ORIGINAL REPORT

USING SELF-REGULATION ASSESSMENT TO EXPLORE ASSOCIATIONS BETWEEN SELF-REGULATION, PARTICIPATION AND HEALTH-RELATED QUALITY OF LIFE IN A REHABILITATION POPULATION

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Objective: **Self-regulation, participation and health-related quality of life are important rehabilitation outcomes. The aim of this study was to explore associations between these outcomes in a multi-diagnostic and heterogenic group of former rehabilitation patients.**

Methods: **This cross-sectional survey used the Self-Regulation Assessment (SeRA), Utrecht Scale for Evaluation of Rehabilitation-Participation (USER-Participation) and the Patient-Reported-Outcome-Measurement-System (PROMIS) ability and PROMIS satisfaction with participation in social roles, and the EuroQol-5L-5D and PROMIS-10 Global Health. Regression analyses, controlling for demographic and condition-related factors, were performed.**

Results: **Respondents ($n = 563$) had a mean age of 56.5 (standard deviation (SD) 12.7) years. The largest diagnostic groups were chronic pain disorder and brain injury. In addition to demographic and condition-related factors, self-regulation subscales explained 0–15% of the variance in participation outcome scores, and 0–22% of the variance in HRQoL outcome scores. Self-regulation subscales explained up to 22% of the variance in satisfaction subscales of participation (USER-Participation and PROMIS) and the mental health subscale of the PROMIS-10. Self-regulation subscales explained up to 11% of the restriction and frequency subscales of participation (USER-Participation) and the physical health subscale of the PROMIS-10.**

Conclusion: **Self-regulation is more strongly associated with outcomes such as satisfaction with participation and mental health compared with outcomes such as restrictions in participation and physical health.**

Key words: self-regulation; participation; health-related quality-of-life; rehabilitation; outcome measurement.

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LAY ABSTRACT

This article provide insights into the assocations between self-regulation, participation and health-related quality of life. This was studied in a rehabilitation population. Diagnostic groups included were: brain injury, chronic pain disorder, spinal cord injury, neurological and neuromuscular disorder, musculoskeletal disorder and oncology. We found that persons with higher levels of self-regulation, experience more satisfaction with their functioning in the community and experience less mental health problems. Also, when persons have trust in themselves, they tend to have less mental health problems and are more satisfied in their daily life.

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After the onset of disability, individuals must adapt to physical and psychological changes in their bodies and lives. Rehabilitation contributes to this adaptation process and can be defined as "a set of interventions designed to optimise functioning and reduce disability in individuals with health conditions in interaction with their environment" (1; p.1). Disability is an umbrella term for impairments, activity limitations and participation restrictions according the International Classification of Functioning, Disability and Health (ICF) (2). Participation is defined as an individual's involvement in life situations (2), and is part of the larger concept of health-related quality of life (HRQoL), which is a multidimensional construct that covers physical, psychological and social health (3).

In recent years, attention has increasingly focused on the role of self-regulatory elements as conditional to optimize health outcomes among people with

disabilities (4–6). Based on a qualitative investigation, we defined self-regulation in a specific rehabilitation context and with a focus on the conditional aspects, as: "to create insights and awareness of one's own condition, limitations and possibilities, and give direction to one's own life on all domains" (7). In a rehabilitation context, self-regulation contains 4 themes: *(i)* self-insight into one's own health condition; *(ii)* awareness of one's own capabilities and possibilities; *(iii)* trust and application of self-regulation in life; and *(iv)* organization of help (7). Insight and understanding of the health condition was associated with better outcomes on mental health, social participation and HRQoL (8, 9). Self-awareness was associated with higher levels of psychosocial functioning and task performance after rehabilitation (10, 11). Higher self-efficacy, which can be described as trust in self, was associated with higher life satisfaction, better mental health and less physical conditions (12, 13). Lastly, the theme regarding organization of help contains knowing how and where to find social support as well as technical and medical devices, both of which positively contribute to participation outcomes (14). Identified studies demonstrate the associations between self-regulation elements and participation and HRQoL. However, more comprehensive and complete investigation with regard to associations between these themes of self-regulation, participation and HRQoL can help rehabilitation health workers to decide which themes of self-regulation to focus on in order to improve participation and HRQoL, and thereby identify best practices for rehabilitation care. The Self-Regulation Assessment (SeRA) was developed in response to the absence of measures covering all 4 themes of self-regulation, for use in medical rehabilitation care and research (7, 15). The SeRA can be used to investigate in more detail the relationship between self-regulation and participation and HRQoL in the context of rehabilitation.

The aim of this study was to explore the relative strength of the associations between the 4 self-regulation themes, and participation and HRQoL outcomes in a multi-diagnostic group of former rehabilitation patients after controlling for demographic and condition-related factors.

MATERIAL AND METHODS

Study design and participants

This cross-sectional survey study was part of the research programme "Measurement of Outcomes of Rehabilitation in the Netherlands" (MUREVAN). The "Strengthening the Reporting of Observational Studies in Epidemiology" (STROBE) were applied in the description of this cross-sectional study (Table SI). Participants were recruited through 7 health institutions in the Netherlands: 3 university hospitals, 2 medical rehabilitation centres, 1 general hospital and 1 outpatient rehabilitation clinic.

Inclusion criteria were: a minimum age of 18 years at the time of rehabilitation treatment, ability to speak and understand the Dutch language, received rehabilitation treatment (inpatient or outpatient) between 2012 and 2019, and diagnosed with amputation, neurological disease (including neuromuscular diseases), chronic pain disorder, musculoskeletal disorder, spinal cord injury, acquired brain injury, organ disorder, or oncology. These are the main diagnostic groups receiving medical rehabilitation treatment in the Netherlands (16, 17).

Procedure

Invitation emails including information about the study were sent by the participating institutions to their former patients who met the inclusion criteria between February 2020 and March 2020, and between September 2020 and February 2021. Between these periods data collection was temporarily interrupted in response to COVID-19 restrictions in the Netherlands. The invitation emails enclosed a link to access the online questionnaire and an unique login code, provided to the institutions by the researchers in order to facilitate anonymous participation. Potential participants were asked to login with their unique code, provide informed consent by ticking a box and then complete the questionnaire. If no email address was available, the invitation and questionnaire were sent by post. A reminder was sent to all persons who did not respond within 2 weeks after the initial request.

Instruments

Self-regulation was assessed with the SeRA. This measure was developed specifically for rehabilitation healthcare. It measures all conditional and application themes of self-regulation, as defined in previous studies (7, 15, 18, 19). Three measures were used to evaluate participation: the Utrecht Scale for Evaluation of Rehabilitation-Participation (USER-Participation) (20); the Patient Reported Outcome Measure Information System (PROMIS) ability to participate in social roles and activities (PROMIS-APS); and the PROMIS satisfaction with social roles and activities (PROMIS-SPS) (21). The above-mentioned measures were selected based on their content. This selection process was performed based on an assessment via 2 Delphi rounds among rehabilitation physicians on the concepts and related measures (22). The USER-Participation was mostly used and classified as

applicable for participation. The PROMIS measures are vested measures and internationally classified as valid and efficient. Furthermore, the measures complement each other in their content, as can be read below in the descriptions. Two measures were used to measure HRQoL: the EuroQol-5D-5L (23) and the PROMIS-10 Global health (PROMIS-10) (24). Those 2 were selected because they are most commonly used in rehabilitation healthcare and, together, they provide a complete indication of quality of life (QoL).

The Self-Regulation Assessment (SeRA). The SeRA consists of 22 items and was developed as a patient-reported outcome measure for self-regulation in the context of rehabilitation (7, 15, 18, 19). Different participant groups were included in the different phases of the development of the SeRA. The SeRA was developed according the Consensus-based Standards for the selection of health Measurement Instruments (COSMIN) (25). The 22 items were categorized into 4 subscales, based on the conceptual modal and exploratory factor analyses: self-insight into one's own health condition (SeRA-SI); awareness of one's own capabilities and possibilities (SeRA-AC); trust and application of self-regulation in life (SeRA-TA); and organization of help (SeRA-OH). Each item is scored on a 5-point scale: "totally disagree", "disagree", "neutral", "agree", and "totally agree". Total scores are computed for the total 22-item scale and each subscale as the sum of the item scores, which is converted into scores with a range from 0, indicating poor self-regulation, to 100, indicating the best self-regulation possible. The SeRA total scale and the 4 subscales showed high internal consistency (0.85–0.93) in the current study group (18). Scores showed moderate to strong inter-correlations (0.43–0.71), which demonstrates the usefulness of the separate subscales (18). Content validity was found to be good (19).

USER-Participation. The USER-Participation consists of 32 items in 3 subscales: frequency, restrictions and satisfaction (20). The frequency subscale consists of 11 items on the frequency of performance of activities such as work, social activities or housekeeping. The first 4 items are scored in hours per week (as usual) and the following 7 items are scored in frequency of performance in the previous 4 weeks. Items are scored on a 6-point scale ranging from 0, which reflects "none or never", up to 5, which reflects "36 h or more/19 times or more". The restriction scale consists of 11 items similar to those in the frequency scale, but on experienced restrictions in performing these activities. A 4-point scale, from 0, which reflects "not possible", up to 3, which reflects "without difficulty", is used. The satisfaction subscale consists of 10 items on how satisfied one is with one's functioning in these activities. Items are scored on a 5-point scale, from 0, which reflects "very dissatisfied", up to 4, which reflects "very satisfied". For each subscale the scores are summed and the sum score is transformed into a score with a range from 0 (very poor participation) up to 100 (excellent participation). Reproducibility of the 3 scales was moderate to good (20). The USER-Participation showed good concurrent validity and responsiveness in a prospective study (26). Scores on all 3 subscales showed moderate inter-correlations, which demonstrate the usefulness of the separate scales (20, 27).

PROMIS ability and satisfaction to participate in social roles and activities. The PROMIS group developed a series of item banks and 4, 6 and 8-item short-forms to measure the ability to participate in social roles and activities, and satisfaction with social roles and activities (21). This study used the 8-item short forms. Taking into account that administration of the full item bank would not be feasible and computerized adaptive testing was not possible in the survey tool used in the current study, the longest short form available was considered the best option. The ability scale (PROMIS-APS) consists of items asking for the limitations and difficulties persons experience with social and daily activities. Items are scored on a 5-point scale (response options "never" up to "always"). Responses are reverse coded so that higher scores indicate better ability. The satisfaction scale (PROMIS-SPS) consists of items asking for the satisfaction level with social and daily activities, and is also scored on a 5-point scale (response options "not at all" up to "very much"). Both scale scores are computed by calculating the sum of the items and transforming this sum-score into a T-score metric (mean=50, standard deviation (SD) = 10), using a concordance table for each scale. For the PROMIS-APS scale, 25.9 reflects the lowest score of ability and 65.4 reflects perfect ability to participate. For the PROMIS-SPS scale, 26.2 reflects the lowest score and 65.6 reflects perfect satisfaction with participation. Both PROMIS measures showed good validity and reliability scores in a Dutch population (21).

EuroQoL-5D-5L. The EuroQoL-5D-5L consists of 5 items (23). Per item, 1 domain of HRQoL is covered: mobility, self-care, daily activities, pain, anxiety or depression. Answers contain 5 options ranging from "no problems at all" to "severe problems/not possible". The item scores were transformed into a total valuation score using the EurQoL-5D-5L crosswalk index value calculator (28). A value score of 1 reflects a perfect health state, and a negative score reflects as a health state worse than death (28). The EuroQoL-5D-5L is a reliable and valid generic instrument and showed good psychometric properties across different diagnostic groups (29).

PROMIS-10 global health. The PROMIS-10 global health consists of 10 items on physical and mental

health (24, 30). The first 9 items are scored on a 5-point scale. The last item on pain is scored on a 10-point scale, which was also converted to a 5-point score. PROMIS-10 total scores were computed for physical health and mental health by calculating the sum of the items and transforming this sum-score into a T-score metric using a concordance table for each subscale. For the mental health subscale, 21.2 reflects the lowest score of mental HRQoL and 67.6 reflects perfect mental HRQoL. For the physical HRQoL 16.2 reflects the lowest score and 67.7 reflects perfect physical HRQoL. Measurement properties of the PROMIS-10 were proved to be acceptable (24).

Demographic and disease specific variables

Characteristics asked about were: age, sex, living situation, educational background and ethnic background. Furthermore, disease-specific characteristics were included: diagnosis, time since onset, time since rehabilitation and inpatient or outpatient treatment. No functional measure could be found that was suitable to all diagnostic groups included in the study.

Statistical analyses

Descriptive analyses were used to describe characteristics of included participants and score distributions of all measures. Cronbach's alpha was used to analyse internal consistency to determine the reliability of the included measures. Cronbach's alpha values of >0.70 were considered as satisfactory (31). Because of a non-normal score distribution in 1 of the SeRA subscales, the Spearman correlation was used for initial exploratory correlations for similar interpretability. Correlations were considered weak (<0.3), moderate ($0.3-0.5$), or strong (>0.5) (32). Hierarchical general linear regression analyses were performed to calculate adjusted regression coefficients between all self-regulation scales and all participation and HRQoL scales separately. In the first model, demographic and disease-related characteristics were added as independent variables. These characteristics were dichotomized: sex in female vs male, living situation in alone vs together (the category "other" was merged with the "alone" group), educational background in low (no education up to lower practical education) vs high (higher practical education or higher) and migration background in native vs migration background. Disease-related characteristics were dichotomized into: diagnoses without cognitive impairments, such as spinal cord injury, amputation or musculoskeletal disorder vs diagnoses with cognitive impairments, such as brain injury or neurological disorders; time since onset 0–5 years vs >5 years (based on median); time since rehabilitation 0–3 years vs >3 years (based on median); and inpatient vs outpatient rehabilitation. In the second model the self-regulation scale and subscales were added to determine the additional explained variance by self-regulation themes. A significance level of $p<0.05$ (2-tailed) was used. Analyses were performed with IBM SPSS Statistics for Windows (Version 27.0).

Statement of ethics

This study was conducted according the principles of the Declaration of Helsinki. The protocol of the study was reviewed by the medical ethics committee of the University Medical Centre of Groningen, and this committee declared that this study did not require approval according to Dutch law (registration number 201800582). All 7 participating institutions approved the study (18).

RESULTS

Participants

A total of 2,988 former patients were invited to participate (18). The final sample consisted of 563 participants who matched the inclusion criteria and completed the questionnaire. The majority of participants completed the questionnaire online (87.8%). The largest diagnostic groups were brain injury ($n=125$) and chronic pain disorder ($n=110$). More than half of the participants (57.2%) were outpatients, and mean time since rehabilitation was 3.3 years (SD 2.3).

Table I. Characteristics of the respondents ($n=563$)

Characteristic	*n* (missing)	% or mean (SD)
Age	539 (24)	56.7 (12.7)
Male	252	44.8
Native Dutch	493	87.6
Higher education	252	44.8
Current living situation		
Alone	164	29.1
Together	386	68.6
Other	13	2.3
Diagnostic group	(1)	
Brain injury	125	22.2
Chronic pain disorder	110	19.5
Spinal cord injury	79	14.0
Neurological and neuromuscular disorder	87	15.6
Musculoskeletal disorder (including amputation)	83	14.8
Other (including oncology, organs)	78	13.9
Time since rehabilitation in years	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
Inpatient rehabilitation	241	42.8
Invited via		
University Medical Centre	184	32.7
General hospital	32	5.7
Rehabilitation centre	221	39.3
Pain rehabilitation clinic	126	22.3

SD: standard deviation.

Table II. Score distributions of the measures of self-regulation, participation and health-related quality of life (HRQoL)

	Mean (SD)	Range	Median (IQR)	% maximum scores	α	Skewness	Missing
SeRA 22-item	73.8 (14.1)	28.4–100	73.9 (64.8–83.2)	3.9	0.93	−0.16	2
1: Insight into own health condition (SeRA-SI)	80.4 (16.6)	0–100	81.3 (75–93.8)	22.2	0.86	−1.05	2
2: Awareness of own capabilities (SeRA-AC)	71.3 (17.5)	12.5–100	70.8 (62.5–83.3)	9.4	0.86	−0.35	2
3: Trust and applying self-regulation (SeRA-TA)	72.9 (16.0)	9.4–100	75 (62.5–84.4)	6.9	0.89	−0.35	1
4: Organization of help (SeRA-OH)	72.5 (17.7)	6.3–100	75 (62.5–82.8)	11.9	0.85	−0.47	1
USER-Participation Frequency	30.1 (10.1)	2.8–64.3	30.4 (23.2–37.1)	0.2	0.57	0.05	0
USER-Participation Restriction	76.3 (19.5)	0–100	79.2 (66.7–92.6)	13.1	0.90	−0.9	0
USER-Participation Satisfaction	64.0 (16.0)	11.1–100	65 (52.8–75)	1.4	0.82	−0.32	0
PROMIS Ability for social functioning (APS)	46.2 (8.0)	25.9–65.4	47.1 (42.7–51.6)	0.9	0.96	0.47	2
PROMIS Satisfaction with social functioning (SPS)	47.1 (7.4)	26.2–65.6	45.0 (41.1–51.7)	5.3	0.95	0.31	1
EuroQoL-5D-5L	0.7 (.2)	0–1	0.7 (0.6–0.8)	8.0	0.74	−0.96	10
PROMIS mental health	44.1 (7.4)	21.2–67.6	43.50 (38.80–48.30)	0.5	0.81	0.16	1
PROMIS physical health	41.5 (8.4)	23.5–67.7	39.8 (34.9–47.7)	0.7	0.70	0.39	2

SD: standard deviation; IQR: interquartile range; SeRA: self-regulation assessment; PROMIS: patient reported outcome measure information system; USER: utrecht scale of evaluation for rehabilitation.

Participants' characteristics are shown in Table I. Score distributions of outcome scores of each measure and the subscales are shown in Table II.

Outcome analyses

All exploratory correlations between the 4 self-regulation scales and the participation scales, and the HRQoL scales, were weak to moderate (Table SII). Demographic and disease-specific characteristics of the participants explained 3–12% of the variance in participation and HRQoL outcomes (see Table III; model 1). The additional variance explained by self-regulation ranged from 0–15% of the variance in participation outcome scores, and 0–22% variance in HRQoL outcome scores (Table III; model 2).

Self-regulation total as well as subscales explained least of the participation scores on frequency, restrictions and ability outcomes (0–2%). The highest explained variance was found between the SeRA-TA subscale and the satisfaction subscales of participation (10% of the variance in the USER-Participation satisfaction subscale and 15% of the PROMIS-SPS subscale). Self-regulation total score and subscales explained most of the variance in the HRQoL mental health scale (4–22%), and least of the variance in the physical health subscale of HRQoL (1–6%). The SeRA-TA explained most of the variance in participation and HRQoL scores compared with the other SeRA subscales (2–22% vs 0–9%, respectively) and to the SeRA total score (1–16%). The SeRA-SI explained least of the variance in participation and HRQoL outcomes (0–4%).

DISCUSSION

Self-regulation themes explained 0–15% of the variance in participation outcomes, and 0–22% of the variance in the HRQoL outcomes. Self-regulation was mainly associated with satisfaction with participation and mental health outcomes. Associations were weak

Table III. Self-Regulation Assessment (SeRA) aspects as predictors for participation and health-related quality of life (HRQoL) outcomes, adjusted for person and disease specific factors

	Participation outcome scores					HRQoL outcome scores		
	USER-Participation Frequency	USER-Participation Restrictions	USER-Participation Satisfaction	PROMIS ability for social functioning (APS)	PROMIS satisfaction for social functioning (SPS)	EuroQol-5D-5L	PROMIS mental health	PROMIS physical health
	R square model 1							
	0.12	0.12	0.05	0.06	0.03	0.10	0.04	0.09
	R square change model 2							
SeRA Total score	0.01*	0.01*	0.07**	0.08**	0.12**	0.04**	0.16**	0.04**
1: Insight into own health condition (SeRA-SI)	0.00	0.01	0.02**	0.02**	0.04**	0.01*	0.04**	0.01*
2: Awareness of own capabilities (SeRA-AC)	0.01*	0.00	0.04**	0.05**	0.08**	0.02**	0.09**	0.03**
3: Trust and applying self-regulation (SeRA-TA)	0.02**	0.02**	0.10**	0.11**	0.15**	0.07**	0.22**	0.06**
4: Organization of help (SeRA-OH)	0.00	0.00	0.02**	0.02**	0.04**	0.00	0.06**	0.01

Model 1: Regression with potential confounders (age, sex, ethnicity, living situation, educational background, type of rehabilitation, time since rehabilitation, time since diagnosis, and diagnostic group) as determinants. Model 2: Regression with potential confounders and SeRA as determinants.

SeRA: self-regulation assessment; PROMIS: patient reported outcome measure information system; USER: utrecht scale of evaluation for rehabilitation.

*Significant with p-value <0.05. **Significant with p-value <0.01.

between self-regulation themes and outcomes on frequency and restrictions in participation, and physical health. Furthermore, the SeRA subscale on trust in self (SeRA-TA) was more strongly associated with participation and HRQoL outcomes compared with the other SeRA subscales.

The finding of overall weak to moderate associations may be explained by several factors. Looking into the ICF model, self-regulation can be classified as a personal factor, while, on the other hand, participation and HRQoL are more overarching outcomes. The ICF framework describes participation and HRQoL as a result of interactions between the health condition, personal and environmental factors, body functions and activities (2, 33). According to a study among a multi-diagnostic rehabilitation population, factors such as physical activity, mobility, personal care and social support were strongly associated with participation outcomes after rehabilitation (34). Also, personal, contextual and health condition related factors, such as age, sex, educational level, partnership status and severity of condition, were identified as strongly associated with participation outcomes in a spinal cord injury population (35). The current study found demographic and disease-specific-related factors explaining 3–12% of the variance in participation or HRQoL. Factors such as severity of physical and cognitive impairments could not be included in the current model. In any case, a study on the prediction of participation identified that themes such as self-efficacy had a greater influence on participation than the health condition or social support (12).

Of all self-regulation themes, "trust and application of self-regulation" was most strongly associated with participation and HRQoL. This result is not surprising, since, theoretically, it is the application of self-regulation that might impact participation and HRQoL, and the other 3 themes can be considered as conditional to be able to apply self-regulation (7). Furthermore, the self-regulation theme on trust is closely connected with the construct self-efficacy, which can be described as the confidence persons have in their abilities to manage their life (36). A study among a spinal cord injury population found that self-efficacy correlated strongly (0.54) with participation outcome scores (12). This is somewhat stronger compared with the current study, which found moderate correlations (0.12–0.43) between trust in self and participation outcomes. This difference may be explained by the different measures for participation that were used in the different studies.

The weakest associations with participation and HRQoL outcomes were found for the SeRA subscale on self-insight (SeRA-SI) and the SeRA subscale on organization of help (SeRA-OH). This does not mean that these themes are not important components of self-regulation. Multiple studies were identified that demonstrated positive associations between insight into the health condition and HRQoL and frequency and satisfaction with participation (8, 37). However, in these studies the strength of the associations also differs. One study among an oncology rehabilitation population found a strong association between insight into the health condition and mental health, but weak associations between insight into the health condition and physical health and social participation (38). This pattern is similar to the current study results. The theme on organization of help showed very weak correlations with both participation and HRQoL domains. In the literature some clear associations were found with social support and medical devices, which are categorized as environmental factors (14). In the current study the organization of help was classified as a personal factor in the context of "I know when and where to find help", which means the ability to ask for help, not the amount of help received. This could cause the difference in explained variance. Another explanation for these weak associations could be the independence of most of the current study participants, who had completed their rehabilitation trajectory some years previously. Further research is required in subsequent longitudinal studies.

Finally, associations between self-regulation themes and satisfaction with participation and mental health, which are more subjective outcomes, were stronger than the associations between the self-regulation themes and participation in terms of frequency or restrictions and physical health, which are more objective outcomes. This could be explained by the point that psychosocial factors, such as emotional distress, depression or personality, probably determine a persons' feeling of self-regulation, but also their feeling of satisfaction in life and mental health. In the literature, mixed results were identified. Some studies were in line with the results of the current study and found that self-regulation aspects were positively associated with subjective types of outcomes (8, 39). However, also strong correlations between self-regulation aspects and objective outcomes were also identified in rehabilitation populations, which is in contrast with the current findings (39).

Strengths and limitations

This is the first study using the SeRA to study associations of self-regulation themes with different domains of participation and HRQoL in a generic rehabilitation population. Data were used from a large sample that was recruited through different types of rehabilitation settings throughout the Netherlands (18). Future research should be conducted in consideration of the

following limitations. The SeRA is a new measure and needs further research on validity, responsiveness, different settings and different languages. This is a cross-sectional study, and the results should be interpreted with care and no conclusions on causality can be drawn. A longitudinal study in individuals who are receiving rehabilitation treatment is recommended as a next step to further investigate longitudinal associations between the concepts of self-regulation, participation and HRQoL. In addition, this study was conducted in the period when national restrictions due to COVID-19 were implemented. This could have consequences for the level of self-regulation, participation and HRQoL experienced by participants. Furthermore, this study did not report on the severity of diagnoses, the severity of physical and cognitive impairments, and emotional status. Future research should also register condition-related details, severity of physical and cognitive impairments and emotional status in order to draw more specified conclusions. Furthermore, research into the feasibility of the measures for people with cognitive impairments is required. In this study not all potential influencing factors, according to the ICF and changes over time, could be studied. A more comprehensive and longitudinal study is recommended. Finally, the response rate was low (19%). This could be due to the (mostly) online distribution of the questionnaire. In addition, the length of the questionnaire could play a role in this. Characteristics of the non-responding persons are not known. Therefore the current study cannot draw any conclusions about non-response bias.

Implications

Although the results of this study are too premature to directly impact clinical practice, the study provides first insights into the associations between important outcomes of rehabilitation practices. Insights into associations between these outcomes can help in setting rehabilitation goals and specifying directions for interventions (40). In addition, this can help when tailoring therapies. Furthermore, based on prior research, it was expected that measurement of the combination of conditional as well as application themes of self-regulation would be valuable for rehabilitation practice to patients' outcomes (15). Based on this initial investigation, themes of self-regulation explained no or modest additional variance in participation and HRQoL outcomes. This indicates the differences in the concepts of self-regulation and participation and HRQoL, which could be seen as positive, arguing the added value of the SeRA. Furthermore, higher levels of self-regulation act as a positive indicator for higher levels of satisfaction with participation and for mental health. However, for frequency and restrictions of participation and physical health of HRQoL, self-regulation seems not to act as a positive indicator. Monitoring and measurement of the concepts in clinical practice would still be desirable to detect patients who are at risk of mental health issues. In addition, insights into associations between these themes of self-regulation, participation and HRQoL can help rehabilitation health workers to decide which themes of self-regulation to focus on in order to improve participation and HRQoL, and thereby identify best practices for rehabilitation care. Therefore, further research into the associations between the subthemes is required.

CONCLUSION

After rehabilitation, persons with higher levels of self-regulation tend to have higher levels of satisfaction with participation and mental health. Self-regulation is, to a lesser extent, or not at all, associated with outcomes in participation limitations and physical health. Looking into the subscales of self-regulation, the subscale on trust and applying self-regulation was most strongly associated with participation and HRQoL and the theme on organization of help the weakest.

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