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ASSESSMENT PROCEDURE

The Self-Regulation Assessment (SeRA) questionnaire: development and exploratory analyses of a new patient-reported outcome measure for rehabilitation

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ABSTRACT

Purpose: To develop and explore underlying dimensions of the Self-Regulation Assessment (SeRA) and psychometric features of potential components. Further, to identify associations between the SeRA and disability-management self-efficacy, type of diagnosis, and type of rehabilitation.

Materials and methods: Based on a previously developed model of self-regulation, expert and patient opinions, and cognitive interviews, a list of 22 items on self-regulation (the SeRA) was constructed. The SeRA was included in a cross-sectional survey among a multi-diagnostic group of 563 former rehabilitation patients. Exploratory analyses were conducted.

Results: Respondents had a mean age of 56.5 (*SD* 12.7) years. The largest diagnostic groups were chronic pain disorder and brain injury. Four components were found within the SeRA, labelled as "insight into own health condition," "insight into own capabilities," "apply self-regulation," and "organization of help." Cronbach's alpha was high (total scale: 0.93, subscales: range 0.85–0.89). Only scores on the first subscale showed a ceiling effect. Subscale three showed the highest correlation with a self-efficacy measure. Small differences in SeRA total scores (range 71.6–78.1) were found between different diagnostic groups.

Conclusion: The SeRA is a new self-regulation measure with four subscales. Further research is needed to establish the validity and reliability of the SeRA.

➤ IMPLICATIONS FOR REHABILITATION

- The Self-Regulation Assessment (SeRA) was developed to provide a comprehensive measurement of self-regulation among rehabilitation populations.
- The SeRA could potentially be used to identify persons with self-regulation problems at the start of rehabilitation treatment and measure outcomes of rehabilitation for self-regulation.
- The SeRA could potentially be used to help analyse outcomes of rehabilitation practice as well as evaluate interventions on self-regulation.

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Self-regulation; rehabilitation; patient-reported outcome measures; validation studies; exploratory factor analyses

Introduction

Medical rehabilitation treatment aims to improve a persons' independence, self-regulation, and societal participation [1]. Self-regulation can be defined as "a process of managing and changing the self" [2]. Self-regulation is a wide-ranging concept and refers to learning self-management, self-control, and goal-setting [3,4]. Having and applying self-regulation skills are required for obtaining optimal levels of participation in society [5]. Therefore, regaining self-regulation is recognised as a key facet throughout rehabilitation [4].

To operationalize the concept of self-regulation in the context of rehabilitation, a conceptual model of self-regulation based on patient perspectives was developed in a previous study [6]. The model consists of three main themes and a total of six subthemes, that were identified during focus group discussions with

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former rehabilitation patients. These themes partly reflect conditions for the ability to self-regulate, and partly the application of self-regulation. The first theme refers to having self-insight, with three subthemes, namely having self-insight into ones' own health condition, having insight into ones' own limitations due to this health condition, and having insight into ones' abilities for independent physical and cognitive functioning. The second theme refers to coping with the consequences of the health condition, with the subthemes; ability to communicate about limitations and having trust in one's own body and functioning. The third theme refers to the application of self-regulation in daily life with the subtheme using abilities to optimize functioning in daily life [6]. An explorative Delphi study among Dutch rehabilitation physicians showed support for this model but also revealed the need for an additional fourth main theme of "asking and directing help" [7].

In a systematic review searching for generic measures for self-regulation in a rehabilitation context, many measures of self-regulation or closely-related concepts were identified [8]. However, screening of the contents of these measures showed that none of these measures were able to measure all four main themes and thereby the full concept of self-regulation [8]. The available measures focus either on the themes conditional to regaining self-regulation or on the application of self-regulation. For example, the Awareness Questionnaire mainly focuses on the individual's understanding of their condition and on having self-insight [9]. In contrast, for example, the University of Washington Self-Efficacy Scale (UW-SES) focuses on the application of self-regulation in everyday life [10].

Due to the lack of a comprehensive self-regulation measure for a rehabilitation population, a new measure, the Self-Regulation Assessment (SeRA), was developed to measure self-regulation in a rehabilitation context. Preferably, the SeRA would be used to identify persons with self-regulation problems at the start of medical rehabilitation treatments and would be used to measure self-regulation outcomes of rehabilitation treatment and interventions. Furthermore, the SeRA should be suitable to rate levels of self-regulation in medical rehabilitation across different diagnostic groups (generic focus).

The current study aims to explore the factor structure of the SeRA. The research questions were:

- Which underlying dimensions of self-regulation can be identified within the SeRA and what are the psychometric features of these potential components?
- Which associations can be found between the SeRA and the UW-SES-6, type of diagnosis, and type of rehabilitation?

Due to the exploratory character of this study, no hypotheses for both research questions were formulated before the analyses. However, we expected positive associations between all items and to be able to identify multiple subscales. It was unsure whether to expect the 22 items to cluster in seven components (reflecting the six subthemes plus the theme on help), four components (reflecting the four themes), or fewer components. Further, we included a measure of disease-management self-efficacy, the UW-SES-6 to explore the convergence between this scale and the total score and possible subscale scores of the SeRA. It was expected that items on the application of self-regulation would show stronger correlations with this UW-SES-6 compared to items on aspects conditional for self-regulation. Lastly, the SeRA was developed as a generic instrument and therefore no major differences in outcomes between different diagnostic groups or between former inpatients and outpatients were expected.

Methods

Study design and participants

This cross-sectional survey study was part of a larger research program named "Measurement of Outcomes of Rehabilitation in the Netherlands" (MUREVAN). Potential participants were recruited through seven institutions in the Netherlands: University Medical Center of Utrecht, University Medical Center of Groningen, Amsterdam University Medical Centers, De Hoogstraat Rehabilitation Center, Heliomare rehabilitation Center, Sint Antonius Hospital, and Center for Integral Rehabilitation (CIR). The sample size was determined as at least 15 participants per included item of the longest measure in the study [11]. Inclusion criteria for participants were: aged 18 years or older, received inpatient or outpatient rehabilitation treatment between 2012 and 2019, not receiving any rehabilitation treatment at the time of this study, and belonging to one of the main diagnostic groups in the Dutch medical rehabilitation landscape: amputation, neurological diseases (incl. neuromuscular diseases), chronic pain disorder, musculoskeletal disorder, spinal cord injury, acquired brain injury, organ disorder, and oncology [12,13]. The survey was provided in the Dutch language, therefore the inability to speak and read the Dutch language was an exclusion criterion.

Procedure

Potential participants were invited between February 2020 and March 2020, and between September 2020 and February 2021. Between these periods data collection was temporarily interrupted due to Covid-19 restrictions in the Netherlands. Potential participants were contacted via the participating institutions. These institutions sent invitation emails including information about the study to their former patients who met the inclusion criteria. The emails also contained a link and a unique login code to access the online questionnaire. The researchers were unaware of who received which log-in code to keep the data anonymous. Potential participants were asked to log in, provide their informed consent by clicking a box, and after that complete the online questionnaire. A few potential participants without email addresses were sent the invitation and the questionnaire by postal mail. A reminder was sent to all potential participants who did not respond within two weeks after the initial request. Respondents with missing values on the SeRA scale were excluded from the dataset.

Statement of ethics

The study protocol was reviewed by the Medical Ethics Committee of the University Medical Centre of Groningen, and it was declared that this study did not require formal approval according to Dutch law (registration number 201800582). The head of the departments of all seven participating institutions provided approval for study execution. This study was conducted according to the principles of the Declaration of Helsinki.

Instruments

Development of the Self-Regulation Assessment (SeRA)

The Consensus-based Standards for the selection of health Measurement Instruments (COSMIN) were taken into account in the description of the development [14,15]. The first step was the investigation of the construct of interest and the description of the aim of the instrument and the target population. These are

described in two previous publications [6,8]. Conceptualization of the construct was conducted based on focus group discussions with former rehabilitation patients to identify important components of self-regulation, and items were drafted based on the previously developed conceptualization of self-regulation [6,8]. Potential items were reviewed by rehabilitation researchers, rehabilitation physicians with expertise with measurement issues, representatives of patient organizations, and rehabilitation management board members. This way, a list of 25 items was created. Intentionally, each of the four main themes was covered by four to eight items for good coverage of the construct. The next step in the process was content validity. Two rounds of individual cognitive interviews ($N = 8$ and $N = 16$), with heterogeneous samples of former rehabilitation patients, were performed, as described in detail elsewhere [16]. The relevance, comprehensiveness, and comprehensibility of the individual items and the measure as a whole were assessed [14,15]. These participants were not involved in any other phase of the development of the SeRA. Participants were asked to read the items out loud and express all of their thoughts and ideas about the items (available upon request). The interviews were audiotaped and transcribed by a research assistant. Three different researchers were involved in the analyses. After coding and analyzing the results per item, five items seemed unclear and were omitted. One item was split into two items and one item was added. The wordings of a few other items were slightly changed. The subsequent round of cognitive interviews confirmed content validity. This list with 22 items was included in the cross-sectional survey. Each item is scored on a 5-point scale: "totally disagree," "disagree," "neutral," "agree," and "totally agree."

UW-SES-6

The 6-item version of the UW-SES was used to assess disability-management self-efficacy [10]. Self-efficacy appeared to be a related construct of self-regulation [8], and therefore a moderate ($\geq$0.30) correlation between the SeRA and the UW-SES-6 was expected. Each item of the UW-SES-6 is scored on a 5-point scale: "not at all," "a little," "quite a bit," "a lot," and "completely." The UW-SES-6 total score is computed by summing the item scores and transforming this sum-score into a T-score metric using a concordance table. A perfect self-efficacy score is valued at a T-score of 68.9 and the lowest score of self-efficacy is valued at a T-score of 20. The UW-SES-6 showed high reliability and strong evidence of validity in rehabilitation populations [10,17].

Statistical analyses

Analyses were performed with IBM SPSS statistics 27. Descriptive analyses were used to describe the distribution of the item scores of the SeRA. The Kaiser-Meyer-Olkin (KMO) measure was computed to check the adequacy of the data for analyses. KMO values are considered as good when >0.7, and therefore valued as a minimum to continue analyses [18]. Barlett's test of sphericity was checked on significance ($p < 0.05$) [11]. Further, inter-item correlations were valued as satisfactory if between 0.2 and 0.5 [11]. Many lower or higher correlations would indicate too much or too little heterogeneity across the 22 items, respectively. Exploratory factor analyses with oblique rotation were performed to investigate the structure of the SeRA. Oblique rotation was used because we expected that all items would be inter-correlated and therefore did not expect that orthogonal rotation, which assumes uncorrelated factors, would represent the data well [19]. The number of factors was determined by Kaiser's criterion based on eigenvalues of >1 and the point of inflection of the scree plot [18]. Principal component analysis was used for factor extraction [11]. Items were considered to load on a factor if the factor loading was >0.3 [20]. If an item loaded on two factors with ≤0.1 difference between the factor loadings, the project team decided based on content to which factor this item belonged [19]. If the difference was >0.1 the item was placed in the factor with the highest factor loading [19].

Internal consistency was analyzed using Cronbach's Alpha and corrected item-total correlation. Cronbach's Alpha values of >0.70 and corrected item-total correlations > 0.3 were considered as satisfactory [18,21]. Descriptive analyses of the total SeRA scale and the identified subscales were performed. For the total scale and each subscale, a score was computed with the range from 0 (very poor self-regulation) up to 100 (excellent self-regulation). Floor or ceiling effects were considered present if >15% of the participants scored the minimum or the maximum score, respectively [11]. Spearman correlations between the total SeRA scale and the subscales were analyzed. To explore convergent validity, correlations were calculated between the SeRA 22-item scale, the SeRA subscales, and the UW-SES-6. Correlations were considered weak (<0.3), moderate (0.3–0.5), or strong (>0.5) [22]. Finally, correlations between subscales were analyzed and compared across diagnostic groups and rehabilitation trajectories (inpatient *vs.* outpatient) to reveal possible differences in the structure of the SeRA across different rehabilitation groups.

Results

Participants

A total of 2988 former patients were invited to participate. Our final sample consisted of 563 participants. These respondents matched the inclusion criteria and showed no missing data. Most participants completed the questionnaire online (87.8%). Characteristics of the participants are displayed in Table 1. The largest included diagnostic groups were chronic pain disorder ($n = 110$), and brain injury ($n = 125$). Most participants were native Dutch (87.6%).

SeRA scores

The score distributions of the 22 items of the SeRA are displayed in Table 2. Items were ranked based on their mean scores, ranging from 3.37 to 4.35. Overall, all participants did show high scores on each item, however, there are some exceptions of participants with low scores on self-regulation outcomes.

Component structure

The KMO value (0.93) and the significant Barlett's test ($p < 0.01$) verified the suitability of the data for factor analysis. The correlation matrix (Supplementary Table A) showed that >80% of the inter-item correlations were between 0.2 and 0.5. Less than 1% of the correlations were <0.2 and 17.7% were higher than 0.5. The scree plot indicated either a one or four-factor solution by the two points of inflection in the plot. Factor analysis indicated a 4-factor solution, with a strong first factor with an Eigenvalue of 9.66. Other factors showed Eigenvalues of 2.08, 1.58, and 1.10, respectively. The total explained variance was a satisfactory 65.5%. Explained variance per factor and factor loadings after oblique rotation are displayed in Table 3. Each item loaded on at least one factor. Items 11 and 12 loaded on two factors with <0.1 difference. They were assigned based on content. Inspection of the items in factor 1 suggested that this component represents

Table 1. Characteristics of the respondents ($N = 563$).

Characteristic	*n* (missing)	% or mean (*SD*)
Age [mean (*SD*)]	539 (24)	56.7 (12.7)
Male (%)	252	44.8
Ethnicity (%)		
Native Dutch	493	87.6
Migration background*	70	12.4
Education (%)		
No education/lower education	311	55.2
Higher education	252	44.8
Current marital status (%)		
Living alone	133	23.6
Married/living together without children	235	41.7
Married/living together with children	151	26.8
Living alone with children	31	5.5
Other	13	2.3
Diagnose (%)	(1)	
Brain injury	125	22.2
Chronic pain disorder	110	19.5
Spinal cord injury	79	14
Neurological and neuromuscular disorder	87	15.6
Musculoskeletal disorder (incl. amputation)	83	14.8
Other (incl. oncology, organs).	78	13.9
Time since last rehabilitation treatment in years [mean (*SD*)]	561 (2)	3.31 (2.30)
Time since diagnosis (%)		
1–2 years ago	87	15.5
3–5 years ago	286	50.8
6–10 years ago	80	14.2
Longer than 10 years ago	110	19.5
Type of last rehabilitation treatment (%)		
Inpatient	241	42.8
Outpatient	322	57.2
Reached via (%)		
University Medical Centres	184	32.7
General Hospital	32	5.7
Rehabilitation Centres	221	39.3
Private Rehabilitation Clinic	126	22.3

*Dutch speaking.

Table 2. The 22 items of the SeRA and the distribution of the item scores.

	Mean*	(*SD*)	1. Totally disagree (%)	2. Disagree (%)	3. Neutral (%)	4. Agree (%)	5. Totally agree (%)
1. I understand my condition.	4.35	0.83	1.1	2.7	8.8	35.2	52.1
3. I understand the physical impact of my condition.	4.26	0.78	0.7	2.7	8.1	46.8	41.5
4. I understand the emotional impact of my condition.	4.14	0.78	0.4	2.8	13.8	48.6	34.3
2. I recognize what my body is telling me.	4.11	0.77	0.7	3.7	8.8	57.1	29.5
5. I am aware of what I can do.	4.07	0.85	0.4	5.5	14.5	46.3	33.2
20. I determine how I make use of my options.	4.06	0.77	0.2	2.8	17.7	48.9	29.5
14. I know who to ask for help.	4.05	0.79	0.9	3.2	13.6	54.6	27.6
10. I decide what I do.	4.04	0.83	0	4.4	19.5	43.6	32.3
21. I do what I think is important.	4.04	0.78	0.5	2.5	17.8	50.9	28.3
6. I am aware of my capabilities.	4.02	0.85	0.5	5.3	15.5	48.9	29.5
19. I trust the choices I make.	3.99	0.84	0.7	3.4	20.8	45.6	29.5
15. I know how to get help.	3.97	0.79	0.7	3.7	17.3	54.2	23.9
22. If I want something, I know how to go about it.	3.96	0.79	0.2	3.2	22.8	48.1	25.8
16. I indicate how I want to be helped.	3.95	0.83	0.2	4.9	21.2	47.3	26.1
11. I know how to cope with my impairment(s).	3.93	0.81	0.7	4.1	20.3	51.2	23.7
17. I trust my (own) thoughts.	3.93	0.86	0.5	6.4	18.6	48.9	25.6
12. I know when I need help from others.	3.90	0.78	0.7	4.4	18.4	56.9	19.4
7. I can explain the consequences of my condition clearly to others.	3.83	1.00	1.9	9.0	21.6	39.4	27.9
9. I dare to indicate my limits to others.	3.70	0.98	1.8	12.4	20.8	44.3	20.5
13. I ask others for help when I think I need it.	3.63	0.98	2.1	11.5	25.8	42.0	18.4
8. I know my limits.	3.61	0.99	2.1	12.7	25.3	41.9	17.8
18. I trust my body.	3.37	1.07	3.5	20.1	26.3	35.5	14.5

*Items are ranked from highest (less difficult) to lowest (most difficult) mean scores.

an understanding of the health condition and the consequences of this health condition. Items in factor 2 describe the awareness of own capabilities and possibilities. Factor 3 consisted of items about trust and the active application of self-regulation in practice. The last factor (4) consisted of items about the organization of help. As a result, item 11 was assigned to factor 3 and item 12 to factor 2.

Item content of the component structure

The initial classification, as well as the classification of items after factor analysis, can be found in Table 3. First, self-insight appeared to entail two different themes in this study. In the initial model, the items on insight were all supposed to be part of the same theme. In addition, in the initial model, all trust-related

Table 3. Exploratory factor analysis: 4-factor solution for the SeRA (all loadings shown of ≥0.30): pattern matrix after oblimin rotation.

	4-Factor solution				Item classified in which theme prior to the analyses	Item classified in which factor after analyses
	3	1	4	2		
1. I understand my condition.		**0.84**			1	1
2. I recognize what my body is telling me.		**0.74**			1	1
3. I understand the physical impact of my condition.		**0.90**			1	1
4. I understand the emotional impact of my condition.		**0.78**			1	1
5. I am aware of what I can do.		0.36		**−0.57**	1	2
6. I am aware of my capabilities.		0.38		**−0.51**	1	2
7. I can explain the consequences of my condition clearly to others.				**−0.67**	2	2
8. I know my limits.				**−0.77**	2	2
9. I dare to indicate my limits to others.				**−0.62**	2	2
10. I decide what I do.	**0.70**				2	3
11. I know how to cope with my impairment(s).	**0.35**	0.36			2	3
12. I know when I need help from others.			0.40	**−0.45**	4	2
13. I ask others for help when I think I need it.			**0.69**	−0.39	4	4
14. I know who to ask for help.			**0.84**		4	4
15. I know how to get help.			**0.85**		4	4
16. I indicate how I want to be helped.			**0.61**		4	4
17. I trust my (own) thoughts.	**0.74**				2	3
18. I trust my body.	**0.48**				2	3
19. I trust the choices I make.	**0.85**				2	3
20. I determine how I make use of my options.	**0.86**				3	3
21. I do what I think is important.	**0.85**				3	3
22. If I want something, I know how to go about it.	**0.76**				3	3
Eigenvalues	9.66	2.08	1.58	1.10		
% of variance explained	43.89	9.45	7.16	4.98		

Factor loadings: these are the regression coefficients of the variable on the factor with the highest factor loading.

Table 4. Outcome scores of the SeRA, the SeRA subscales and the UW-SES-6.

	N of items	α	Range	% Floor	% Ceiling	Mean* (*SD*)	Median (IQR)	Skewness
Total 22-item scale	22	0.93	28.4–100	0.2	3.9	73.8 (14.1)	73.9 (64.8–83.2)	−0.16
Subscale 1: insight in own health condition.	4	0.86	0–100	0.4	22.2	80.4 (16.6)	81.3 (75–93.8)	−1.05
Subscale 2: insight in own capabilities.	6	0.86	12.5–100	0.4	9.4	71.3 (17.5)	70.8 (62.5–83.3)	−0.35
Subscale 3: trust in self and apply self-regulation.	8	0.89	9.4–100	0.2	6.9	72.9 (16)	75 (62.5–84.4)	−0.35
Subscale 4: organisation of help.	4	0.85	6.3–100	0.4	11.9	72.5 (17.7)	75 (62.5–82.8)	−0.47
UW-SES-6	6	0.91	20–68.9	0.7	4.1	44.3 (9.9)	42.6 (36.4–50.2)	0.41

*The higher the score, the better self-regulation (SeRA) or self-efficacy (UW-SES-6).

Table 5. Spearman correlation between the SeRA, the SeRA subscales and the UW-SES-6.

	Total 22-item list	Subscale 1	Subscale 2	Subscale 3	Subscale 4
Subscale 1: insight in own health condition	0.73				
Subscale 2: insight in own capabilities	0.91	0.63			
Subscale 3: trust on self and apply self-regulation	0.88	0.53	0.71		
Subscale 4: organisation of help	0.75	0.43	0.64	0.58	
UW-SES-6	0.36	0.26	0.28	0.41	0.20

items were classified in the theme regarding coping, whereas in the final model all trust items were assigned to factor 3 on the active application of self-regulation in practice. Lastly, items belonging to the theme of help mainly were classified in one factor. However, the item "to know when help is needed" was clustered with the items on insight into own capabilities.

Cronbach's alpha coefficient

The Cronbach's Alpha of the total 22-item version of the SeRA was 0.93 (Table 4). All of the subscales showed high internal consistency as well (α = 0.85–0.89). All of the corrected item-total correlations were >.30 (range 0.54–0.78).

Floor and ceiling effects

In this study population, the total SeRA score showed a slight left-skewed distribution with no signs of floor or ceiling effects. In the four subscales, subscale 1 showed a ceiling effect as 22.2% reported the maximum score. All scores can be found in Table 4.

Exploratory convergent outcomes

Correlation analyses showed moderate to strong correlations (range 0.43–0.71) between the four subscales of the SeRA (see Table 5). The correlation coefficient between SeRA total scale and UW-SES-6 was 0.36. Correlations of SeRA subscales showed weak to moderate positive correlations with UW-SES-6 of 0.26, 0.28, 0.41, and 0.20, respectively (Table 5). The SeRA subscale 3, on trust in self and applying self-regulation, showed the highest correlation with the UW-SES-6 (0.41).

Differences across subgroups

SeRA scores slightly differed between different diagnostic groups and between inpatients and outpatients (all outcome scores and

distributions are displayed in Supplementary Table B). For the SeRA total scale, the range between the lowest and highest mean score was 71.6 (chronic pain disorder) to 78.1 (spinal cord injury). For subscales 2 and 4, this range of mean scores was a little wider (subsequently, 68.7–77.0 and 69.6–77.9). In subscales 1 and 3 the range was similar to the range in the total scale. Former inpatients and outpatients differed in outcome scores with a mean of 76.6 for inpatients and 71.7 for outpatients on the SeRA total scale. Furthermore, correlations between the subscales were found all in the same effect size category between the different rehabilitation groups (all correlations are displayed in Supplementary Table C).

Discussion

The SeRA was developed as there was no measure available fitting the conceptual model of self-regulation in a rehabilitation context. The final SeRA consists of 22 items. This study has revealed a four-factor structure. Based on the content of the four factors, the subscales are labeled as: "insight into own health condition," "insight into own capabilities," "trust in self and apply self-regulation," and "organization of help." Each subscale consists of four to eight items and showed high internal consistency. The SeRA total and subscale scores showed weak to moderate correlations with the UW-SES-6. Furthermore, only minor differences in outcome scores and inter-correlations among the subscales between different rehabilitation groups were found.

The results of this study build upon previous studies, in which a conceptual model was constructed that consists of four main themes [6,7]. Results from this empirical study also indicate four factors. However, some differences between the initial model and currently identified factors were found, based on content and classification of items as shown in the results (Table 3). Due to the high percentage of explained variance on the first factor, it could be discussed if a four-factor structure would be the best solution compared to a one-factor solution. Spearman correlation analysis between the subscales showed a correlation coefficient as high as 0.71 between subscales 2 and 3. With this in mind, a four-factor structure would still be advisable. Furthermore, the SeRA covers each theme of self-regulation indicated by former patients. Other measures of self-regulation mainly focus on one theme or one domain of self-regulation, such as treatment [23], physical exercise [24,25], coping [26], or addiction [27]. Or, for example, the UW-SES-6 mainly focuses on the third theme of trust and applying self-regulation in life [6,10]. The focus of most self-regulation measures and self-regulation theories is on the application of self-regulation in life and not on conditional aspects [28–30]. Likewise, the highest correlation was found between the SeRA subscale on applying self-regulation and the UW-SES-6. This may indicate that the SeRA has a potential added value for rehabilitation practices in terms of the specific items conditional for regaining self-regulation. The SeRA measures these conditional elements rather than just measuring the concept of self-regulation which may explain the weak correlations between the SeRA subscales on conditional elements and the UW-SES-6. The four-factor structure provides specific insights into the four overarching themes which are found conditional in regaining self-regulation [6].

The content of the SeRA was mainly developed based on patient perspectives from all diagnostic groups which are common in rehabilitation treatment [6]. The qualitative analysis also showed that self-regulation was conceptualised in the same way throughout all diagnostic groups. However, this does mean outcome scores on self-regulation are necessarily similar throughout these groups. All participants in the current study were in the chronic phase of their condition and all had finished their rehabilitation treatment. Therefore it was expected that SeRA scores would be high in all diagnostic groups. However, it could also be expected that participants with cognitive impairments could show lower scores on self-regulation compared to diagnoses with just physical impairments. Indeed, even though the differences were small, on each subscale the mean score in the diagnostic groups for brain injury and neurological disorders was lower compared to the mean scores in the other diagnostic groups. Also, the diagnostic group with chronic pain disorder showed somewhat lower scores. It is not known if that is due to comorbid cognitive impairments, or if this was due to other factors. The pattern of correlations between subscales was however similar across diagnostic groups. This might indicate that the SeRA can be used throughout different rehabilitation populations.

Implications for clinical practice

Patient-reported outcome measures are vital to evaluate constructs that are important to patients themselves. Until now, there has been no measure available that measures all relevant aspects of self-regulation, based on patients' perceptions, in a rehabilitation population. The SeRA was designed as a rehabilitation measure that can be used regardless of the health condition or type of rehabilitation. Further, due to its measurement of conditional aspects underlying self-regulation as an assessment of rehabilitation patients, it could help set personal rehabilitation goals. However, this still has to be tested in a population receiving rehabilitation.

Limitations and implications for future research

Some limitations of this study are noteworthy to mention. First, only exploratory analyses were conducted in this study. As a next step, it is needed to conduct a confirmative factor analysis as well as testing for convergent validity with other self-regulation, or related measures. Furthermore, it is recommended to gather longitudinal data to investigate the test–retest reliability, responsiveness, and interpretability of the SeRA as an evaluative instrument. Another drawback of the study population is that only former rehabilitation patients were invited for the current study. It is also necessary to test the SeRA in a sample whose participants are receiving rehabilitation. For now, this could explain the ceiling effect on the SeRA subscale on insight into own health condition. Individuals already went through the regaining of self-regulation during rehabilitation, so it would be expected that they scored positive on having self-insights. The SeRA was developed in the Dutch language. It was translated into English to enable the publication of the study. This translation is preliminary and in need of confirmation in a cognitive interview study. The validity and reliability of the English version of the SeRA also have to be examined before its use can be recommended. Finally, to fulfill the practical implications of the SeRA, analyses on the discriminative validity, and additional analyses on reliability, such as test–retest correlations, are needed [31]. Furthermore, confirmative psychometric analyses should be conducted to validate the SeRA [14,15]. The SeRA has the utility to provide relevant and additional information on the level of self-regulation for inpatient and outpatient rehabilitation treatment.

Conclusion

This study reported the development and initial evaluation of the factor structure of the newly developed SeRA on self-regulation in a former rehabilitation population. Four factors were revealed, namely "insight into own health condition," "insight into own capabilities," "apply self-regulation," and "organization of help." Internal consistency of the total scale and of all four subscales appeared to be high. However, further research on the reliability and validity of the SeRA in different settings, diagnostic groups, and language versions is recommended.

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