending on the treatment goals, the relative contributions of the interventions to the treatment differ. The strongest rela-

tionships were found for massage and exercise therapy.

Table 7 shows the relationships between disabilities used to form treatment goals and the interventions. Only those disabilities used to form treatment goals in more than 1% of the patients are listed (the cutoff of 1% indicates that the goal was chosen in approximately 90 or more patients). Overall tests (columnwise) were significant, indicating that the application of interventions differed depending on the treatment goals. The only exception was with diadynamic currence. Application of this intervention did not depend on the treatment goals. With each intervention, multiple comparisons among the treatment goals were made (pair-wise comparisons within columns). The number of significant comparisons ranged from 71 out of 231 for manual therapy to 1 out of 231 for interferential therapy and diadynamic currence. This means that specific relationships exist between goals at the level of disabilities and interventions. However, whereas at least half of the comparisons were significant for impairments, fewer than one third of the comparisons were significant for disabilities. Thus, the degree of specificity was less at the level of disabilities than at the level of impairments.

The strength of the relationship between goals and interventions was determined. Average tau values (Tab. 7) ranged from .14 for exercise therapy to .04 for diadynamic currence. It should be noted that at the level of disabilities, the strength of the relationship was generally lower than at the level of impairments. For all 11 interventions, the average tau value was lower for disabilities than for impairments (binomial test, $P<.001$).

Table 7 shows that the treatment of disabilities largely consisted of massage, exercise therapy, instruction (home exercise), and advice (living rules). The relative contribution of manual therapy and physical applications did not exceed 10% in most instances; the only exceptions were for ultrasound, as used to reduce

Diadynamic currence is a kind of electrical stimulation.[16]

Table 7. *Treatment Goals Regarding Disabilities and the Application of Interventions[a]*

Treatment Goal	Intervention[b]										
	MS	EX	MA	US	IF	SW	HE	DD	IN	AD	OA
Self-care											
Washing	32	26	1	7	6	7	10	0	6	5	1
Dressing	18	35	2	11	5	3	3	1	13	7	2
Physical control											
Sitting	32	22	7	3	6	3	7	1	10	6	4
Standing	22	28	4	4	6	3	8	2	11	6	6
Kneeling	14	32	2	12	9	7	3	1	11	6	4
Bending	29	17	10	3	6	3	6	1	12	10	3
Mobility											
Getting in and out of bed	28	19	8	3	6	0	2	1	10	20	3
Walking	21	35	4	7	6	4	2	1	13	3	5
Climbing stairs	15	34	1	13	7	8	2	0	11	7	2
Cycling	21	27	4	10	3	6	3	3	11	11	3
Driving a car	25	15	6	10	6	4	9	0	9	10	5
Household and professional activities											
Shopping	32	22	2	6	2	3	7	0	8	17	0
Doing housework	21	21	1	8	4	3	8	0	14	20	3
Caring for other household members	24	24	1	3	7	2	3	1	11	6	5
Sitting long periods	34	19	5	4	7	3	6	1	13	8	3
Standing long periods	23	26	4	6	8	4	4	1	14	6	3
Lifting	25	23	4	7	5	2	3	1	16	14	2
Maintaining a normal tempo during work	34	16	15	5	8	3	2	0	11	5	3
Stress resistance	23	19	1	1	3	1	7	0	11	10	23
Sports/hobbies											
Sports	25	22	4	12	6	3	1	1	16	8	5
Hobbies	25	17	4	8	5	5	3	0	12	21	1
Other activities	33	21	7	5	6	3	2	1	9	6	6
Significance of overall Kruskall-Wallis test[c]	*	*	*	*	*	*	*		*	*	*
Number of significant comparisons, out of a total of 231 comparisons	58	31	71	48	1	18	44	1	9	41	33
Average tau	.09	.14	.10	.09	.07	.07	.08	.04	.05	.08	.08

[a]The entries in the table are mean relative contributions of interventions to the treatment for specific goals. Each row of relative contributions adds to 100%, not counting rounding errors.

[b]MS=massage therapy, EX=exercise therapy, MA=manual therapy, US=ultrasound therapy, IF=interferential therapy, SW=shortwave therapy (diathermy), HE=heat and cryotherapy, DD=diadynamic currence (a form of electrical stimulation[16]), IN=instruction (home exercise), AD=advice (living rules), OA=other applied treatment.

[c]Asterisk indicates $P < .000$.

disabilities in dressing, kneeling, climbing stairs, and sports.

were used from a survey study on 30 primary health care practices (74 physical therapists) in the Netherlands. Specific relationships were found to exist between impairments or disabilities used to form treatment goals and the application of interventions. These relationships were particularly marked at the impairment level. At the disability level, relationships between goals and interventions existed, but these relationships were weaker than at the impairment level. These data indicate, among the Dutch therapists in this study, the predictive validity of the present diagnostic system for a given treatment. The application of interventions has been shown to depend on which impairments and disabilities are used to form treatment goals.

From a descriptive point of review, interesting relationships between treatment goals and interventions were observed. For example, the relative contribution of exercise therapy to the treatment was highest for the improvement of muscle strength and lowest for the reduction of swelling. Manual therapy and physical applications were applied only for subsets of treatment goals. Pain reduction mainly relied on means of massage therapy and various physical applications. Recovery of joint range of motion relied mainly on massage, exercise therapy, and manual therapy. Disabilities were mainly treated by means of massage, exercise therapy, instruction (home exercise), and advice (living rules). These and other relationships described in Tables 6 and 7 provide a scientifically based insight into physical therapy. More refined analyses are clearly indicated. Even at this level of analysis, however, rather clear-cut relationships have emerged.

With regard to the specificity and strength of the observed relationships, the following issues should be raised. First, the treatment goals and the interventions were not assessed independently. The therapists could choose an intervention first, and then they could think of a treatment goal that suits the intervention. It is there-

Discussion

In this report, we have described the relationship between diagnosis and treatment in physical therapy. Data

fore possible that the specificity and strength of the relationships between treatment goals and interventions have been somewhat overestimated. Second, therapists were permitted to indicate only one intervention for each treatment goal. Thus, if the therapist ordinarily would have indicated more than one intervention for a treatment goal, the fact that the therapist was limited to only one intervention could have resulted in data seemingly indicating that the interventions are applied more specifically than they are in actual practice. Thus, the observed relationships may have been somewhat overestimated. Third, the data on location of impairments were not used. Impairments in different locations (areas of the body) are likely to be treated differently. Because the locations were ignored, the specificity of the resulting diagnoses is likely to be decreased. This may have caused an underestimation of the specificity and strength of the relationships. Fourth, rather broad categories of interventions were studied (eg, exercise therapy). It seems reasonable to assume that the specificity and strength of the relationships between goals and interventions will be increased if more specific categories of interventions are used. Thus, again, the relationships in this study may have been underestimated. Finally, within diagnostic groups (eg, patients with back pain), no further distinctions among subgroups of patients were made. Refined differentiations among subgroups of patients might predict therapeutic outcome, as has recently been shown for patients with back pain.[17] This finding underscores the importance of identifying meaningful subgroups of patients.[18]

Similarly, no attempt was made to analyze the interdependence of treatment goals or the interdependence of the applied interventions. It is expected that the treatment goals will show interdependence and that the interventions will do so as well. The dynamic process of treatment was also not considered. It is expected that certain treatment goals (eg, pain reduction) will be prominent in the early phase of treatment, whereas other goals (eg, improvement of posture) will become more important in a later stage. Refinements such as those discussed will enhance the specificity and strength of the observed relationships. In summary, some aspects of the design of this study may have caused an overestimation of the specificity and strength, whereas other aspects may have caused an underestimation. Our data, therefore, should be interpreted somewhat cautiously. Assuming that effects causing underestimation and overestimation cancel each other, however, it appears that true relationships between goals and interventions do exist.

The observed relationships were stronger at the level of impairments than at the level of disabilities. This finding possibly indicates that the diagnostic system is more valid at the level of impairments than at the level of disabilities. A refined differentiation between simple and complex disabilities may be required. With such a differentiation, stronger relationships between disabilities and interventions might emerge. An alternative explanation, however, could be that physical therapists' interventions are primarily aimed at the alleviation of impairments. Accordingly, alleviation of disabilities is a secondary treatment goal. Informal observations showed that physical therapists readily identified the goals of their interventions at the impairment level, but they had much more difficulty in identifying goals at the disability level. It seems that the physical therapists participating in our study have been educated to intervene primarily at the impairment level. In support of this explanation, the data shown in Tables 3 and 4 indicate that impairments were much more frequently used to form treatment goals than were disabilities.

In addition, some of the relationships at the level of disabilities seem to require further explanation. Although the relative contributions to the treatment were rather low, the therapists indicated that physical applications were used to treat disabilities (Tab. 7). For example, ultrasound therapy was used to treat disorders in climbing stairs. Physical applications, however, primarily operate at the level of impairments. The therapists probably used physical applications to treat an impairment (eg, swelling of the knee), and in that way, they intended to remedy an associated disability (eg, climbing stairs). The therapists had been instructed to record their primary treatment goals, as opposed to secondary or long-term treatment goals. Apparently, however, both primary goals (eg, reduction of swelling) and secondary goals (eg, improvement of climbing stairs) have been recorded. Possibly, more definite instructions should have been provided to the therapists. This could have prevented the confusion regarding relationships between interventions and treatment goals at the level of disabilities. In this context, it should be noted that the approach of recording impairments and disabilities as treatment goals is new. Both researchers and therapists must gain experience with this approach.

Conclusion

The observed relationships between treatment goals and interventions indicate (1) that the diagnostic system derived from the conceptual framework of the ICIDH validly predicts which interventions are applied and (2) that the selection of interventions depends on which treatment goals are pursued. Both conclusions apply in particular to the level of impairments.

Acknowledgments

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Commentaries

Following are two commentaries on "Diagnosis and Treatment in Physical Therapy: An Investigation of Their Relationship."

For more than a decade, physical therapists have grappled with identifying our body of knowledge. Dr Dekker and colleagues have presented important data that bring us closer to understanding physical therapy as an intellectual discipline. They pose the question, Is there a relationship between impairment and disability that is somehow inherent in what physical therapists do? The answer to this question uses proxy evidence: what Dutch physical therapists have chosen to document about patient care. The authors found that the words Dutch physical therapists use to describe what they do during treatment frequently do, in fact, refer to impairments and less frequently to disabilities. Thus, the authors conclude that there is something about the relationship between impairment and disability that is inherent to the patient care process in physical therapy.

If we assume that the body of knowledge of physical therapy consists only of scientific facts about which treat-

ments work best or explanations of the mechanism by which they work, this study does not appear to address the issue of the body of knowledge in physical therapy. This study, however, used a broader vision of a professional body of knowledge that has two dimensions. The first dimension encompasses how physical therapists make sense of their interactions, what assumptions they make, and how they justify what they do with and to patients. The second dimension comprises scientific research that supports or explains what physical therapists do, which is more typically thought to be our "body of knowledge."

Using written accounts of patient care practices, Dekker and colleagues illustrate the social construction of a professional body of knowledge. Specifically, if physical therapists typically use the relationship between impairment and disability to describe and justify their professional actions toward patients, then this relationship is an essential component of what physical therapists "know." This broader conception of our professional body of knowledge explains how a physical therapist is able (1) to define the situation (What information do I seek during the evaluation?), (2)

to organize observations (Is there a relationship between impairment and function?), and (3) to justify the action taken (What procedure could remediate the impairment and/or improve function?). The first two questions in particular relate to "thinking like a therapist" beyond the utilization of scientific evidence to support practice.

Dr Dekker and his coinvestigators also demonstrate some of the barriers to conceptualizing the body of knowledge in physical therapy. As they indicate in their report, a number of models, which are reasonably similar, have been proposed. This study strongly indicates that the discrepancy among the various models is related to the overuse of a few terms to refer to many concepts. There appears to be little difference in the way various models use the term "impairments" to denote alterations in physical or psychological structures or function (eg, loss of range of motion or strength). Beyond impairments of a single system or organ, there are also complex movements that depend on the integration of structure and function, but are not necessarily related to a particular goal (eg, sitting, standing, bending, kneeling, stooping, and crouching). These sorts of movement

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