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Identifying factors that could predict the treatment outcome of a multidisciplinary rehabilitation program for patients with chronic low back pain

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Thanks to our good cooperation and our tenacity and persistence, we were able to bring this project to a successful conclusion.

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M.B. and J.H.

Research context

Low back pain (LBP) is one of the most frequent healthcare problems in our modern society, and will be accompanied by major health care costs. The probability that a person will experience low back pain at some point of life, consists of 70-85 %.^[1] In the majority of these persons (90%), symptoms will disappear within a period of three months. However, the remaining minority (10%) still experience health problems after a period of three months.^[2] They are defined as chronic low back pain (CLBP) and are the leading cause of work absenteeism.^[1] Exercise therapy is effective in the prevention and treatment of this type of patients.^[3] For therapists, it would be convenient if prognostic variables were available. These prognostic factors could be used in order to adapt a rehabilitation program in function of the patient needs. We expect that these variables can significantly improve treatment outcomes.

This retrospective study is situated within a study carried out under the guidance of Prof. Dr. Annick Timmermans and Drs. Thomas Matheve.

We initiated this project last year by conducting a literature study in form of a systematic review about the potential variables that could affect an exercise program for chronic, non-specific low back pain patients (CNSLBP). We searched for possible prognostic, influencing or mediating factors.

This year, we performed a data acquisition independently at the Jessa hospital in Hasselt from the beginning of February until the end of May 2015. To bring this master thesis to a successful conclusion, work was divided equally. The written parts were re-read by the other student and complemented.

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WHAT THE GAP FILLS

What we already know

Chronic low back pain is a complex health problem, and remains difficult to treat. Knowledge of prognostic factors for a good treatment outcome could improve rehabilitation.

What this study adds

Prognostic variables were dependent on the outcomes measure used in the prognostic model. Only a small amount of the variance in treatment outcome could be explained by these prognostic factors emphasizing again the complexity of chronic low back pain.

1. ABSTRACT

Introduction: Low back pain (LBP) is a major problem. Exercise therapy is widely used as treatment of choice for these patients. Despite the positive effects on pain and disability, the effect sizes are small to moderate.

Aim: To identify factors that could predict the treatment outcome, i.e. pain, disability and compliance, of a multidisciplinary rehabilitation program for patients with chronic LBP.

Methods: A retrospective study of 323 participants who completed a multidisciplinary rehabilitation. Data was collected from patient history, progressive stationary bicycle test, questionnaires and electromyography results. After dichotomizing the independent factors, predictive models were created by using a Logistic Regression Modeling with a backward stepwise deletion.

Results: A total of 100 patients (33.90%) completed the VAS-scale and 96 patients (32.54%) completed the RMDQ. 48% of these subjects clinically improved in pain and 35.87% clinically improved in disability. Age and baseline HADS depression were prognostic factors for compliance and accounted for 10% variance. Prognostic factors for pain were baseline VAS, RMDQ and TSK. This accounted for 28% variance. Baseline RMDQ was a prognostic factor for a reduction in disability and accounted for 14% variance.

Discussion: Because of the low compliance, we were faced with many missing data. There is a wide variety of prognostic factors and the importance of each variable depends on the outcome.

Conclusion: Given that CLBP is a complex pathology, it will be difficult to predict the potential treatment effects even if we make use of a wide variety of possible prognostic factors.

Keywords

Chronic, Low Back Pain, Rehabilitation, Prognostic Factors

2. INTRODUCTION

With an incidence of 10-15% per year and a lifetime prevalence of 84%, low back pain (LBP) is one of the most common health problems in our society.^[1-3] LBP is defined as “pain and discomfort at the spine, located under the costal margin and above the inferior gluteal region, with or without referred pain in the lower limbs”.^[4] Only five to ten percent receives a specific diagnosis such as disc herniation, fractures, neurological disorders or inflammatory diseases. The remaining patients are diagnosed as having non-specific LBP,^[5] which means that no specific pathoanatomical cause of LBP can be detected.^[3] The majority of the patients have an good prognosis, since more than 90% of the patients recover within three months. If the duration of the symptoms persists for three months or more, LBP is defined as chronic LBP (CLBP), which has a poorer prognosis.^[5] In addition, CLBP is a leading cause of work absenteeism, resulting in high socio-economic costs.^[1]

In recent years, it has become clear that the population with chronic non-specific low back pain (CNSLBP) consists of different subgroups.^[6] Because of this heterogeneity, it is difficult to determine which patients are more likely to respond to a specific type of intervention.^[4, 7] It has been shown for example, that a multidisciplinary rehabilitation program has positive effects on pain, function and quality of life.^[8-10] However, the effect sizes are only small to moderate and not all patients will benefit from this type of treatment. Therefore, prognostic factors can provide useful information because they have the ability to predict treatment outcome. Based on these prognostic variables, the choice of treatment can be tailored to the needs of the patient, which may consequently improve the treatment outcomes.

In previous studies, the role of prognostic factors was explored for exercise therapy and manipulative therapy.^[11] Prognostic factors can be found in the patient’s characteristics such as age^[12], gender, Body Mass Index (BMI)^[13, 14] or in the disease characteristics such as the intensity and duration of symptoms.^[12] Up to now, little research has been done on prognostic variables for a long-term multidisciplinary rehabilitation program. Verkerk et al. (2013) investigated prognostic factors for LBP patients who received a multidisciplinary therapy with a 5-month follow-up: being married or living with one adult, shorter duration of back complaints at baseline, younger age, higher disability score at baseline, no previous rehabilitation, decreased course of pain three months prior to baseline and higher scores on the SF-36. The explained variance of this model was only 12.8%.^[15]

From these results, no conclusion could be drawn for shorter follow-ups. Van Der Hulst et al. (2005) examined the role of sociodemographic, physical, and psychological predictors of a multidisciplinary rehabilitation.^[16] Concerning sociodemographic predictors, a higher pain intensity and higher interference of pain with activities was related to a poor outcome. No physical prognostic variables were found. Aimed at the psychological prognostic factors, higher levels of baseline depression were associated with a poorer outcome. While lower levels of depression and active coping were related to a good outcome.

Therefore, the primary aim of this retrospective study was to identify prognostic factors that could predict the treatment outcome of a multidisciplinary rehabilitation program for patients with chronic low back pain. In addition, this study aims to identify prognostic factors for treatment adherence to this type of rehabilitation program.

3. METHOD

3.1 Study design

A retrospective study

3.2 Study population

A convenience sample of 323 patients who completed a multidisciplinary rehabilitation program at the Jessa hospital were included in the study. Patients were only included when they started their rehabilitation in the first six months of 2012 to 2014. The inclusion criteria were: 1) non-specific mechanical low back pain for more than six weeks; 2) more than three months after spinal surgery. Subjects suffering from cervical or thoracic pain as well as subjects with a serious underlying pathology, like cancer or multiple sclerosis, were excluded.

3.3 Prognostic variables

The study was approved by the Ethical Committee of Hasselt University, Belgium. The data were retrieved from an electronic database containing all medical and paramedical records from consultations and treatments received at the hospital. A data-collection was performed independently by two researchers. Discrepancies were detected, reconsidered and reassessed.

Data was collected from a progressive stationary bicycle test, patient history, questionnaires and electromyography results when available. From the progressive stationary bicycle test, maximum load (Watt) was gathered. From the patient history, the following prognostic variables were extracted: age, gender, Body Mass Index (BMI), signs and symptoms of nerve root compression, presence of sciatica, location of LBP, diagnosis, type of surgery, infiltration(s) prior to the rehabilitation, involvement of the sacro-iliac joint (SIJ), employment status, medication use and distance from patient's home to the hospital. Signs and symptoms of nerve root involvement were subdivided into two categories: 1) indicated in patient history; 2) obtained from EMG. This variable was scored if there was evidence of paraesthesia, numbness or weakness due to a nerve root pathology was mentioned. Sciatica was defined as radiating leg pain below the knee with a positive Lasègue's sign in clinical examination. Involvement of the SIJ was considered positive if the pain provocation tests were positive or if it, as such, was diagnosed by a doctor. With employment was meant whether the patient was working at baseline and/or at completion of the rehabilitation program. The questionnaires used were the Visual Analogue Scale (VAS) for pain, Roland-Morris Disability Questionnaire (RMDQ), the Hospital Anxiety and Depression Scale (HADS) and the Tampa scale for Kinesiophobia (TSK). These questionnaires were filled out by the patients before the start of the rehabilitation program and patients who completed the program also filled out the questionnaires immediately after the end of their rehabilitation.

3.4 Outcome measures

This retrospective study will investigate possible prognostic factors for three outcome measures, i.e. pain, disability and number of attended physical therapy visits (compliance). The Visual Analogue Scale (VAS) was used to measure the patient's level of pain. For this scale, participants were asked to indicate the intensity of their current back pain using an 11-point ordinal scale ranging from zero ("absence of pain") to ten ("worst imagined pain"). Disability was measured by use of the Roland Morris Disability Questionnaire (RMDQ). This questionnaire consisted of 24 questions, each scored yes or no. A higher score indicated a greater disability. Adherence was measured by using a central computer program. When the patient showed up for a treatment session, it was registered by the secretary or physiotherapist.

3.5 Rehabilitation protocol

Participants who completed the full program received 36 physical therapy sessions, lasting two hours each, with a frequency of two sessions per week. The rehabilitation program comprised one intake session, five back school sessions, one psychological interview, a rehabilitation program and a posttreatment measurement at the end of rehabilitation. Patients received no manual therapy treatment during the program. During the intake session, patients had to take a progressive stationary bicycle test and a physical therapist performed a clinical examination consisting of inspection (sitting and lying), palpation, active lumbar spine range of motion (ROM) assessment (flexion; extension; lateral flexion; 3D flexion homonym; 3D extension homonym), movement control tests^[17], Lasègue's sign and pain provocation tests for the SIJ. During the program, the patient followed five back school lessons. Subjects were informed about the anatomy, pathology and pathomechanics which are involved in low back pain. In addition, ergonomic advice on posture and activities in daily life was provided by an occupational therapist. One back school session was organized by a psychologist who learned the subjects how to cope with their pain, disability, kinesiphobia, anxiety and depression.

During the rehabilitation, patients performed a two-hour program which consisted of the following exercises: cycling on an ergometer for 20 minutes at 85% of the maximal heart rate, treadmill walking or crosstrainer for ten minutes on an individually adjusted speed and slope, arm ergometer for ten minutes, and stabilization exercises for 80 minutes. When it was considered necessary, therapists would add strength training (e.g. leg press) or a stretching protocol. The sessions were executed in groups, but every subject had an individually designed rehabilitation program. Three physical therapists were present during the training sessions.

3.6 Statistical analysis

The statistical analyses were conducted by means of the program JMP Pro 11 developed by the SAS Institute. Descriptive statistics were used to summarize patient demographics at baseline. The factors were divided into either continuous variables or categorical variables. Regarding the continuous variables, account was taken of a mean, standard deviation and range were described. As for the categorical variables, frequency and percentage were described.

3.6.1 Logistic Regression Modeling

Independent factors were converted into dichotomized variables. These independent factors consisted of compliance (dichotomized at 29 sessions), pain reduction (dichotomized at 2 points reduction on VAS) and disability reduction (dichotomized at 3.5 points reduction on the RMDQ).^[18] These values were obtained from the study of Ostelo et al. who described the minimally clinically important change (MCIC) and was defined as “the smallest difference in score in the domain of interest which patients perceive as beneficial and would mandate, in the absence of troublesome side effects and excessive cost, a change in the patient’s management”. To create the predictive models, a Logistic Regression Modeling with a backward stepwise deletion (0.05 exit) was used, meaning that there was a backward elimination of non-significant independent factors. A significance level of $p < 0.05$ was used to select the predictive variables. A cut-off point for compliance was set at 29 treatment sessions. This was calculated by taking 80% of the total number of sessions prescribed. A reduction of 30% on the RMDQ was calculated as follows: $[(\text{Pre-treatment RMDQ score} - \text{Post-treatment RMDQ score}) / (\text{Pre-treatment RMDQ score})] \times 100$. The Prediction Profiler was used in order to test the type of correlation for the dependent variables, i.e. positive or negative. Additional, individual p-values for each variable were analyzed. Subsequently, a generalized R-square (R^2) and the model p-value were examined for every significant model.

4. RESULTS

4.1 Patient demographics

A total of 295 patients with CLBP were enrolled in a multidisciplinary rehabilitation program. The continuous baseline demographics are summarized in **Table I**, while the categorical baseline demographics are summarized in **Table II**. The mean age was 42.96 years (Standard Deviation [SD] 11.07; range 19 - 76) and consisted of 38% men and 62% women. The mean number of attended physical therapy visits was 21.7 (SD 12.84). In total, 125 patients had completed the program (42.37%). Of the 295 patients in the sample, 110 (37.29%) had a known history of infiltration(s) prior to the rehabilitation. While 59 subjects (20%) had undergone surgery for back pain before their participation.

Table 1. Baseline demographics, continuous variables (N = 295)

Continuous variables	Mean	Standard deviation	Range
Age (years)	42.96	11.07	19 – 79
BMI (kg/l²)	26.41	4.87	16.65 – 42.97
Number of sessions performed	21.7	12.84	1 – 36
Distance to the hospital (Km)	14.37	10.37	0.4 – 51
VAS	6.5	2.31	0 – 10
RMDQ	10.78	5.6	1 – 24
HADS anxiety	8.68	4.12	0 – 21
HADS depression	7.26	4.33	0 – 21
TSK	39.06	7.87	18 - 64

BMI = Body Mass Index; VAS = Visual Analogue Scale; RMDQ = Roland-Morris Disability Questionnaire; HADS = Hospital Anxiety and Depression Scale; TSK = Tampa Scale for Kinesiophobia

Table 2. Baseline demographics, categorical variables (N = 295)

Categorical variables	Frequency	%
Completed the program (29 sessions)	Yes = 125	41.36
	No = 170	58.64
Gender	Male = 111	38
	Female = 184	62
Employment	Working = 83	37.29
	Not working = 110	62.71
Medication use	Yes = 171	84
	No = 32	15
Infiltration(s) prior to the rehabilitation	Yes = 110	37.29
	No = 181	62.71
Previous spinal surgery	Yes = 59	20
	No = 293	80
Signs and symptoms of nerve root compression	Patient history = 58	13.66
	EMG = 33	11.18
Presence of sciatica	Yes = 73	38.62
	No = 114	61.38
Involvement of the sacro-iliac joint	Yes = 27	9.15
	No = 71	90.85

4.2 Program effects

By the end of this multidisciplinary rehabilitation program, a total of 100 patients (33.90%) completed the VAS-scale and 96 patients (32.54%) completed the RMDQ. In order to verify the effectiveness of the program, only those patients who had participated in both pre- and post-measurements were included. The mean score for pain decreased from 6.30 to 4.54 (SD 2.90; p 0.05). The minimally clinically important change (MCIC) of the VAS-scale was set at 2 points. This implies that 48% subjects clinically improved in pain. Only one patient reported to be free of pain after completion.

The mean score on the RMDQ decreased from 9.47 to 6.69 (SD 4.94; p 0.05). For this questionnaire, a MCIC of 3.5 points of reduction was used, which means that 35.87% clinically improved in disability. The mean percentage for a decrease in VAS and RMDQ (T0-T1/T0) was 18.57% (SD 87%) and 20.43% (SD 76%) respectively. At the end of rehabilitation, only 15 participants (5.08%; p 0.05) were still unable to work and 41 patients (13.90%; p 0.05) used medication both before and after rehabilitation.

Table 3. Program effects (N=295)

Primary outcome measures	Pre-measurement (SD)	Post-measurement (SD)	Progress (%)
VAS	6.30 (±2.45)	4.54 (±2.90)	18.57%
RMDQ	9.59 (±5.11)	6.69 (±4.94)	20.43%

VAS = Visual Analogue Scale; RMDQ = Roland-Morris Disability Questionnaire; SD = Standard Deviation

4.3 Multivariate regression analysis

The previously mentioned variables were entered as dependent variables into the multivariable backward logistic regression, while the three outcome measures, i.e. pain (VAS), disability (RMDQ) and compliance (number of sessions), were entered as independent variables. All three models were significant. Two variables were significantly associated with compliance. A reduction of two points or more on the VAS-scale contained three significant variables. Reduction of three and a half points or more on the RMDQ had one significant variable. Age and HADS for depression were significant factors for compliance. The VAS-score at baseline was a significant prognostic variable for pain, while the baseline score on the RMDQ was a significant factor for pain and disability reduction. The baseline score on the TSK was significant for pain. Finally, the HADS for depression was significant for the compliance model.

Table 3. Multivariable backward logistic regression for prognostic factors

Model	Variable	Individual r-value	Correlation	Generalized Rsquare
Compliance (29 sessions) N = 295	Age	0.04*	HADS high: - HADS low: +	0.10*
	HADS depression	0.01*	Age high: - Age low: +	
VAS (2 points) n = 100	VAS	0.03*	TSK high: + TSK low: -	0.28*
	RMDQ	0.07	+	
	TSK	0.05*	VAS high: + VAS low: -	
RMDQ (3.5points) n = 92	RMDQ	0.02	-	0.19*

VAS = Visual Analogue Scale; RMDQ = Roland-Morris Disability Questionnaire; HADS = Hospital Anxiety and Depression Scale; TSK = Tampa Scale for Kinesiophobia; + = Positively correlated; - = Negatively correlated; * = p-value <0.01

4.3.1 Variance

Age and HADS depression were independent predictors of the patient compliance and accounted for only 10% ($R^2= 0.10$). Baseline VAS, baseline RMDQ and baseline TSK were independent predictors of pain reduction and accounted for 28% ($R^2= 0.28$). Baseline RMDQ was an independent predictor of a reduction in disability and accounted for 14% ($R^2= 0.14$).

4.3.2 Compliance

Age and baseline HADS depression were significantly associated with compliance. Age was negatively correlated with compliance ($R=0.04$, $p<0.01$) meaning that younger patients showed a better compliance.

The HADS depression correlation with compliance ($R=0.01$, $p=0.09$) was dependent on the age; for lower age, HADS depression was positively correlated with compliance and for a higher age, HADS depression was negatively correlated. This means that younger subjects had a better compliance if they had a high score for HADS depression, while older subjects' compliance was better if they had a low score on the HADS depression scale.

4.3.3 Reduction in pain

Baseline VAS, baseline RMDQ and baseline TSK were significantly associated with pain. The VAS correlation with pain reduction ($R=0.03$, $p=0.14$) was dependent on the TSK-score; for a higher TSK, VAS was positively correlated with pain reduction for a lower TSK, VAS was negatively correlated. This means that subjects with a high baseline TSK showed more pain reduction if they had a high baseline VAS, while subjects with a low baseline TSK score better had a low baseline VAS to show more pain reduction.

RMDQ was positively correlated with a reduction in pain ($R=0.07$, $p=0.03$), meaning that subjects with a higher baseline RMDQ showed more pain reduction

The TSK correlation with pain reduction ($R=0.05$, $p=0.06$) was dependent on the VAS score: for a lower VAS score, TSK was negatively correlated with improvement on pain, for a higher VAS score, TSK was positively correlated. This means that subjects with a low baseline VAS showed more improvement on pain if they had a low baseline TSK, while subjects with a high baseline VAS better had a high baseline TSK to show more improvement on pain.

4.3.4 Reduction in disability

Only baseline disability score was significantly associated with a reduction in disability ($R=0.14$, $p<0.01$). The correlation was negative. This means a lower baseline RMDQ score resulted in a better reduction in disability.

5. DISCUSSION

The objective of this retrospective study was to search for possible prognostic factors, which may influence the treatment outcome of a multidisciplinary rehabilitation program for CLBP patients. Knowledge of these prognostic variables could contribute to a better prognosis of recovery. The results from this study should be interpreted with caution though. During the data collection, we were faced with many missing data. A possible explanation for this could be the lack of consistency in performing a patient history and physical examination. This had the consequence that not all of the possible prognostic factors could be identified in every single medical report. Hence, it was unclear whether these variables were not investigated or negative. Consequently, these variables were not scored. This concerned following factors: signs and symptoms of nerve root compression, presence of sciatica and , involvement of the sacro-iliac joint (SIJ). Another reason for this large amount of missing data, is the fact that only those patients who have completed their rehabilitation program (29 sessions), underwent a physical examination and filled out the questionnaires for the second time.

A first outcome measurement in this study was compliance. The number of attended physical therapy visits within this multidisciplinary rehabilitation program was low. Of the 295 patients in this study, only 125 (42.37%) completed at least 29 treatment sessions. This means that a total of 170 subjects have ended their rehabilitation too early (57.63%). Compared to the study of Gregg et al. (2014), who conducted a similar retrospective study about prognostic factors that may be associated with outcomes in LBP treated within a multidisciplinary rehabilitation program^[19], we noticed that our score for compliance was much lower. Although no significant differences could be found in baseline characteristics, a possible explanation could be the amount of supervision during the exercises^[20], because during our study, subjects trained under partial supervision. Due to the partial supervision, the therapeutic alliance might be reduced with the possible result of a lower compliance. In our prior review, we found a significant association between therapeutic alliance and a better improvement in pain and disability. The relationship between therapeutic alliance and compliance is not yet explored. Another reason for the low compliance could be explained by the patient's perception of the progress to be made during the rehabilitation program. It is important that the patient and physical therapist have an agreement of treatment expectations^[21]. This can be obtained by educating the patient by clarifying the possible developments of the treatment outcomes during the treatment program to the extent this is possible.

This study showed that younger patients with more depressive feelings or older patients with less depressive feelings had the highest chance of completing this multidisciplinary rehabilitation program. These factors explained only 10% of the variance though. Gender was not a prognostic factor for compliance. On the contrary, Mannion et al. (2009) found that male patients, combined with a high self-efficacy, had a higher therapy compliance and accounted for a 32% variance during a spinal segmental stabilization program^[22]. In this study, data of self-efficacy were not available. This could

possibly be the reason gender was no significant factor, which might have been the case when combined with self-efficacy.

In about half of the patients that completed the program, there was a significant decrease in pain and disability. Results should be interpreted with some caution, since there was a drop-out rate of 66%. Recent studies have confirmed the positive effects of a multidisciplinary program. They indicated that a multidisciplinary rehabilitation program resulted in an improved pain, disability, kinesiophobia and quality of life^[23, 24]. Pieber et al. (2014) showed that these remained visible for a long period of time. Steffens et al. (2012) indicated that patients with a higher level of pain, disability and kinesiophobia at baseline had the highest chance to obtain a clinical improvement in pain^[25]. They found that there was a clinically relevant improvement in pain when it came to patients with lower levels of pain at baseline. These results were consistent with our current findings, i.e. patients with a high level of pain, disability and kinesiophobia had the most chance of getting a minimal clinically important difference in pain. Gregg et al. found a clinically relevant improvement in pain when it came to patients with lower levels of pain at baseline. This was in line with our results, on the condition these patients had low kinesiophobia at baseline.

This study reported that patients who initially scored low on the RMDQ, showed a greater improvement in disability. According to Cecchi et al. (2012), a higher disability score (RMDQ) at baseline predicted a better response rate to back school and individual physiotherapy, which resulted in a reduction of disability^[11]. They divided the Roland-Morris score into three subgroups, i.e. low, medium and high disability scores. The difference could be explained by the fact that a different type of intervention was applied. Results showed mainly positive results for spinal manipulation as an intervention. Another explanation could be that mainly older patients were included.

We observed that all prognostic factors of this study, with the exception of age, could be obtained by making use of different questionnaires. This is in line with the literature study that was performed earlier. Within this review, we concluded that psychological prognostic factors could have a positive impact on the therapeutic outcome of an exercise therapy, while this was not the case for physical factors. Self-efficacy, therapeutic alliance and pain catastrophizing were positively associated with a better prognosis and reduction in pain and disability. Furthermore, self-efficacy caused an increase in exercise adherence. Despite the fact that it could be an important prognostic factor, self-efficacy was not examined within the current study.

From the results of these studies, together with our current study, we can conclude that there is a wide variety of prognostic factors with a lot of contradictions between studies. This could be due to differences between patient populations, interventions or prognostic factors. The importance of each variable depends on the outcome. The prognostic models in this study could partially explain the total variance of compliance (10%), reduction in pain (28%) and reduction in disability (19%). A study by Cook et al. investigated possible prognostic factors in the management of LBP. They used manual

therapy as intervention and obtained an equivalent variance for compliance (15.4%), reduction in pain (20.2%) and reduction in disability (23.1%). Given that CLBP is a complex pathology, it will be difficult to predict the potential treatment effects even if we make use of a wide variety of possible prognostic factors.

A strength of this study is the fact that it used a wide range of possible prognostic factors at baseline. These factors were included as dependent variables which ensures that the results can be more generalized into practice. Performing a retrospective study contributes to the generalizability to CLBP patients. Although except from pain lasting more than six weeks and more than three months after spinal surgery, no inclusion criteria were set. This could have caused that the results are applicable for a too widespread patient population.

A major limitation of this study is that although a large sample of 323 patients with CLBP was included in this retrospective study, there was a large amount of missing data because of the high drop-out rate. As a result, program effects could only be measured with those subjects who carried out both pre- and post-measurements. No reasons for drop-out were given. No intention-to treat analysis was performed which could lead to an overestimation of the treatment effects, because it can be expected that subjects who do not complete the rehabilitation program experience less improvement.^[21] Furthermore, independent variables were dichotomized which has several negative consequences; there's a loss of power, loss of information and it can lead to bias^[26]. This bias could be caused by incorrect classification of patients, because as consequence of small adjustments to the cut-off, potentially group proportions change and other predictors could be found within the same model. Nevertheless, we decided to use these cut-off scores based on the current literature. The study of Ostelo et al. indicated that the scores that we used were indeed evidence based.

Future research should be focused more specifically on examining the influence of baseline characteristics that could be extracted solely from questionnaires on the outcome of a multidisciplinary treatment program for chronic low back pain patients, excluding physical factors in the prognostic models. To be able to predict the outcome of this program clearer and more specific, the correlations between these factors need to be better investigated.

6. CONCLUSION

Prognostic variables were dependent on the outcomes measure used in the prognostic model. Not much of the variance could be explained by these prognostic factors emphasizing again the complexity of chronic low back pain. Except from age, all prognostic factors could be retrieved by making use of different questionnaires.

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