Differences between Physiotherapists Estimated and Actual Care Episodes and Number of Sessions, and Associations between Care-Related and Patient-Reported Outcomes in Patients with Whiplash Associated Disorder

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Abstract

Background: From both evidence-based physiotherapy care and cost perspective, it is important that the duration of treatment episode and the number of physiotherapy sessions in traffic collision-related Whiplash Associated Disorders (WAD) is tailored to the patient and can be prognosticated. However, little is known about the accuracy of physiotherapists' estimation and the associations between the duration of care episodes, number of sessions, and patients' perceived recovery.

Aim: To investigate whether physiotherapists can accurately estimate the duration of a physiotherapy care episode and the number of physiotherapy sessions in relation to the actual duration and number of sessions, and to relate these factors to patient-reported recovery.

Methods: Data were collected over a period of 10 years in two primary care physiotherapy practices in the Netherlands. The duration of estimated and actual physiotherapy episodes in months was divided into four categories and the number of sessions allocated to one of five categories. All patients were assigned to one of the six-time phases of the Quebec Task Force WAD, and were allocated to one of the three prognostic profiles for recovery. Patients were asked to complete the outcome measure 'perceived recovery'. Agreement was calculated between estimated and actual treatment episode and number of physiotherapy sessions. Spearman's coefficients ($r_s \geq 0.25$ acceptable association) were calculated to explore associations between care-related outcomes and patient-reported outcomes. *P* value ≤ 0.05 was considered statistically significant.

Results: A consecutive sample of 523 patients was included. Clinical estimates were in line with the

actual physiotherapy episode and the number of sessions in approximately 60% to 70% of patients. Associations between clinically estimated and actual physiotherapy episode and number of sessions were fair (r_s=0.37; *P*<0.001) to moderate (rs=0.63; *P*<0.001) to). About half of the patients were recovered (completely recovered n=34 [6.5%]; much recovered n=207 [39.6%]), but the remainder self-reported as 'slightly changed' (n=199 [38.8%]) or 'much worse' (n=83 [15.9%]). Associations between estimated and actual duration of physiotherapy episodes and number of sessions, and patient reported recovery were weak (r_s<0.25; *P*>0.05).

Conclusion: Physiotherapist can adequately estimate the physiotherapy episode and the number of sessions in patients with WAD for setting time-contingent treatment goals and expecting recovery. No significant associations were found between care-related outcomes and patient-reported recovery outcome.

Keywords: Whiplash-associated disorders; Physiotherapy; Clinical reasoning; Clinical experience; Care-related outcomes; Patient-reported outcomes

Introduction

The annual cumulative incidence of traffic collision-related Whiplash-Associated Disorders (WAD) varies widely between countries and continents but has increased over the past 30 years [1-3]. Neck pain is one of the most prevalent symptoms in patients with WAD and is found in about 50% of those reporting chronic pain after a whiplash-related accident [4]. Approximately 50% of patients with neck pain develop persistent symptoms, resulting in moderate to severe limitations in activity and participation [5-7]. Physiotherapy is the most frequently used paid healthcare related service during the chronic phase of WAD [8]. In view of these figures in combination with available research-based evidence, it is important that the duration of physiotherapy care and the number of physiotherapy sessions remains patient-centered, time-efficient and cost-effective.

Many physiotherapeutic options are available for the treatment of patients with WAD [2,9-13]. Despite growing evidence that active exercise therapy and pain education are key components of any multimodal treatment approach, there is a paucity of evidence on Care-Related Outcomes (CROs) [14,15]. Care-Related Outcome Measures (CROMs), such as the duration of the physiotherapy care episode and the number of physiotherapy sessions, are neither recommended nor integrated in clinical practice guidelines for the physiotherapy management of WAD (CPGs WAD) [16-22].

When collecting clinical data, a physiotherapist's clinical experience and appraisal are cornerstones of the clinical reasoning process [23]. Clinical experience is defined as 'the ability to use clinical skills and past experience to identify a patient's health status and diagnosis, the individual risks and benefits of potential interventions, and their personal values and expectations' [24]. One important clinical skill is estimating the duration of a treatment episode and the number of physiotherapy sessions needed in trajectories of recovery. It is plausible that the duration of a treatment episode and the number of physiotherapy sessions depends on the time since a whiplash-related accident, and on a positive or negative prognostic profile for recovery, due to personal factors such as passive coping, fear avoidance, kinesiophobia and depression. Most negative prognostic factors are psychological in nature [25-27]. Furthermore, it can be assumed that longer periods since the accident and less favorable prognostic profiles for recovery will result in longer care periods and a higher number of physiotherapy sessions.

Patient-Reported Outcome Measurements (PROMs) and Patient-Reported Outcomes (PROs) have both received increasing attention in recent years [28-31]. However, despite the growing importance of PROMs and PROs in physiotherapy practice, particularly in patients with low back pain and neck pain, the association between PROs and CROs is still poorly understood. To date, PROMs and CROMs have not been widely incorporated into Routinely Collected Datasets (RCDs), such as the RCD-WAD dataset, even though they could potentially enhance our understanding of physiotherapy care [32]. The RCD-WAD is characterized by the structured and standardized recording of clinical data in broadly professionally supported terms, preferably linked to classifications such as the International Classification of Functioning, Disability and Health (ICF) advised by the World Health Organization (WHO) and Classification Allied Health Care – Version Physiotherapy [33,34].

An association presumably exists between experienced recovery, the physiotherapy care episode and the number of physiotherapy sessions for patient with WAD. It can therefore be hypothesized that physiotherapists specialized in the management of patients with WAD should be able to prognosticate the duration of the physiotherapy care episode and the number of physiotherapy sessions required in relation to the phase after the whiplash-related accident and the prognostic health profile [35,36]. However, evidence supporting or refuting this hypothesis is currently unavailable and therefore represents an important gap in research knowledge [5].

In order to address this issue, the primary aim of this study was to investigate whether physiotherapists can accurately estimate the duration of a physiotherapy care episode and the number of physiotherapy sessions in relation to patient-reported recovery at discharge in patients with WAD, and to investigate the associations between the estimated and actual physiotherapy episodes, the number of physiotherapy sessions for patients with WAD and patient-reported recovery at discharge.

Materials and Methods

Design

In 2016, a quality improvement study was launched that focused on the quality of primary care physiotherapy management in patients with WAD. Details of the design and execution of that cohort study have been published elsewhere [32,37,38].

The Medical Ethics Committee of Radboud University Medical Centre Nijmegen, the Netherlands waived the requirement for ethical approval. Retrospective research based on anonymized patient files does not fall within the scope of the Medical Research Involving Human Subjects Act.

Data collection

Routinely Collected Data on patients with WAD (RCD-WAD) in the form of standardized pen and paper patient records were gathered in two primary care physiotherapy practices in the Netherlands. The first WAD patient record was developed in 1995 and updated in both 2002 and 2009 based on the national CPG Physiotherapy Documentation and the national CPG Whiplash including professional consensus and scientific evidence. Data on PROMs and CROMs were collected over a period of 10 years. The current analysis concerns the evaluation of this period [17,18,39,40].

Clinical data related to the time phases after a whiplash-related accident and to the prognostic profiles for recovery were extracted in order to guide the steps of the 'treatment plan' and the 'evaluation' of the clinical reasoning process. A complete flowchart including the steps of the clinical reasoning process and the items per step has been published elsewhere and is modified here as Supplementary file 1 [32]. Stepped 'treatment plan' items include: Short and long-term treatment goals, prognostic estimation of the physiotherapy episode, and the number of sessions. 'Evaluation' items include: Actual duration of the episode, the actual number of sessions, and patient-reported recovery at discharge.

Patient characteristics

A consecutive sample of patients classified as WAD Grade 1 to 3 was originally included in the study. Data were registered in standardized patient records. A complete overview of patient characteristics has been published elsewhere [32,37,38].

Based on consensus within the steering group (RABO, JWHE and EvT), a number of patient characteristics relevant to this study were selected in order to assess differences in estimated and actual duration of the physiotherapy episode and number of sessions in relation to patient-reported recovery. The following baseline patient characteristics were selected: Age, gender, WAD classification, phase after whiplash-related accident, and prognostic profile. The Quebec Task Force WAD classifies patients with WAD, based on the severity of signs and symptoms, as either Grade 1 (patient complains of neck pain, stiffness, or tenderness with no 6 positive findings on physical examination), Grade 2 (neck symptoms and musculoskeletal sign(s), Grade 3 (neck symptoms and neurological sign(s), or Grade 4 (neck symptoms and fracture or dislocation) [35]. Symptoms and disorders that can manifest in all grades include deafness, dizziness, tinnitus, headache, memory loss, dysphagia, and temporomandibular joint pain.

The phases after a whiplash-related accident were modified according to the Quebec Task Force WAD timeframe: Phase 1: <7 days (acute); phase 2: 1 to 3 weeks (acute); phase 3: 4-6 weeks (sub-acute); phase 4: 7 to 12 weeks (sub-chronic); phase 5: 3 to 6 months (chronic); and phase 6: >6 months (chronic) [35,41].

A prognostic health profile is defined as a complex of positive and negative variables that can be used to estimate the probability of functional recovery in patients with WAD [25-27,41,42]. Based on the physiotherapist's clinical experience, together with pre-existing symptoms and previous prognostic factors for recovery, patients were classified as Profile A (normal recovery, low pain intensity, decreasing pain, increasing activities, active coping and no fear avoidance), as Profile B (uncertain recovery, medium pain intensity, persistent pain, persistent activity limitations, mixed coping strategies coping and fear avoidance) or as Profile C (delayed recovery, high pain intensity, increasing pain, decreasing activities, passive coping and fear avoidance). Profile A was characterized as positive, profile B as inconclusive, and profile C as a negative profile for functional recovery.

Physiotherapist characteristics

Physiotherapists from two primary care practices participated in collecting data. The following characteristics of the physiotherapists were registered: Age, gender, postgraduate education in manual therapy, clinical experience, and specialized experience regarding assessment of patients with WAD. During clinical assessment of the first 50 patients with WAD, each physiotherapist was supervised by an experienced senior colleague (RABO).

Care-reported outcome measures

A 'care episode' commences with the first contact between physiotherapist and patient and ends on the date of completion of the discharge note. A 'physiotherapy session' is defined as a documented patient encounter [15].

The duration of the estimated and actual physiotherapy care episodes in months was divided into four categories (1=<1; 2=1 to 3; 3=4 to 6; 4=>6 months) and recorded. The number of physiotherapy sessions was allocated to one of five categories (1= ≤5; 2=6 to 10; 3=11 to 15; 4=16 to 20; 5=>20) and recorded.

Patient-reported outcome measure

Patients were asked to complete the outcome measure 'perceived recovery', rating the pre- to post-intervention perceived change from 1 (completely recovered) to 6 (much worse) [43,44]. The Global Perceived Effect (GPE) is a reliable, valid and responsive measure of health status in patients with musculoskeletal pain [44]. The six scores of the GPE were condensed to 'completely recovered', 'much recovered', 'slightly changed' (slightly recovered, no change, slightly worse) or 'much worse'.

Analysis

Analyses were performed in Statistics 9.0. The dataset was checked for missing values [7]. Descriptive statistics (frequency, means and 95% confidence interval) were used to present data on the total group and the groups per phase after whiplash-related accident and per prognostic profile. Perceived recovery data was recorded as one of the four categories.

Cross tabulation was used to describe the relationship between the categorical variables 'estimated duration of physiotherapy care episode', 'estimated number of physiotherapy sessions', 'actual duration of physiotherapy care episode' and 'actual number of physiotherapy sessions' for the total group and for the groups per phase after whiplash-related accident and per prognostic profile.

Spearman's rank correlation coefficients (r_s) were calculated to explore associations between CROs (estimated and actual episode and number of sessions) and PROs (patient-reported recovery). The following criteria were used to indicate the strength of association: 0.00 to 0.25 weak association; 0.25 to 0.50 fair association; 0.50 to 0.70 moderate association; 0.70 to 0.90 substantial association; and >0.90 perfect association [45]. In this study, r_s<0.25 was considered as cutoff point for acceptable association. For all associations, P values ≤ 0.05 were considered statistically significant.

Table 1: Steps of clinical reasoning I-IX in patients with Whiplash-Associated Disorders (WAD)*: Selected routinely collected data.

Total n=523: n (%) unless otherwise stated	
I. Sociodemographic characteristics	
Age (year) (mean; 95% CI)	
- Female	43.4 (42.1-44.7)
- Male	42.2 (39.8-44.5)
Gender (female)	396 (75.7)
II. History taking	
Accident-related characteristics	
Pre-existent health status	
Previous diagnostics and treatment	
Current health status and recovery rate	
III. Objectives examination	
IV. Clinical examination	
V. Analysis and conclusion	
Classification WAD**	
- Grade 1	38 (7.3)
- Grade 2	406 (77.6)
- Grade 3	79 (15.1)
- Grade 4	-
Phase since whiplash-related accident	
- <7 days	14 (2.7)
- 1-3 weeks	98 (18.7)
- 4-6 weeks	118 (22.6)
- 7-12 weeks	114 (21.8)
- 3-6 months	123 (23.5)
- >6 months	56 (10.7)
Prognostic profile***	
- Profile A	40 (7.6)
- Profile B	339 (64.8)
- Profile C	144 (27.5)
VI. Treatment plan	
Estimated prognostic duration of physiotherapy care episode	
- <1 month	64 (12.2)
- 1-3 months	125 (23.9)
- 4-6 months	334 (63.9)
- >6 months	-
Estimated prognostic number of physiotherapies sessions	
- ≤ 5 sessions	65 (12.4)
- 6-10 sessions	-
- 11-15 sessions	134 (25.6)
- 16-20 sessions	158 (30.2)
- >20 sessions	166 (31.7)
VII. Treatment	
VIII. Evaluation	
Actual duration of physiotherapy care episode	
- <1 month	-
- 1-3 months	164 (31.4)
- 4-6 months	359 (68.9)
- 6 months	-
Actual number of physiotherapy sessions	
- ≤ 5 sessions	-
- 6-10 sessions	3 (0.6)
- 11-15 sessions	178 (34.0)
- 16-20 sessions	278 (53.2)
- >20 sessions	64 (12.3)
Patient-reported improvement	
- Completely recovered	34 (6.5)
- Much recovered	207 (39.6)
- Slightly changed	199 (38.8)
- Much worse	83 (15.9)
IX. Discharge	

*The complete dataset of the steps of the clinical reasoning process I -IX has been published elsewhere [28].

** **Classification WAD**: Whiplash-Associated Disorders: Grade 0: no neck symptoms, no physical sign(s); Grade 1: neck pain, stiffness or tenderness only, no physical sign(s); Grade 2: neck symptoms and musculoskeletal sign(s); Grade 3: neck symptoms and neurological sign(s); Grade 4: neck symptoms and fracture or dislocation

*** **Prognostic profile**: Profile A: normal recovery, low pain intensity, decreasing pain, increasing activities, active coping and no fear avoidance; Profile B: uncertain recovery, medium pain intensity, persistent pain, persistent activity limitations, inconclusive coping and fear avoidance; Profile C: delayed recovery, high pain intensity, increasing pain, decreasing activities, passive coping and fear avoidance
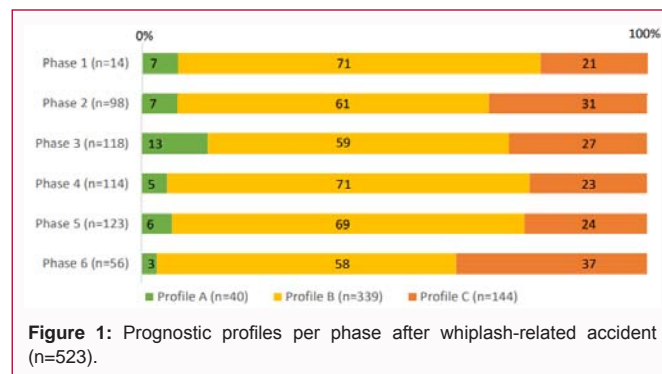
Figure 1: Prognostic profiles per phase after whiplash-related accident (n=523).

Results

Patient characteristics

A consecutive sample of 523 patients classified as WAD grade 1 to 3 was included in the study. Selected baseline characteristics of the patients are presented in Table 1. The most frequent WAD classification was WAD grade 2 (n=406; 77.6%). At the time of (re-) referral to the practice, 123 patients (23.5%) were dived into phase 5 (3 to 6 months post injury) and 56 patients (10.7%) into phase 6 (>6 months post injury), equaling a total study sample of 179 patients (34.2%) with chronic WAD (≥ 3 months).

Based on the clinical judgment of the physiotherapist and existing prognostic factors, 40 patients (7.6%) were classified as Profile A, 339 patients (64.8%) as Profile B and 144 patients (27.5%) as Profile C. The distribution of the three prognostic profiles over the phases 1 to 6 is presented in Figure 1. The most frequently used profile was Profile

Table 2: Clinically-estimated and actual physiotherapy care episodes and number of physiotherapy sessions per phase* in patients with Whiplash-Associated Disorders (WAD).

Duration of care episode per phase*	Clinical estimate n (%)	Actual episode n (%)	Number of physiotherapy sessions per phase*	Clinical estimate n (%)	Actual sessions n (%)
Phase 1 (n=14)			Phase 1 (n=14)		
- <1 month	10 (71.4)	-	- ≤ 5 sessions	10 (71.4)	-
- 1-3 months	3 (21.4)	4 (28.6)	- 6-10 sessions	-	-
- 4-6 months	1 (7.1)	10 (71.4)	- 11-15 sessions	3 (21.4)	6 (42.9)
- >6 months	-	-	- 16-20 sessions	1 (7.1)	7 (50.0)
			- >20 sessions	-	1 (7.1)
Phase 2 (n=98)			Phase 2 (n=98)		
- <1 month	54 (55.1)	-	- ≤ 5 sessions	55 (56.1)	-
- 1-3 months	32 (32.7)	44 (44.9)	- 6-10 sessions	-	3 (3.1)
- 4-6 months	12 (12.2)	54 (55.1)	- 11-15 sessions	31 (31.6)	51 (52.0)
- >6 months	-	-	- 16-20 sessions	12 (12.2)	43 (43.9)
			- >20 sessions	-	1 (1.0)
Phase 3 (n=118)			Phase 3 (n=118)		
- <1 month	-	-	- ≤ 5 sessions	-	-
- 1-3 months	87 (73.7)	73 (61.9)	- 6-10 sessions	-	-
- 4-6 months	31 (26.3)	45 (38.1)	- 11-15 sessions	91 (77.1)	92 (78.0)
- >6 months	-	-	- 16-20 sessions	27 (22.9)	26 (22.0)
			- >20 sessions	-	-
Phase 4 (n=114)			Phase 4 (n=114)		
- <1 month	-	-	- ≤ 5 sessions	-	-
- 1-3 months	1 (0.9)	16 (14.0)	- 6-10 sessions	-	-
- 4-6 months	113 (99.1)	98 (86.0)	- 11-15 sessions	3 (2.6)	14 (12.3)
- >6 months	-	-	- 16-20 sessions	110 (96.8)	98 (86.0)
			- >20 sessions	1 (0.9)	2 (1.8)
Phase 5 (n=123)			Phase 5 (n=123)		
- <1 month	-	-	- ≤ 5 sessions	-	-
- 1-3 months	-	17 (13.8)	- 6-10 sessions	-	-
- 4-6 months	123 (100)	106 (86.2)	- 11-15 sessions	5 (4.1)	10 (8.1)
- >6 months	-	-	- 16-20 sessions	8 (6.5)	72 (58.5)
			- >20 sessions	110 (89.4)	41 (33.3)
Phase 6 (n=56)			Phase 6 (n=56)		
- <1 month	-	-	- ≤ 5 sessions	-	-
- 1-3 months	2 (3.6)	10 (17.9)	- 6-10 sessions	-	-
- 4-6 months	54 (96.4)	46 (82.1)	- 11-15 sessions	1 (1.8)	5 (8.9)
- >6 months	-	-	- 16-20 sessions	-	32 (57.1)
			- >20 sessions	55 (98.2)	19 (33.9)

Phases after whiplash-related accident:
- Phase 1: <7 days
- Phase 2: 1-3 weeks
- Phase 3: 4-6 weeks
- Phase 4: 7-12 weeks
- Phase 5: 3-6 months
- Phase 6: >6 months

B (n=339; 64.8%), which was approximately equally divided over all phases after the whiplash-related accident.

Physiotherapist characteristics

Eight physiotherapists from two primary care physiotherapy practices routinely collected the data. All patients were assessed by one of the participating physiotherapists. The mean age of the physiotherapists (n=8) at the beginning of the study was 46.2 years (SD=5.6), six were male (75.0%) and six were manual physiotherapists (75.0%). The clinical experience regarding assessment of patients with whiplash-related injuries varied between 6 and 28 years. Mean practice experience regarding patients with WAD was 14.4 years (SD 12.5).

Table 3: Differences in clinically-estimated and actual duration of physiotherapy care episodes and number of physiotherapy sessions per phase* after whiplash-related accident and per prognostic profile**.

Duration of care episode per phase after whiplash-related accident			
Phases*	Over-estimation	Agreement	Under-estimation
	n (%)	n (%)	n (%)
Phase 1 (n=14)	-	1 (7.1)	13 (92.9)
Phase 2 (n=98)	4 (4.1)	30 (30.6)	64 (65.3)
Phase 3 (n=118)	10 (8.5)	84 (71.2)	24 (21.1)
Phase 4 (n=114)	15 (13.2)	99 (86.9)	-
Phase 5 (n=123)	17 (13.8)	106 (86.2)	-
Phase 6 (n=56)	9 (16.1)	46 (82.1)	1 (1.9)
Number of physiotherapy sessions per phase after whiplash-related accident			
Phases*	Over-estimation	Agreement	Under-estimation
	n (%)	n (%)	n (%)
Phase 1 (n=14)	1 (7.1)	2 (14.3)	11 (78.6)
Phase 2 (n=98)	5 (5.1)	32 (32.7)	61 (62.4)
Phase 3 (n=118)	9 (7.6)	101 (85.6)	8 (6.8)
Phase 4 (n=114)	12 (10.5)	100 (87.7)	2 (1.8)
Phase 5 (n=123)	70 (56.9)	52 (42.3)	1 (0.8)
Phase 6 (n=56)	36 (64.8)	20 (35.7)	-

*Phases after whiplash-related accident
- Phase 1: <7 days
- Phase 2: 1-3 weeks
- Phase 3: 4-6 weeks
- Phase 4: 7-12 weeks
- Phase 5: 3-6 months
- Phase 6: >6 months

Table 4: Clinically-estimated and actual physiotherapy care episodes and number of physiotherapy sessions per prognostic profile* in patients with Whiplash-Associated Disorders (WAD).

Duration of care episode (month [m])	Clinical estimate n (%)	Actual n (%)	Number of physiotherapy sessions (s)	Clinical estimate n (%)	Actual n (%)
per prognostic profile*			per prognostic profile*		
Profile A (n=40)			Profile A (n=40)		
- <1 m	6 (15.0)	-	- ≤ 5 s	6 (15.0)	-
- 1-3 m	9 (22.5)	14 (35.0)	- 6-10 s	-	1 (2.5)
- 4-6 m	25 (62.5)	26 (65.0)	- 11-15 s	11 (27.5)	15 (37.5)
- >6 m	-	-	- 16-20 s	14 (35.0)	22 (55.0)
			- >20 s	9 (22.5)	2 (5.0)
Profile B (n=339)			Profile B (n=339)		
- <1 m	39 (11.5)	-	- ≤ 5 s	40 (11.8)	-
- 1-3 m	78 (23.0)	106 (31.3)	- 6-10 s	-	1 (0.3)
- 4-6 m	222 (65.5)	233 (68.7)	- 11-15 s	82 (24.2)	110 (32.4)
- >6 m	-	-	- 16-20 s	103 (30.4)	183 (54.0)
			- >20 s	114 (33.6)	45 (13.3)
Profile C (n=144)			Profile C (n=144)		
- <1 m	19 (13.2)	-	- ≤ 5 s	19 (13.2)	-
- 1-3 m	38 (26.4)	44 (30.6)	- 6-10 s	-	1 (0.7)
- 4-6 m	87 (60.4)	100 (69.4)	- 11-15 s	41 (28.5)	53 (36.8)
- >6 m	-	-	- 16-20 s	41 (28.5)	73 (50.7)
			- >20 s	43 (29.9)	17 (11.8)

*Prognostic profile:
- Profile A: normal recovery, low pain intensity, decreasing pain, increasing activities, active coping and no fear avoidance
- Profile B: uncertain recovery, medium pain intensity, persistent pain, persistent activity limitations, inconclusive coping and fear avoidance
- Profile C: delayed recovery, high pain intensity, increasing pain, decreasing activities, passive coping and fear avoidance

Care-related outcomes

Physiotherapy care episode: Percentages of the estimated prognostic duration of the episode and the actual episode for the total group (N=523) are presented in Table 1. The clinically-estimated duration of physiotherapy care episodes ranged from <1 month for 64 patients (12.2%) to 4 to 6 months for 334 patients (63.9%). Actual values for physiotherapy care episodes were 1 to 3 months for 164 patients (31.4%) and 4 to 6 months for 359 patients (68.6%).

The cross tabulated percentages of agreement between the estimated and actual duration of physiotherapy episode corresponded in 70.0% of the patients (n=366) with overestimation for 10.5% (n=55) and underestimation for 19.5% (n=102) of patients. The association between the estimated and actual physiotherapy care episode was fair (r_s=0.37; *P*=0.001).

Number of physiotherapy sessions: Percentages of the estimated prognostic number of physiotherapy sessions and the actual number for the total group are presented in Table 1. The clinically-estimated number of physiotherapy sessions ranged from ≤5 sessions for 65 patients (12.4%) to >20 sessions for 166 patients (31.7%). The actual number of physiotherapy sessions ranged from 6 to 10 sessions for 3 patients (0.6%) to >20 sessions for 64 patients (12.3%).

The cross tabulated percentages of agreement between estimated and actual number of physiotherapy sessions corresponded for 58.7% of patients (n=307), with overestimation for 24.9% (n=130) and underestimation for 16.4% (n=86) of patients.

The association between estimated and actual number of physiotherapy sessions was moderate (r_s=0.63; *P*<0.001).

Phases after whiplash injury: Physiotherapy care episode: Percentages for the estimated and actual duration of physiotherapy episodes for the phases 1 to 6 after whiplash-related injury is presented in Table 2. The most frequently estimated treatment episode per phase was <1 month in phase 1 (71.4% [n=10]) and in phase 2 (55.1% [n=54]), 1 to 3 months in phase 3 (73.7% [n=87]) and 4 to 6 months in phase 4 (99.1% [n=113]), phase 5 (100% [n=123]) and phase 6 (96.4% [n=54]). The most frequently actual treatment episode was 4 to 6 months in all phases.

The cross tabulated percentages of agreement for the above can be found in Table 3, and ranged from 7.1% (n=1) in phase 1 (n=14) to 86.9% (n=99) in phase 4 (n=114). The duration of the treatment periods in patients in phase 1 (n=14) and phase 2 (n=98) were most underestimated for 92.9% (n=13) and 65.3% (n=64) of patients.

Phases after whiplash injury: Number of physiotherapy sessions: Percentages for the estimated and actual number of physiotherapy sessions for the phases 1 to 6 are presented in Table 2. The most frequently estimated number of treatment sessions per phase was ≤ 5 sessions in phase 1 (71.4% [n=10]) and in phase 2 (56.1% [n=55]), 11 to 15 sessions in phase 3 (77.1% [n=91]) and 16 to 20 sessions in phase 4 (96.8% [n=110]), and >20 sessions in phase 5 (89.4% [n=110]) and phase 6 (98.2% [n=55]). The most frequently actual number of sessions was 16 to 20 sessions in the phases 1, 4, 5 and 6.

The cross tabulated percentages of agreement between the estimated and actual number of sessions per phase are presented in Table 3, and ranged from 14.3% (n=2) in phase 1 (n=14) to 87.7% (n=100) in phase 4 (n=114). The number of treatment sessions in patients in phase 1 (n=14) and phase 2 (n=98) was most underestimated for 78.6% (n=11) and 62.4% (n=61), and in patients in phase 5 (n=123) and in phase 6 (n=56) most overestimated for 56.9% (n=70) and 64.8% (n=36) of patients.

Prognostic profiles: Physiotherapy care episode: The estimated *vs.* actual duration of physiotherapy episodes for the prognostic profile A (n=40 [7.6%]), profile B (n=339 [64.8%]) and profile C (n=144 [27.5%]) are presented in Table 4. The most frequently estimated treatment episode per prognostic profile was 4 to 6 months for profile A (62.5% [n=25]), profile B (65.5% [n=222]) and profile C (60.4% [n=87]). The most frequently actual treatment episode was 4 to 6 months for all profiles.

The cross tabulated percentages of agreement for the above can be found in Table 5, and ranged from 69.9% (n=237) in Profile B (n=339) to 70.1% (n=101) in Profile C (n=144). The treatment episode was most underestimated for 21.5% (n=31) for profile C, and most overestimated for 18.9% (n=64) for profile B.

Prognostic profile: Number of physiotherapy sessions: The estimated and actual number of physiotherapy sessions for the prognostic profiles A (n=40), B (n=339) and C (n=144) can be found in Table 4. The most frequently estimated number of treatment sessions per prognostic profile was 16 to 20 sessions for profile A (35.0% [n=14]), and >20 sessions for profile B (33.6% [n=114]) and

Table 5: Differences in clinically-estimated and actual number of physiotherapy sessions per prognostic profile*.

Duration of care episode per prognostic profile			
Prognostic profile*	Over-estimation	Agreement	Under-estimation
	n (%)	n (%)	n (%)
Profile A (n=40)	5 (12.5)	28 (70.0)	7 (17.5)
Profile B (n=339)	64 (18.9)	237 (69.9)	38 (11.2)
Profile C (n=144)	12 (8.3)	101 (70.1)	31 (21.5)
Number of physiotherapy sessions per prognostic profile			
Prognostic profile*	Over-estimation n (%)	Agreement n (%)	Under-estimation n (%)
Profile A (n=40)	17 (42.5)	23 (57.5)	-
Profile B (n=339)	91 (26.8)	193 (56.9)	55 (16.2)
Profile C (n=523)	30 (20.8)	91 (63.2)	23 (16.0)

*Prognostic profile:
- Profile A: normal recovery, low pain intensity, decreasing pain, increasing activities, active coping and no fear avoidance
- Profile B: uncertain recovery, medium pain intensity, persistent pain, persistent activity limitations, inconclusive coping and fear avoidance
- Profile C: delayed recovery, high pain intensity, increasing pain, decreasing activities, passive coping and fear avoidance
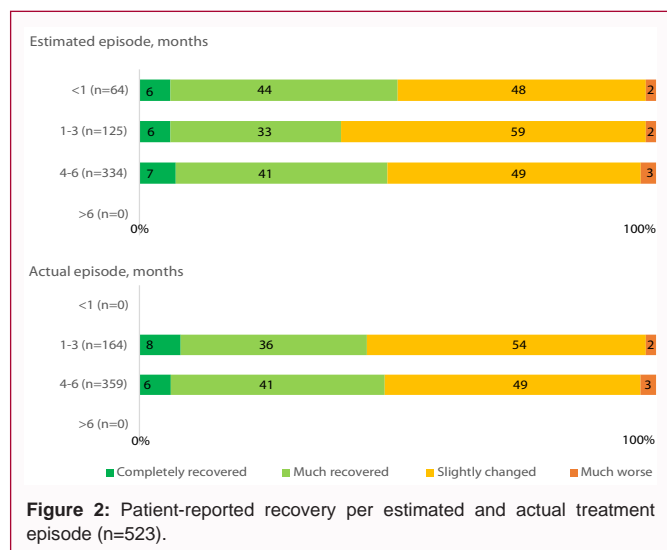
Figure 2: Patient-reported recovery per estimated and actual treatment episode (n=523).
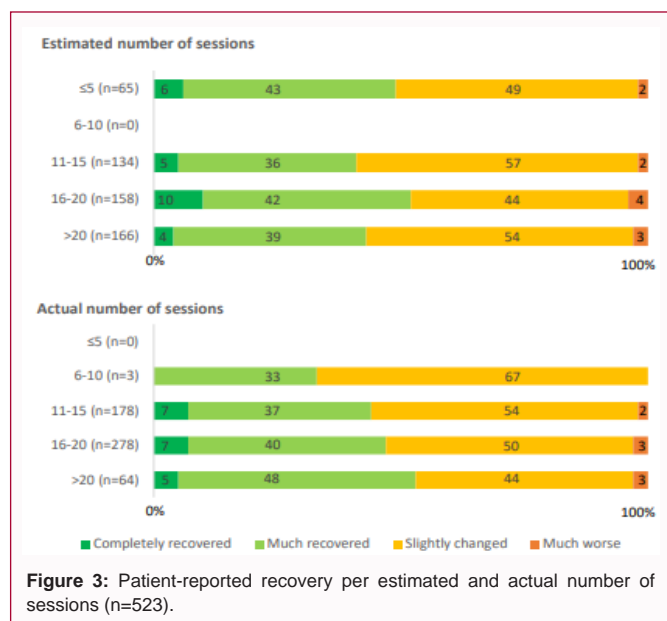

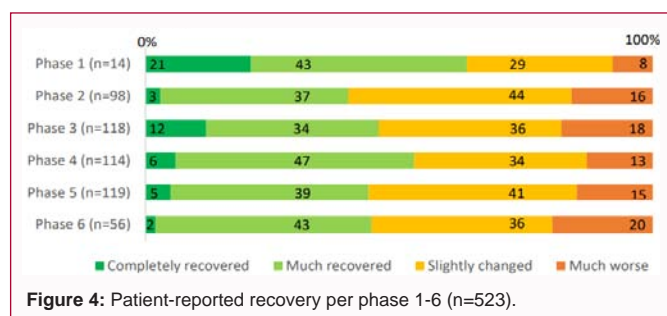**Figure 3:** Patient-reported recovery per estimated and actual number of sessions (n=523).

Figure 4: Patient-reported recovery per phase 1-6 (n=523).

Figure 5: Patient-reported recovery per prognostic profile A, B and C (n=523).

Patient-reported outcome

About half of the patients were recovered (completely recovered: n=34 [6.5%]; much recovered: n=207 [39.6%]), and half self-reported as 'slightly changed' n=199 [38.8%]) or 'much worse' (n=83 {15.9%}).

Patient-reported recovery as regards estimated and actual treatment episodes is presented in Figure 2. The most frequently estimated treatment episode was 4 to 6 months (n=334 [63.9%}), broadly in line with the actual duration in most patients (n=359 [68.6%]). In patients who self-reported as 'completely recovered' (n=21 [5.8%]) or 'much recovered' (n=148 [41.2%]) at discharge, the estimated and actual treatment episode were both 4 to 6 months.

Patient-reported recovery as regards estimated and actual number of sessions is presented in Figure 3. Regarding patient-reported recovery, the highest estimated frequency of treatment sessions was >20 sessions (n=166 [31.7%]) whereas the actual number was somewhat lower at 16 to 20 sessions (n=278 [53.2%]). For about half of the patients whose self-reported recovery at discharge 10 was 'complete recovery' (n=19 [6.8%]) or 'much recovered (n=110 [39.6%]) the actual number of sessions at discharge was 16 to 20.

Patient-reported recovery for the phases 1 to 6 is presented in Figure 4. In phases 2 to 6 around half of all patients were 'completely recovered' or 'much recovered', while a higher percentage of patients in phase 1 reported as 'completely recovered' or 'much recovered' (n=15 [64.3%]).

Patient-reported recovery for the prognostic profiles A, B and C is presented in Figure 5. Most patients with Profile A were 'completely recovered' or 'much recovered' (n=34 [85.0%]), compared to around 50% of patients with Profile B and about 40% of the patients with Profile C.

Associations between patient-reported outcome and care-related outcomes

Non-significant weak associations ($r_s<0.25$; $P>0.05$ were found between patient-reported recovery and the estimated and actual duration of physiotherapy episodes and number of sessions.

The association between patient-reported recovery and the phases after whiplash-related accident was non-significant and weak ($r_s<0.25$; $P>0.05$).

The association between patient-reported recovery and the prognostic profiles was significant and weak ($r_s=0.18$; $P<0.001$).

Discussion

Main findings

Based on phases after whiplash-related accident, the estimated duration of physiotherapy episodes and the number of physiotherapy sessions were in line with the actual episodes and numbers in

profile C (29.9% [n=43]). The most frequently number of treatment sessions was 16 to 20 sessions for all profiles.

Cross tabulated percentages of agreement for the above are presented in Table 5, and ranged from 56.9% (n=193) in Profile B (n=339) to 57.5% (n=23) in Profile A (n=40) and 63.2% (n=91) in Profile C (n=144). The number of treatment sessions was most underestimated for 16.2% (n=55) for Profile B, and most overestimated for 42.5% (n=17) for Profile A.
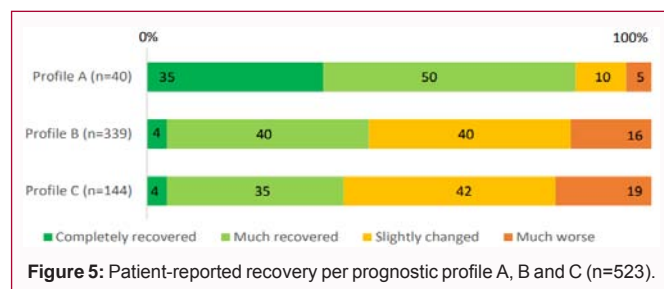
approximately 60% to 70% of the patients. However, in the first three phases the physiotherapy episode and the number of physiotherapy sessions was (decreasingly) underestimated, while in the last three there was an increasing overestimation, particularly in the number of sessions. Based on prognostic profiles, the clinical estimate was in line with the actual episode and number of sessions.

Associations between patient reported recovery and the treatment episode and the number of sessions were not significantly weak only the association between patient-reported recovery and the prognostic profiles was significant, albeit weakly.

The most plausible explanation for the underestimation of episode duration and the number of sessions in relation to the first three phases is that both patient and physiotherapist expected a normal trajectory of recovery in the first weeks after the whiplash injury. However, the trajectory of functional recovery from WAD is often prolonged [3-7]. In reality, the treatment period was longer and the number of sessions higher in the acute phase (phase 1 to 3). In the later phases (phase 4 to 6) the duration of the treatment episode and, in particular, the number of sessions were increasingly overestimated. Based on the evaluation at discharge, around half of all patients showed a relatively stable or only slightly changed level of recovery (slightly recovered or slightly worse). One possible consideration for the physiotherapist is treating patients over a longer time period but at a lower frequency [11].

This over- en underestimation of duration of treatment episode and number of treatment sessions may be due to the phenomenon of unrealistic absolute optimism being the unjustified belief that a personal outcome will be more favorable (shorter episode and less treatment sessions required) than the objectively measured outcome [46]. Such optimism could occur when physiotherapists have a perception of control over the situation, which may be stronger in the more short-term phases, and is - for instance - motivated by the desire to quick recovery. Being confronted with patients with WAD in chronic phases, physiotherapists may have a lower control perception because of their awareness of the influence of factors (e.g., cognitions and emotions) beyond their control.

Prognostic profile: Pattern recognition *via* clinical experience

Physiotherapists recognize patterns of illness ('WAD illness scripts') in patients with WAD that approximately correspond to prognostic profiles for recovery. This process requires physiotherapists to have assembled, through clinical experience, a repertoire of metaphorical illness scripts with corresponding trajectories of recovery after a whiplash-related injury. Importantly, all participating physiotherapists had extensive clinical experience regarding assessment of patients with whiplash related injuries. Although adeptness in the process of clinical reasoning is not strictly related to years of clinical experience, pattern recognition as a component of clinical reasoning requires prior clinical experience if a repertoire of positive, inconclusive or negative prognostic profiles is to be constructed. This non-analytical form of clinical reasoning involves the recognition of observed clinical features as similar to a previous specific experience. The next step is to validate this form of clinical reasoning based on a measurable form of clinical reasoning, including the modifiability of prognostic factors.

A complex of positive, inconclusive and negative variables can be used to estimate the probability of functional recovery in patients with WAD, and together these may constitute prognostic profiles for recovery recognized by experienced physiotherapist [47-50]. Based on clinical experience and knowledge of prognostic factors, Profile A was defined as positive, Profile B as inconclusive, and Profile C as a negative prognostic profile for functional recovery. It is remarkable that in more than half of all patients the profile was inconclusive, due to the presence of a mix of both positive and negative predictive factors for recovery, varying due to contextual factors. Traditionally physiotherapy has operated within a biomedical model. Today, physiotherapists partially recognized cognitive, psychological and social factors in people with WAD. However, they feel uncertain about incorporating these factors into their treatment to enhance functional recovery [51,52]. The large number of patients with an inconclusive profile is probably an expression of this uncertainty.

Recovery in patients with the prognostically positive Profile A was consistent with 'completely' or 'much recovered' in about 80% of the patients. Recovery in patients with the prognostically inconclusive Profile B was consistent with 'completely' or 'much recovered' in about half of all cases, and with 'slightly changed' or 'much worse' in the remaining half. Profile B is thought to be a combination of mutual exchange of positive and negative prognostic factors. Changes in patients with the prognostically negative Profile C were 'completely' or 'much improved' in about 40% and 'slightly changed' or 'much worse' in around 60% of patients.

At this stage, clinical use of prognostic profiles - unrelated to time since whiplash-related accident - is currently the best way to predict functional recovery in patients with WAD. However, it is still unclear which prognostic factors are potentially modifiable by physiotherapy [53]. Many modifiable and non-modifiable prognostic factors in the recovery trajectory of patients with WAD have been identified and most factors are psychological in nature [25-27]. Consequently, whether these psychological factors are modifiable will depend on the skills of the physiotherapist. Therefore, in addition to assessing and acquiring diagnostic skills, there is a need for adequate education in the psychosocial domain and for gaining therapeutic skills to target psychological characteristics in WAD.

Comparison with literature

Physiotherapy episode and number of sessions in this study were comparable to data concerning patients with chronic disorders in a longitudinal database registry (2014-2018) of Dutch primary physiotherapy care [54]. The most frequent episode in that database was 4 to 6 months, with 11 to 20 sessions.

However, in patients without a chronic disorder, the physiotherapy episode and the number of sessions was considerably lower (6 weeks and 6 to 10 sessions, respectively 54, and more consistent with the average number of sessions found in various Dutch observational studies of patients with neck pain [55,56].

The Dutch CPG Neck Pain (including trauma-related neck pain [formerly whiplash-related injury]) recommends discharging patients with the prognostic Profile A within 3 to 6 physiotherapy sessions, and patients with the prognostic Profiles B and C should be evaluated at six weeks, preferably using PROMs [21,22]. If no improvement in pain and functioning is achieved within a six-week physiotherapy episode, it is recommended that a patient should be discharged or the referring physician should be consulted regarding further treatment options. However, the findings of this study are inconsistent with these recommendations, as more than half of patients with profile A

required a treatment episode of 2 to 3 months, consisting of 11 to 20 sessions. Furthermore, over half of all patients with Profile B or Profile C required a treatment episode of more than 4 to 6 months and 16 to 20 or >20 sessions.

No comparable studies were found in the literature concerning the estimated and actual duration of physiotherapy episodes or the number of sessions in patients with WAD. Nevertheless, a number of studies in recent years have considered whether physiotherapists can accurately estimate the probabilities of recovery in patients with acute whiplash injury, in patients with neck pain or back pain or can estimate general improvement in patient outcomes [57-59]. Clinical prediction rules concerning the prognosis for recovery in patient with neck pain are still under debate [2,60]. A systematic review regarding clinical prediction rules in neck pain patients concluded that four prognostic clinical prediction rules relating to neck pain, three of which addressed acute whiplash, concern the initial stage of the recovery trajectory and therefore their routine clinical use is not yet justified [61]. Accordance between this type of prognostic clinical prediction rule and the physiotherapists' own assessment of risk of poor recovery following a whiplash injury was very low, showing agreement in only 29% of cases [57].

Strengths and Limitations

The data analyzed in this study were derived from one of the largest longitudinal databases in patients with WAD. Routinely collected data on patients with WAD (RCD-WAD) in the form of standardized pen and paper patient records were gathered over a period of ten years. The dataset was complete and without missing data. Although the pen and paper record has now been replaced by electronic patient documentation, the pen and paper record used in this study still meets the requirements of the most recent Dutch CPG physiotherapy documentation and the Dutch CPG Neck Pain [62,21,22]. Despite the limitations of RCD studies in general, including this RCD-WAD study, we expect that the results of this study provide valid insights into the PROs and CROs in patients with WAD anno 2021 [63,13].

The principal limitations of this longitudinal cohort study were the involvement of only two primary care physiotherapy practices in the Netherlands and the collection of data by eight experienced physiotherapists in total. While the characteristics of the participating physiotherapists are comparable to the national average and the patient sample was comparable to patients with neck pain in Dutch observational studies and randomized controlled trials, the low number of participating practices and physiotherapists may have limited the generalizability of the results [54-56,64-67].

Conclusion

This study highlighted the integration of CROMs in the management of patients with WAD. These recommended outcome measurements were successfully applied in two primary care physiotherapy practices over a period of 10 years, across all phases after whiplash-related accident and across different prognostic health profiles.

Although only weak associations were found between the care-related outcomes (duration of treatment episode and number of sessions) and the patient-reported outcome (recovery of functioning), physiotherapists were largely able to prognosticate the duration of the physiotherapy episode and the number of sessions in patients with WAD at a fair to moderate level.

Use of clinical prognostic profiles - not linked to the time after the whiplash-related accident - is currently the best way to prognosticate patient-reported functional recovery in patients with WAD.

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Supplementary File 1:

Steps of clinical reasoning I-IX, including items, quality indicators and level of evidence per step in patients with Whiplash-Associated Disorders (WAD).

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Steps of clinical reasoning (number of indicators)	Item	Indicator The average degree (in %) in which …	Level of evidence[*]
I. Administration: 2 indicators [1-2]			
	Name, year of referral, referral, medical information	1. Patient's information is shared.	IV
	Period since accident, request for help	2. Patient's request for help is noted.	IV
II. History taking: 7 indicators [3-9]			
IIa. Sociodemographic characteristics	IIa. age, gender, educational level, family status, employment status	3. Patients were subjected to a methodically performed history taking, and sociodemographic characteristics are noted.	IV
IIb. Accident-related information	IIb. location in vehicle, use of seatbelt, use of positioned headrest, anticipated collision, type of trauma, time of onset of whiplash- related complaints	4. Patients were subjected to a methodically performed history taking, and accident-related information is noted.	IV
IIc. Pre-existent functioning and health status	IIc. Pre-existent activity limitations, participation problems, job-related problems	5. Patients were subjected to a methodically performed history taking, and pre-existent functioning is noted.	IV
	IIc. Previous history of neck injury, pre- existent neck pain and/or stiffness, and/or irradiating arm pain, pre-existent pain else, comorbidity, relevant medication use	6. Patients were subjected to a methodically performed history taking, and pre-existent health status is noted.	IV
IId. Previous diagnostics and treatment	IId. Previous medical imaging neck diagnostics, cervical soft collar after trauma, pain medication, modalities of (manual) physiotherapy, recovery after previous treatment	7. Patients were subjected to a methodically performed history taking, and previous diagnostics and treatment are noted.	IV
IIe. Current health status and recovery rate since accident	IIe. Impairments in musculoskeletal neck functions, activity limitations, participation problems, job-related problems	8. Patients were subjected to a methodically performed history taking, and current functioning are noted.	IV
	IIe. Recovery rate since accident, type and number of complaints, type of signs and symptoms, inventory prognostic factors, pain medication, *symptoms related to the presence of central sensitization (*since 2009)	9. Patients were subjected to a methodically performed history taking, and recovery rate since accident, prognostic factors and the presence of central sensitization are asked and administrated.	IV
III. Objectives of examination: 1 indicator [10]			
IIIa Objectives of musculoskeletal examination IIIb. Objectives of neurological examination IIIc. Objectives of oto-neurological examination IIId. Objectives of psychological examination	Examination objectives in agreement with patient's history taking and supplementary medical data, choice of clinical musculoskeletal, neurological and oto-neurological tests, and selection of psychological questionnaires	10. Examination objectives in agreement with patient's history are noted, and choice of clinical tests and psychological questionnaires is noted.	IV
IV. Clinical examination: 4 indicators [11-14]			
IVa Musculoskeletal examination	Cervical testing (observation of posture, range of motion and palpation) in agreement with objectives of musculoskeletal examination	11. The results of clinical evaluation of cervical musculoskeletal functions testing are noted.	II - IV
IVb. Neurological examination	Testing of sensory functions and pain, muscles functions, reflexes and coordination, and testing of cranial nerve functions (partly incorporated in oto-neurological examination, particularly trigeminal nerve) in agreement with objectives of neurological examination	12. The results of clinical evaluation of neurological functions are noted.	IV
IVc. Oto-neurological examination	Standing and gait testing, dizziness test, positional testing, eyes movement test in agreement with objectives of oto- neurological examination	13. The results of clinical evaluation of equilibrium and dizziness / vertigo are noted.	IV
IVd. Psychological examination	Observation of pain behavior, and questionnaires (Fear- Avoidance Beliefs Questionnaire – FABQ – and Pain Coping Inventory -PCI)	14. The results of examination of psychological functions and tests are noted.	II - IV
V. Analysis and conclusion of diagnostic process: 2 indicators [15,16]			
	Classification Whiplash-Associated Disorders, time phase since accident, recovery in time since accident, determination of health profile A / B / C, prognostic factors, use of questionnaires, referral to GP in case if insufficient or no results expected, indication physiotherapy	15. Individual health profile addressed to the whiplash injury since accident, an indication of treatment prognosis, and an indication for physiotherapy have been established and are noted.	II- IV
	Presence of central sensitization	16. Presence of central sensitization is noted.	IV

VI. Treatment plan: 3 indicators [17-19]			
	Main treatment goals in different time phases since accident and in agreement with individual health profile, prognostic duration of treatment period and prognostic number of treatment sessions, pre-treatment measures pain (VAS) and functioning (NDI) , treatment plan in agreement with patient	17. Treatment goals are methodically determined and noted in agreement with individual prognostic health profile, time phase since accident, and with patient.	IV
		18. Prognostic treatment period and number of treatment sessions are noted.	IV
		19. Pre-treatment scores VAS and NDI are measured and noted.	I
VII. Treatment: 2 indicators [20,21]			
	Physiotherapy modalities with best available evidence in different time phases since accident in agreement with patient profile and treatment goals, and check for side effects	20. Physiotherapy modalities in agreement with treatment goals in time phases since accident and health profile, and with best available evidence are applied and noted.	II-IV
		21. Treatment effects and side effects are noted in patient's record.	IV
VIII. Evaluation: 5 indicators [22-26]			
VIIIa. Evaluation during treatment	Perceived result per treatment goal, regular and systematic evaluation and, if necessary, adjustment of treatment goals and treatment modalities, contact physician if insufficient treatment result	22. A methodically performed evaluation of treatment goals and treatment modalities are noted.	IV
VIIIb. Final evaluation	Final subjective and objective evaluation of treatment goals, post-treatment measures (pain (VAS) and functioning (NDI) , global perceived effect (GPE) , return to work, duration of treatment period and number of treatment sessions at the end of total treatment	23. Reached treatment goals and returned to work are subjectively evaluated and noted.	IV
		24. Post-treatment scores (pain (VAS) and functioning (NDI)) are measured and noted.	I
		25. Global perceived effect is measured and noted.	II
		26. Duration of treatment period and number of treatment sessions are noted.	IV
IX. Discharge: 2 indicators [27,28]			
	Reason for discharge, written report to physician in copy to patient	27. A final report is written and noted.	IV
	If necessary, arrangement of aftercare	28. Aftercare is arranged	IV

* Levels of evidence: I = systematic review or >2 high-quality controlled trials or high-quality diagnostic studies or high-quality psychometric studies; II = two high quality controlled trials or high-quality diagnostic studies or high-quality psychometric studies; III: high quality non-controlled trials or low-quality diagnostic studies or low-quality psychometric studies; IV: expert opinion and professional consensus or standard