Original Article

Psychometric Properties of the REMAP Resilience Scale in a Norwegian Sample of ME/CFS Patients and Healthy Controls

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Abstract: Being able to increase and know how to strengthen resilience may be relevant for patients living with long-term symptoms such as chronic fatigue syndromes. The current study aimed to examine the psychometric properties of a Norwegian-translated version of the REMAP resilience measure in a sample of patients with myalgic encephalomyelitis/chronic fatigue syndrome and healthy controls. Factor analyses indicated poor fit for both the one- and five-factor solutions of the translated REMAP measure with best fit for a correlated five-factor model. Validity proved to be good, while reliability was poor for two of the subscales. Differences were revealed between gender, age groups, and between patients and healthy controls. The construct validity indicates that REMAP assesses adequate aspects of resilience. REMAP might be valuable to use to show that resilience resources could be developed in various life domains and aid in coping with chronic illness. However, REMAP should be further tested in other samples and cultures.

Keywords: resilience, myalgic encephalomyelitis, chronic fatigue syndrome, confirmatory factor analyses, validity

Resilience has been defined in a number of ways. In general, it unfolds in the context of stressful events and experiences and it allows the person to cope with and recover from negative effects of the stress (Rutter, 1987). According to Zautra et al. (2010), resilience in adults is about how well the individual manages to sustain health and mental well-being despite aversive contexts and challenges. Research has shown that psychological, physiological, and social factors may be important in maintaining health and well-being under stressful conditions. Resilience as a phenomenon may involve various factors, for example, positive emotional states, adaptability, hardiness, self-efficacy, meaning or purpose in life, age, time, gender, culture or family and other social support (Connor & Davidson, 2003). Some studies have shown higher level of resilience in men than in women, while others found higher resilience in favor of women (Alkım & Çarcit, 2020). Furthermore, older people tend to have different and more variable strategies for coping with stress than younger people (Blanchard-Fields & Irion, 1988). In addition, type and impact of stress may vary during lifespan (Sweeney et al., 2015). There appears to be strong associations between resilience and the construct of hope (Polson et al., 2018). Higher levels of hope may potentially increase resilience (Panter-Brick & Eggerman, 2012) and improve physical and psychological health outcomes (Long et al., 2020). Research has also shown high associations between optimism and positive emotions

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even when individuals are under stress (Tugade et al., 2004). Positive affect (PA) acts as a factor of resilience in itself as it broadens the individual's tendencies for action by encouraging exploration of the environment and thus building intellectual, psychological, social, and physical resources (Fredrickson, 1998). For example, positive emotions have shown to be factors of resilience in patients with various pain conditions (Strand et al., 2006; Zautra et al., 2005). Higher levels of resilience in chronic pain patients have, among other factors, been associated with less pain, with a reduced need for analgesia, and with better daily physical and psychosocial functioning as well as with less mental health problems (Chng et al., 2023).

Research has also shown inverse associations between resilience and depression in patients with breast cancer (Ristevska-Dimitrovska et al., 2015) as well as between resilience and depression, anxiety, and somatization in chronic diseases, such as Parkinson's disease or rheumatoid arthritis (Cal et al., 2015). Research suggests that resilience is linked with good coping with continuous disease-related challenges whether it is physical illness or conditions without directly detectable biological findings, such as certain pain or chronic fatigue conditions may be.

In the current study, we included a sample of patients with myalgic encephalomyelitis/chronic pain conditions (ME/CFS). ME/CFS is characterized by fluctuating symptoms, such as fatigue, cognitive impairment, sleep problems, pain, and irregularities that might be associated with neurological, immunological, endocrine, and autonomic systems (Carruthers et al., 2003). ME/CFS is a debilitating and long-lasting chronic condition with a poorly understood cause and no medical cure. As no medical treatments for ME/CFS patients exist, the patients can best be helped by adjusting lifestyle, optimizing self-care, and well-being. Being able to increase the understanding of resilience and how to strengthen it may be particularly relevant for patients living with ME/CFS. Thus, to make good assessments of patients' resources, we need valid and reliable measurement tools.

A 22-item instrument called REMAP was developed to measure resources of resilience in patients reporting somatic symptoms without identifiable and obvious pathology (Malarkey et al., 2016). REMAP is an acronym of the five resilience resource dimensions assessed by the instrument: relational engagement (RE), emotional sensibility (ES), meaningful engagement (ME), awareness of self and others (ASO), and physical health behaviors (PHB). The idea behind the instrument development was to give healthcare professionals a tool for mapping and initiating discussions around resilience resources with the patients.

REMAP has previously been tested in two different samples (Malarkey et al., 2016) of which one sample, representative of the population in the United States, participated in an online survey and the other sample were employees at a university, who participated in an intervention. The internal consistency of REMAP from the population sample (Cronbach's α was .85) and the intervention sample (baseline Cronbach's α was .85) had $r = .80$ and $p < .001$ between the pre- and postintervention measurements, indicating adequate degree of intercorrelations.

In the original study (Malarkey et al., 2016), a one-factor model and a five-factor model of REMAP were tested showing that the one-factor model, representing the underlying resilience construct, had best fit with the data. These results and further correlational analysis of the REMAP total score indicated according to the authors to prefer the single-factor model. Comparisons of REMAP with other resilience measurements and correlating REMAP with physical functioning, depression, loneliness, sleep, and perceived stress showed good convergent and discriminant validity, respectively.

The aim of the current study was to examine the psychometric properties of REMAP in a Norwegian sample of patients with myalgic encephalomyelitis/chronic fatigue syndrome (ME/CFS) and healthy controls. The study aimed to examine the factor structure and test internal consistency and validity of the Norwegian-translated version of the REMAP instrument.

Methods

Study Procedures and Participants

This cross-sectional study comprised a total sample of N = 428 participants consisting of patients with myalgic encephalomyelitis (ME/CFS) at a specialized health service and healthy controls, all included from a major medical center in Norway. The patient subsample (n = 164) included 136 women (82.9%) and 28 men (17.1%) with the mean age of 37.6 years (SD = 11.00, range = 17–61). Patients who fulfilled the Canadian Consensus Criteria (CCC; Carruthers et al., 2003) were asked to participate in a ME/CFS biobank/thematic register. The healthy control subsample (n = 264) included 186 women (70.5%) and 78 men (29.5%) with the mean age of 30.99 (SD = 8.33, range = 18–59) and was recruited among first time blood donors. The current study material is a sample of convenience collected from March 2013 to February 2019. Of participants asked to take part in the biobank/register sampling during this time, 60% agreed to participate. The participants were informed about the purpose of the data sampling and signed a written informed consent form prior to inclusion. The self-report outcome measurements were completed by pen and paper at home.

Assessments

The REMAP is a 22-item scale developed to assess resilience resources in patients with no identifiable mental health pathology (Malarkey et al., 2016). The instrument includes items from five various resilience domains, including relational engagement (RE), emotional sensibility (ES), meaningful engagement (ME), awareness of self and others (ASO), and physical health behavior (PHB). The items are rated on a four-point Likert scale (1 = *rarely*, 2 = *occasionally*, 3 = *frequently*, 4 = *very frequently*). A higher averaged total score for each scale indicates greater resilience resources. The original study by Malarkey et al. (2016) revealed a Cronbach's α of .85. The instrument has shown adequate psychometric properties with moderately positive correlations with other resilience scales, somatic symptoms, and psychological well-being as well as negative associations with depression and perceived stress (Malarkey et al., 2016), providing evidence for both convergent and divergent validity.

Prestudy, permission to translate the REMAP into Norwegian language was obtained from Dr. Malarkey for use in research. Translation and adaption of the Norwegian version of REMAP followed the five-steps sequential translation procedure recommended for cross-cultural adaptation of self-report questionnaires (Beaton et al., 2000).

Psychosocial and Symptom Assessment

Positive and Negative Affect Schedule (PANAS; Watson et al., 1988) is a scale tapping two major dimensions of mood and categorized into positive affect (PA; *interested*, *strong*, *inspired*, *attentive*, *enthusiastic*, *proud*, *alert*, *lively*, *active*, and *determined*) and negative affect (NA; *distressed*, *upset*, *nervous*, *scared*, *hostile*, *irritable*, *ashamed*, *jittery*, *afraid*, and *guilty*) measured on a five-point scale. Internal consistencies for both scales have been ranging from .83 to .90 (Strand et al., 2006; Watson et al., 1988).

Adult Dispositional Hope Scale (Snyder et al., 1991) is a 12-item self-report inventory designed to tap dispositional hope in adults. The scale has two dimensions reflecting agency (i.e., "I energetically pursue my goals.") and the ability to identify pathways to navigate goals under various circumstances (i.e., "I can think of many ways to get out of a jam."). The psychometric qualities of the scale are acceptable with Cronbach's αs ranging from .74 to .84 and test–retest correlations from .80 or higher (Snyder et al., 1991). To the best of our knowledge, there are no studies of the psychometric properties of the Norwegian version of the instrument.

The 10-Item Perceived Stress Scale (PSS-10; Cohen et al., 1983) is a self-report questionnaire designed to measure perception of stress, appraisal of situations as stressful, and experiences of *unpredictability, uncontrollability, and overload* in life. Responses are rated with a five-point Likert scale with response categories from 1 = *never* to 5 = *very often*. The scale has shown acceptable psychometric properties (Taylor, 2015). While providing overall perceived stress scores, the PSS-10 measures two aspects of stress (Roberti et al., 2006): perceived helplessness (PHS) and perceived self-efficacy (PSES). Both subscales have demonstrated good internal consistency (Bastianon et al., 2020) and distinct predictive quality (Taylor, 2015).

Hospital Anxiety and Depression Scale (HADS) is a 14-item questionnaire assessing the symptoms of anxiety and depression in patients with somatic diseases and is widely used within medical practices in a variety of groups of patients (Zigmond & Snaith, 1983). Participants rate their emotions over the past week, with item scores from 0 to 3. HADS has two seven-item subscales for measuring cognitive and emotional aspects of depression and anxiety. The HADS has shown to be a valid and efficient screening instrument for anxiety and depression in medical populations (Linde et al., 2008; Orive et al., 2010). The Norwegian version of HADS is a well-validated screening instrument for symptoms of psychological distress (National Institute of Public Health, 2016).

The Short Form Health Survey (SF-36) or *RAND Questionnaire* is a 36-item self-report measure of quality of life and functional status related to health (Ware & Sherbourne, 1992). It consists of eight subscales including physical functioning, role physical, bodily pain, general health, role emotional, social functioning, vitality, and mental health. The scores for each subscale range from 0 to 100 with higher scores indicating better functioning. Only the Bodily pain scale was applied in the current study. Previous research has shown SF-36 to be a valid and reliable instrument for health-related quality of life in various samples, including Norwegian samples (Hopman et al., 2014; Loge & Kaasa, 1998).

DePaul Symptom Questionnaire (DSQ1) is an illness-specific standardized symptom registration tool with 100 questions covering demographic information and typical ME/CFS symptoms (Jason & Sunnquist, 2018). The questionnaire assesses specific information related to fatigue frequency and severity, as well as post exertional malaise (PEM) also included in the test of construct validity of the current study. Studies examining psychometric properties of the DSQ conclude that the DSQ is a valid tool with acceptable convergent and discriminant validity (Brown & Jason, 2014), test–retest reliability (Jason et al., 2015), and excellent internal reliability. DSQ is also able to differentiate optimally between patients and controls

(Murdock et al., 2017) and useful for detecting and screening symptoms consistent with a CCC diagnosis in clinical practice and in research studies (Strand et al., 2016).

Statistical Analyses

IBM SPSS Statistics version 26 and Stata/SE 17 were used to perform descriptive statistics, correlations, *t* tests, a one-way ANOVA, χ^2 test, and confirmatory factor analysis (CFA).

CFA with a single-factor model, an uncorrelated five-factor model, or a correlated five-factor model was initially conducted to evaluate the REMAP scale and structures, evaluated with standardized factor loadings and goodness-of-fit statistics such as root-mean-square error of approximation (RMSEA), Akaike information criterion (AIC), Bayesian information criterion (BIC), comparative fit index (CFI), Tucker–Lewis index (TLI) and/or standardized root-mean-square residuals (SRMR). RMSEA values between .05 and .08 indicate acceptable fit (Brown et al., 1992) while the CFI and TLI index > .90 indicate acceptable fit (Marsh & Hau, 1996). Lower value of AIC and BIC indicate better fit and a value lower than 0.10 on SRMR is considered good fit. CFA was conducted for the entire sample and for the ME/CFS patients and Healthy controls separately. To identify and evaluate the factor structure in the observed data, the maximum likelihood (ML) estimator was tested because it is flexible, has adaptability in relation to variation in data patterns, and is more common (Maydeu-Olivares, 2017), and thus easier to compare with other published models. Because of the ordinal nature of the data and the non-continuous response distribution of the item responses there were concerns that maximum-likelihood (ML) based estimators might provide biased findings. Therefore, we also did the calculations using an asymptotically distribution free (ADF) estimator for CFA. The results were similar with those obtained using the maximum-likelihood. Thus, we choose therefore to keep the maximum-likelihood estimator in our analysis. The theoretical assumption related to REMAP is an underlying factor that affects all the measurement variables and that some specific factors affect subgroups. Therefore, we also tested a bifactor S-1 model (not in table), but this model did not converge, making the results uncertain.

Internal consistency of the scales was evaluated by using Cronbach's α for the total sample and calculated for both the total REMAP score and for the five subscale scores. The reliability standard suggested by Barker, Pistrang, and Elliot (Barker et al., 1994), was applied for interpretation of the value of the reliability. To explore the convergent and divergent validity additional measures were included in the study and correlated with the total REMAP score and the subscales using Pearson's product moment correlations. Cohen's guidelines for interpreting correlations were followed (Mukaka, 2012). Convergent validity was assessed by correlating the REMAP scores with the PA subscale from PANAS, with the two subscales from Adult Dispositional Hope and with the PSES from the PSS. Divergent validity measures of anxiety, depression, PHS from the PSS and somatic symptom from DSQ, were selected because they assess distinct constructs and were expected to correlate less, or show negative correlations, with resilience. To compare REMAP scores for gender as well as for patients and healthy controls, *t* tests were applied for continuous variables and χ^2 tests for categorical variables. Three age groups were calculated to compare age with REMAP. Group 1: 17–30 years, Group 2: 31–45 years and Group 3: 46–61 years. A one-way, between-group analyses of variance (ANOVA) was conducted to explore the possible differences between the groups. We considered *p* values below .05 statistically significant.

Results

Descriptive statistics of REMAP items, items missing responses and score item values for the Norwegian-translated REMAP version are presented in Table 1.

Correlations and Internal Consistency

The correlations between the items in the scales revealed correlations of more than .40 except for Item 15 with a correlation of .14 ($p < .01$). (This is not in table). The correlations between the total REMAP score revealed the following values for: RE = .74 ($p < .01$), ES = .79 ($p < .01$), ME = .72 ($p < .01$), ASO = .76 ($p < .01$) and PHB = .69 ($p < .01$), respectively. The highest item correlations were between the items within the specific subscales they are supposed to belong to, while the correlations between items that are assumed not to belong to their respective subscale, are significantly lower. Internal consistency was calculated using Cronbach's α and the coefficient for the total REMAP score was .86 and indicated acceptable good degree of intercorrelations among the 22 items. Cronbach's αs for the REMAP subscales were as following: RE = .64, ES = .80, ME = .75, ASO = .57 and PHB = .56 (not shown in table).

Factor Loadings and Confirmatory Factor Analysis (CFA), Fit Statistic

Sixteen of the 22 items demonstrated distinct and salient loadings ranging from .54 to .78. Four of the seven items on

Table 1. REMAP items descriptive statistics and *t* tests for the total sample

			Response values frequency				Gender (*N* = 415)		
REMAP subscales	Missing (%)	*M* (*SD*)	1	2	3	4	Women, *n* = 312, *M* (*SD*)	Men, *n* = 103, *M* (*SD*)	*p*
RE; Relational Engagement subscale									
REMAP1	3.0	3.25 (.80)	14	60	170	171	3.26 (.77)	3.03 (.89)	.013*
REMAP2	3.3	2.70 (.97)	65	134	129	86	2.55 (.98)	2.67 (1.00)	.320
REMAP3	3.3	3.13 (.85)	18	73	167	157	3.21 (.80)	2.84 (.92)	.001***
ES; Emotional Sensitivity subscale									
REMAP4	3.0	3.36 (.72)	4	54	167	190	3.28 (.73)	3.39 (.72)	.200
REMAP5	3.5	3.00 (.75)	8	90	202	113	2.94 (.77)	3.25 (.67)	.001***
REMAP6	3.5	3.31 (.77)	6	57	160	190	3.20 (.78)	3.58 (.59)	.001***
REMAP7	3.7	3.16 (.77)	9	67	192	144	3.14 (.77)	3.17 (.73)	.720
REMAP8	3.5	3.01 (.81)	16	84	195	118	2.97 (.82)	3.10 (.75)	.177
ME; Meaningful Engagement subscale									
REMAP9	12.9	3.14 (.40)	50	43	120	160	2.94 (1.10)	3.36 (.76)	.001***
REMAP10	16.8	2.93 (.99)	45	57	136	118	2.86 (1.10)	3.08 (.83)	.036*
REMAP11	3.7	3.19 (.83)	15	73	158	166	3.14 (.85)	3.19 (.82)	.644
ASO; Awareness of Self and Others subscale									
REMAP12	3.7	3.05 (.80)	28	93	159	132	2.88 (.92)	3.2 (.81)	.001**
REMAP13	3.5	3.46 (.65)	1	35	160	217	3.41 (.66)	3.53 (.64)	.100
REMAP14	3.3	3.30 (.78)	5	69	145	195	3.27 (.77)	3.31 (.81)	.618
REMAP15	3.3	3.25 (.70)	4	48	198	164	3.28 (.70)	3.20 (.68)	.271
REMAP16	3.0	1.47 (.84)	273	77	35	30	1.61 (.93)	1.45 (.90)	.130
REMAP17	3.5	3.20 (.84)	9	80	142	182	3.24 (.80)	3.08 (.90)	.078
REMAP18	3.3	3.22 (.71)	8	67	194	145	3.16 (.76)	3.11 (.74)	.518
PHB; Physical Health Behavior subscale									
REMAP19	3.7	3.04 (.75)	13	69	215	115	3.06 (.77)	3.02 (.72)	.656
REMAP20	4.4	2.35 (1.05)	134	108	106	61	2.16 (1.10)	2.44 (1.10)	.025*
REMAP21	4.0	3.66 (.85)	33	13	25	340	3.61 (.91)	3.72 (.78)	.250
REMAP22	3.5	2.58 (1.03)	107	91	144	71	2.38 (1.10)	2.61 (.95)	.049*

Note. Significant differences by gender based on *t* tests.
**p* < .05. ***p* < .01. ****p* < .001.

the ASO subscale had loadings below .32 that is the required level (Tabachnick & Fidell, 2001). Item 14 (“I reflect on my life”), Item 15 (“I am a good listener”), Item 16 (“I pray or meditate”); and Item 17 (“I appreciate nature”) had values of .31, .20, .03 and .24, respectively. For the PHB scale the Item 19 (“I eat properly”) and Item 21 (“I abstain from smoking”) had loadings on .30 and .26, respectively. See Table 2 for factor loadings.

The original REMAP version’s one and five factors structure models were used as initial models to perform CFA. A one-factor, an uncorrelated five-factor, and a correlated five-factor model were tested in CFA in the three different samples (The total sample, ME/CFS, and Healthy controls). The models fitted the data quite similarly (Table 3). For the total sample, RMSEA was .101 for the one-factor model, .125 for the uncorrelated five-factor model, and .090 for the correlated five-factor model, indicating quite a poor fit for all the models. However, The RMSEA of the correlated five-factor model was close to .08 in the healthy control sample. AIC, BIC, and SRMR had the lowest values, and CFI and TLI had values most close to one in the total sample, indicating the best fit. Both RMSEA, AIC, BIC, CFI, and TLI values indicated the best fit for the correlated five-factor model in the ME/CFS patient group as well for the healthy control sample. Thus, the correlated five-factor structure model tested in the total sample was found to have the best fit of the samples (i.e., RMSEA = .090, AIC = 17,102, BIC = 17,395, CFI = .771, TLI = .734, SRMR = .078). In addition, a formal likelihood ratio test was conducted to compare the one-factor model with the

Table 2. Confirmatory factor analysis (CFA) and item loadings

Items	Latent/conceptual variable	Standardized factor loadings
REMAP 1 I feel supported	RE	.61
REMAP 2 I attend social functions	RE	.73
REMAP 3 I talk with family members	RE	.55
REMAP 4 I laugh	ES	.66
REMAP 5 I like my self	ES	.80
REMAP 6 I am peaceful	ES	.59
REMAP 7 I am optimistic	ES	.76
REMAP 8 I relax	ES	.60
REMAP 9 I use my mental ability at work	ME	.78
REMAP 10 I feel satisfied by my work	ME	.75
REMAP 11 I feel my life has meaning	ME	.62
REMAP 12 I feel in control of my life	ASO	.75
REMAP 13 I am learning	ASO	.61
REMAP 14 I reflect on my life	ASO	(.31)
REMAP 15 I am a god listener	ASO	(.21)
REMAP 16 I pray or meditate	ASO	(.04)
REMAP 17 I appreciate nature	ASO	(.24)
REMAP 18 I give to or serve others	ASO	.33
REMAP 19 I eat properly	PHB	(.30)
REMAP 20 I exercise	PHB	.64
REMAP 21 I abstain from smoking	PHB	(.26)
REMAP 22 I get refreshing sleep	PHB	.70

Note. Five-factor model of the Norwegian REMAP version, confirmatory factor analysis. REMAP subscales; RE = Relational Engagement; ES = Emotional Sensitivity; ME = Meaningful Engagement; ASO = Awareness of Self and Others; PHB = Physical Health Behavior. Loadings not reaching acquired level of <= .32 are placed in parentheses.

Table 3. Goodness-of-fit statistics and fit indexes from the three CFA models tested in the total sample in ME/CFS patients and in healthy controls

	χ model versus saturated	RMSEA	AIC	BIC	CFI	TLI	SRMR
One-factor model							
Total sample	957 (*df* 209)	.101	17,279	17,534	.694	.662	.081
ME/CFS patients	436 (*df* 209)	.108	5,069	5,238	.599	.556	.107
Healthy controls	618 (*df* 209)	.088	11,438	11,672	.720	.690	.079
ADF estimator	1,098 (*df* 209)	.110	—	—	.659	.623	.176
Uncorrelated five-factor model							
Total sample	1,345 (*df* 209)	.125	17,667	17,922	.536	.487	.222
ME/CFS patients	448 (*df* 209)	.110	5,081	5,250	.577	.533	.181
Healthy controls	890 (*df* 209)	.113	11,710	11,944	.534	.485	.198
ADF estimator	—	—	—	—	1.00	—	.302
Correlated five-factor model							
Total sample	760 (*df* 199)	.090	17,102	17,395	.771	.734	.078
ME/CFS patients	380 (*df* 199)	.098	5,033	5,227	.680	.629	.120
Healthy controls	541 (*df* 199)	.082	11,381	11,650	.766	.728	.082
ADF estimator	872 (*df* 199)	.098			.741	.700	.159

Note. RMSEA = root-mean-square error of approximation; AIC = Akaike information criterion; BIC = Bayesian information criterion; CFI = comparative fit index; TLI = Tucker–Lewis index; SRMR = standard root-mean-square residual; ADF estimator = asymptotic distribution free estimator.

correlated five-factor model. The correlated five-factor model had a significant better goodness of fit with χ^2 (10) = 197.41, $p < .001$ (not shown in table). Based on the overall pattern of fit across the different indicators and the three samples, the correlated five-factor structure model appeared as the preferred final model for the Norwegian version of the REMAP; however, the model indices indicated poor fit.

Construct Validity

Convergent Validity

Statistical comparisons showed that all correlations were significant in the expected direction. The total REMAP score was significantly and strongly correlated with Positive affect [$r = .64$ ($n = 253$), $p < .01$], Hope Agency [$r = .51$ ($n = 412$), $p < .01$], and PSES [$r = .62$ ($n = 415$), $p < .01$] and moderately correlated with Hope Path [42 ($n = 415$), $p < .01$]. Positive affect was significantly correlated with all the five subscales of REMAP [RE $r = .45$ ($n = 253$), $p < .01$, ES $r = .54$ ($n = 253$), $p < .01$, ME $r = .47$ ($n = 253$), $p < .01$, ASO $r = .42$ ($n = 253$), $p < .01$, and PHB $r = .46$ ($n = 253$), $p < .01$]. The ME subscale was most strongly and moderately correlated with Hope Agency [$r = .46$ ($n = 411$), $p < .01$] while the ES subscale ($r = .45$, $p < .01$) was most strongly and moderately correlated with the Hope Path.

Divergent Validity

All the distinct constructs were negatively correlated with the REMAP scores. There were significant and strong negative correlations between the total REMAP score and Depression [$r = -.59$ ($n = 411$), $p = .001$] as well as between the total REMAP score and PEM [$r = -.50$ (416), $p < .01$]. The REMAP total score had medium to strong negative correlations with the two Fatigue measures: Fatigue Intensity [$r = -.49$ ($n = 360$), $p < .01$] and Fatigue Severity [$r = -0.47$ ($n = 357$), $p < .01$], and with Anxiety [$r = -.42$ ($n = 414$), $p < .001$] as well as with Negative affect [$r = -.40$ ($n = 25$), $p < .001$]. The correlations between the PHB subscale and the somatic symptoms, such as PEM [$r = -.62$ ($n = 414$), $p < .01$], Fatigue Intensity [$r = -.62$ ($n = 359$), $p < .01$], Fatigue Severity [$r = -.60$ ($n = 356$), $p < .01$], and Bodily Pain [$r = .51$ ($n = 413$), $p < .01$], were all strong (note that a higher bodily pain score means a lower pain level). The RE scale was strongly correlated with PEM [$r = -.51$ ($n = 414$), $p < .01$] and Fatigue Intensity [$r = -.51$ ($n = 359$), $p < .01$] and also had moderate to strong correlations with Fatigue severity [$r = -.47$ ($n = 359$), $p < .01$] and Bodily Pain [$r = -.43$ ($n = 414$), $p < .01$]. The ES scale had a strong negative correlation with anxiety [$r = -.59$ ($n = 413$), $p < .01$] and depression [$r = -.57$ ($n = 410$), $p < .01$] and a middle to strong correlation with NA [$r = -.49$ ($n = 251$), $p < .01$]. The ES and the ASO subscales had weak correlations with all the symptom scores. The PHS (perceived stress, hopelessness scale) was moderately to strongly associated with the total REMAP score [$r = -.45$ ($n = 333$), $p < .01$] and with the ES subscale [$r = -.46$ ($n = 333$), $p < .01$], and moderately correlated with ME [$r = -.36$ ($n = 332$), $p < .01$] and PHB [$r = -.37$ ($n = 332$), $p < .01$]. The associations between PHS and the RE and PHB scales were rather weak.

Comparing Groups

There were significant differences in RE scores for men (M = 2.85, SD = 0.73) and women [M = 3.01, SD = 0.65 $t(413) = -2.09$; $p = .04$], in ES scores for men (M = 3.29, SD = 0.5) and women [M = 3.11, SD = 0.58; $t(413) = 2.96$, $p = .003$], in ME scores for men (M = 3.19, SD = 0.66), and women [M = 2.97, SD = 0.83; $t(412) = 2.75$, $p = .006$], and in PHB scores for men (M = 2.94, SD = 0.55) and women [M = 2.8, SD = 0.65; $t(412) = 2.19$, $p = .03$]. No significant differences between genders were found on either the REMAP total or the ASO score. There were statistically significant differences between all REMAP scale scores, including the mean total score for patients and healthy controls (see Table 4 for details). The results from the one-way ANOVA with REMAP as the dependent variable and age as the between-subjects variable revealed a significant effect of age [$F(2, 387) = 7.008$, $p = .001$]. This is not presented in the table. Group 1 with the youngest (M = 3.06, SD = 0.42) had significant higher score on REMAP total score than Group 3 with the oldest participants (M = 2.83, SD = 0.45). The difference in mean scores between the groups was small. The effect size (η^2) was 0.035. More specifically, the results showed differences between Group 1 (M = 3.10, SD = 0.63) and Group 3 (M = 2.63, SD = 0.72) on the RE subscale [$F(2, 386) = 12.308$, $p < .001$] with $\eta^2 = .06$. Also, for subscale ES [$F(2, 386) = 3,414$, $p = .03$], Group 1 (M = 3.2, SD = 0.56) had higher score than Group 3 (M = 3.1, SD = 0.57) with $\eta^2 = 0.02$. In addition, there was a significant difference between Group 1 (M = 3.0, SD = 0.6) and Group 3 (2.48, SD = 0.69) on the PHB scale [$F(2, 386) = 15.768$, $p < .001$] with $\eta^2 = 0.08$. Group 2 did not differ significantly from any of these two groups.

Discussion

The current study was conducted to examine the psychometric properties of a Norwegian version of the REMAP resilience resource measure (Malarkey et al., 2016). The sample comprised 428 patients with ME/CFS and healthy controls. We tested the REMAP in three samples: patients, healthy controls, and a combined sample

Table 4. Comparing gender and ME/CFS patients versus healthy controls

		Men (n = 103)	Women (n = 313)					ME/CFS (n = 155)	HC (n = 261)				
Scales	N	M (SD)	M (SD)	Hedges' g	t value	df	p	M (SD)	M (SD)	Hedges' g	t value	df	p
REMAP total	416	3.06 (0.41)	2.98 (0.44)	.18	1.57	414	.12	2.72 (0.40)	3.16 (0.36)	1.17	−11.60	414	<.001***
RE	415	2.85 (0.73)	3.01 (0.65)	.24	−2.09	413	.04*	2.50 (0.57)	3.24 (0.57)	1.3	−12.85	413	<.001***
ES	415	3.29 (0.51)	3.11 (0.58)	.32	2.96	413	.003**	2.98 (0.58)	3.25 (0.54)	0.49	−4.88	413	<.001***
ME	415	3.19 (0.66)	2.97 (0.83)	.28	2.75	412	.006**	2.60 (0.88)	3.27 (0.61)	0.93	−8.27	412	<.001***
ASO	415	2.98 (0.46)	2.98 (0.41)	0	0.05	413	.96	2.89 (0.46)	3.04 (0.39)	0.36	−3.44	413	<.001***
PBH	414	2.94 (0.55)	2.80 (0.65)	.22	2.19	412	.03*	2.34 (0.52)	3.16 (0.36)	1.6	−15.67	412	<.001***

Note. Significant differences by gender and by patients and healthy controls based on t tests. REMAP subscales; RE = Relational Engagement; S = Emotional Sensitivity; ME = Meaningful Engagement; ASO = Awareness of Self and Others; PHB = Physical Health Behavior. ME/CFS; myalgic encephalomyelitis/chronic fatigue syndrome, HC = healthy controls.
$^{*}p < .05$. $^{**}p < .01$. $^{***}p < .001$.

consisting of both the patient and control groups. A one-factor model, a correlated five-factor model, and an uncorrelated five-factor model were tested in confirmatory factor analyses. It was quite poor fit for all the three factor solutions. The correlated five-factor model demonstrated best fit to the data, indicating five factors in the Norwegian version of the REMAP resilience measure. This is not in consistence with findings in the original study (Malarkey et al., 2016) as they found the one-factor model to have best fit with the data.

The RMSEA values for all three models are above recommended threshold (.05–.08), indicating that none of the models fit the data particularly well. In addition, both CFI and the TLI values are below the desired threshold (.90), also confirming the poor fit of the model to the data.

Moreover, both convergent and divergent construct validity proved to be good. The internal consistency for the 22 items was also good (Cronbach's α = .86). The reliability for two of the subscales was acceptable while it was poor for the three subscales: RE, ASO, and PHB. Differences were revealed between the genders on all subscales, except from the ASO scale. There were differences between age groups where the youngest participants had the highest resilience score on the total REMAP and on the RE, ES, and PHB subscales. Healthy controls had higher resilience scores than the ME/CFS patients on all REMAP scales.

Examining the frequency distribution of each item revealed limited variability within the item distribution of the subscales. For example, in the subscales ES and ASO, most participants scored 3 or 4, which gives a relatively skewed distribution of the responses except for Item 16 ("I pray or meditate") where the response distribution was skewed the other way around and two thirds of the sample responses corresponded to the lowest value (*rarely*). This response was also reflected in the average value of Item 16, which was very low compared to the means of the other item responses in REMAP. The mean value for this same item was also lower than what was found in the US sample in the original study (Malarkey et al., 2016). This may reflect cultural and religious attitudes and difference in the Norwegian and US societies.

All correlations between the total REMAP scores, except from one item, correlated, which indicate that the items in the scale contribute approximately equally with the same proportions of information to the underlying concept of resilience (i.e., the total scale score). The estimate of internal consistency reliability for the total REMAP score was Cronbach's α of .86 very similar to the findings from the original study by Malarkey et al. (2016). The scale/item analysis indicated that the interitem correlation coefficients ranged from .56 to .80, and while the ES and ME subscales had acceptable Cronbach's αs, the other three subscales had interitem correlations below what is considered acceptable. This may indicate that these items do not assess similar constructs, and subsequently, applying the subscales in research might be questionable and factor analyses should potentially be conducted before applying the various subscales. However, the REMAP was developed with the intention to assess theoretically resilience resources with the purpose of being able to discuss patients' resilience resources across domains. Although the current study did not identify satisfactory psychometric properties for the five subscales representing each domain, the subscales might be valuable as a way to show patients that resilience resources can be developed and increased from various life domains and used to aid in coping with stress and life challenges.

A poor fit for all the models raises questions about the cross-cultural validity of the theoretical framework of the REMAP for Norwegian populations, as used in the current study. The results indicate that the factor structure of the original REMAP version is not directly applicable to this Norwegian context and that possible cultural and contextual differences between the United States and Norway may influence the underlying factor structure. For example, there is a significantly higher degree of religiosity in the United States than in Norway, and average scores for statement 16 in REMAP ("I pray or meditate") are lower in the Norwegian sample (M = 1.47) than in the American sample (Study 1, M = 2.43). In addition, Item 16 has the lowest factor loading (.04) in the CFAs. Additionally, some items are less relevant for patients with ME/CFS than patients with other unexplained symptoms. Since ME/CFS patients are to a lesser extent employed, at least in Norway, both statements 9 ("I use my mental ability at work") and 10 ("I feel satisfied by my work") will be of little relevance to them. These items actually make up two out of three items in the subscale ME (meaningful engagement). The missing response rates on both Items 9 and 10 are 12.9 and 16.8 percent, respectively, while the rates of missing on the remaining items are around three percent.

Although the results in this study do not show clear REMAP structures to the same extent as the original study, there are several indications that the current form can capture resources of resilience. Strong positive correlations were observed between the total REMAP score and Positive affect, PSS-PSE and the Hope Agency subscale. In addition, moderately positive correlation was identified between the total REMAP score and Hope Path. All REMAP subscales were moderately positive correlated with all the resilience related measures applied in the convergent validity analysis. These findings are in line with previous research, showing strong associations between resilience and hope (Malarkey et al., 2016; Polson et al., 2018), as well as with positive emotions as a factor of resilience in other patient groups such as rheumatoid arthritis and chronic pain conditions such as fibromyalgia (Chng et al., 2023; Strand et al., 2006; Zautra et al., 2005). In contrast, the present results suggested negative relations between resilience scores and PSS-PHS, anxiety, depression, PEM, Bodily pain, and fatigue intensity and severity. These findings are in accordance with findings from the original REMAP study (Malarkey et al., 2016) and in several other studies showing negative associations between the resilience and depression, anxiety, somatic symptoms, and resilience (Cal et al., 2015; Ristevska-Dimitrovska et al., 2015). When comparing the scores on REMAP subscales according to gender, it showed significant differences where men scored slightly higher on both the ES and the ME subscales and women had significant higher mean level on the RE subscale. When inspecting the individual scale item responses, the ES items "I like myself" and "I am peaceful" and the ME item "I use my mental ability at work" had the largest difference in favor of men. Moreover, the mean levels of the RE items "I talk with family members" and "I feel supported" are higher in women than in men, and this was also found in the original study by Malarkey et al. (2016). That the youngest age group had higher resilience scores on several scales may relate to the fact that there are more healthy controls in the youngest group since the control group is younger than the patients. The youngest age group is therefore healthier and probably more socially (RE) and physically (PHB) active than the oldest age group (e.g., patients) and thus answer questions relating to this differently. For patients and healthy controls, there were significant differences on all the REMAP scales where the control group had significantly higher mean scores than the patient group. This may indicate that healthy controls are more resilient than patients with CFS/ME, but it might also imply that the scales capture aspects that may be associated with or result from having CFS/ME symptoms. In addition, there may be factors in the instrument itself that influence the differences between the groups.

Limitations

The study has some limitations. First, the distribution appears skewed for a number of the responses. This means that the spread in the sample might not be optimal. For example, 70% responded with scores 3 and 4 on Item 18 among others. This could potentially indicate the presence of a selected sample and hence potentially not representing the breadth of resilience responses. It could however also mean that the REMAP measure does not necessarily fit a variety of cultures, as there was also an item level spread in the original REMAP study. A skewed sample may also have contributed to an altering of the scale structure and potentially preventing a better fit of the model. For most of the REMAP items, the responses in the current study are on average over three, a number that is quite high, and indicating that the study was not able to identify enough participants in the lower part of the scale. Relatively high scores on REMAP may indicate that participants (i.e., patients and healthy controls) who sign up for study participation may have more resources such as more energy or other resource capacities than those who declined to participate in the study. Moreover, to our knowledge, no other studies have applied REMAP in different cultures or populations, except for the original study by Malarkey et al. (2016). Thus, there are no possibilities to compare the observed factor structure to see if the observed factor structure looks like or is different from previous findings.

In summary, the current study provides some empirical support for the validity and poorer support for reliability of REMAP in a Norwegian cohort consisting of patients diagnosed with ME/CFS and healthy controls. Future examinations of the test–retest reliability of the REMAP could assess differences over a shorter period. Future studies exploring the predictive validity of REMAP and its properties, including ME/CFS patients outside specialist healthcare and with better functioning as well as other Norwegian populations with unexplained physical and psychological symptoms and also with bifactor analyses, could further contribute to a better understanding of the REMAP resilience resource measure.

Conclusion

The results from this study provide some, but quite poor support for the correlated five-factor solution using the REMAP scale. Analyses of both convergent and divergent validity indicate that the instrument captures adequate aspects of resilience and could therefore be used in Norwegian samples. The findings do however indicate that REMAP should be tested further in other patient groups, and before use, in additional cultures and settings. More research is needed to better understand the underlying structure of REMAP in different Norwegian populations. Further studies could explore alternative factor structures, possible cross-cultural differences, and nuances and include different patient groups and samples with different demographics that may have an impact on the underlying factor structure in REMAP. Based on the results of this study, researchers and clinicians using the Norwegian version of REMAP should be careful when interpreting and comparing the scores. When using the instrument in research, account should be taken of the uncertainty linked to the factor structure, lack of structural validity, and the limitations it may entail.

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