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Cognitive emotion regulation strategies and neuroticism in relation to depressive symptoms following burn injury: a longitudinal study with a 2-year follow-up

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Abstract Sustaining burns is considered a stressful life event that has the power to elicit depressive symptoms. This study aimed to identify predictors of depressive symptoms by investigating the role of demographic variables, the number of operations (burn severity), neuroticism, and cognitive emotion regulation styles as possible influencing factors. Data from 242 patients with burns were analyzed employing latent growth modeling. The level of depressive symptoms across the 2-year interval was associated with burn severity, higher levels of neuroticism and rumination, and lower levels of positive refocusing. Notably, rumination partly mediated the effect of neuroticism on the course of depressive symptoms. Correlational analysis suggested a specific effect of burn severity on rumination. The results indicate that screening for symptoms of depression, rumination, and neuroticism in burn patients is useful. Early interventions focusing on cognitive restructuring could assist in improving the cognitive emotional adaptation process following a burn event.

Keywords Rumination · Neuroticism · Latent growth analyses · Burns · Psychological · Depression · Quality of life

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Introduction

Sustaining burns is considered a stressful life event that has the power to elicit depressive symptoms (Van Loey & Van Son, 2003). Depression following burns is important to diagnose at an early stage because it has been associated with long-term reduced physical functioning and diminished quality of life (Ullrich et al., 2009; Van Loey et al., 2012). In a systemic review on the prevalence of depression among burn survivors, in studies using structural interviews 4–10 % of adult patients with burns met diagnostic criteria for major depression within a year post burn, and in studies using self-report questionnaires, the prevalence rate of depression varied from 4 to 26 % (Thombs et al., 2006). Recent studies using structured diagnostic interviews identified major depression in 13 % of patients at 6 months (Palmu et al., 2011) and in 10–16 % of patients at 1–4 years after the burn event (Dyster-Aas et al., 2008; Ter Smitten et al., 2011). Approximately 20–30 % of burn survivors experienced depressive symptoms up to 20 years following the burn event (Lawrence et al., 2006a). The few available longitudinal studies suggest that depressive symptoms tend to persist over time (Lawrence

et al., 2006a; Ullrich et al., 2009; Wiechman et al., 2001). However, the current state of evidence on the risk factors related to depression following burn injuries is hampered by small sample sizes and the use of univariate analyses (Thombs et al., 2006). There is a need for larger studies assessing depressive symptoms occurring immediately following a burn event and subsequently, to investigate the persistence and course of depression in multivariate models.

Theoretical views of depression emphasize the importance of cognition. According to Beck's cognitive model of depression, an adverse event may activate latent schemas (i.e., mental representations of past experiences) that influence the processing of information (Beck et al., 1979). Depressive schemas, which are determined by genetic and personality factors and (early) adverse events, are characterized by negative self-referential beliefs. The activation of these schemas may result in biased attention to negative stimuli as well as biased processing and memory of these stimuli (Disner et al., 2011). Cognitive biases may also explain the activation and perpetuation of depressive symptoms following a burn event. In particular, deep dermal burns cause life-long scars that may act—especially in vulnerable individuals—as a negative reminder of the event and thus elicit and maintain negative emotions. Negative cognitions that are triggered by burn scars may be associated with depressive symptoms following burns.

Numerous studies have shown that impaired cognitive emotion regulation is associated with depression of which rumination in particular has been found salient (Joormann & Gotlib, 2010; Nolen-Hoeksema et al., 2008). Rumination is a cognitive strategy that has been defined as a process of perseverative negative thinking (Nolen-Hoeksema et al., 2008) and a style of self-referential thinking that impairs disengagement from negative material (Koster et al., 2011). Rumination may exacerbate depressive symptoms (Nolen-Hoeksema et al., 2008). Of notice, rejection sensitivity prospectively predicted rumination (Pearson et al., 2011) which may have value in burn research as burn scars can elicit interpersonal rejection (Lawrence et al., 2006b). In that line of reasoning, rumination may be a risk factor particularly for the maintenance of depressive symptoms in individuals with burns showing increased attention to burn-related stimuli, such as other people's reactions to their scars.

Rumination is one of many cognitive emotion regulation strategies (Garnefski et al., 2001) of which, self-blame, catastrophizing, and low positive reappraisal have been associated with depressive symptoms (Garnefski & Kraaij, 2007). Individuals engaging in rumination have been found to use less cognitive reappraisal, i.e., re-interpretation of emotion-eliciting stimuli, while cognitive reappraisal has been shown to positively influence affect (Gross & John, 2003; Joormann & Gotlib, 2010). These findings indicate the value of examining multiple cognitive emotion regulatory strategies as possible modulators of depression.

To fully take account of depressive symptoms, besides external circumstances such as trauma and the way the person cognitively deals with it, also personality traits should be considered. Cognitive emotion regulation strategies—that could be a target in cognitive therapies—are to a certain extent rooted in personality characteristics such as neuroticism. Neuroticism is considered a stable personality trait that is associated with the persistent tendency to experience negative emotions, such as anger, depression, anxiety, guilt, and envy (Costa & McCrae, 1992). Indeed, studies investigating the role of neuroticism in a variety of diseases have shown a longitudinal association between neuroticism and depression (Aben et al., 2002; Finch & Graziano, 2001), and this association has also been shown in people with burns (Andrews et al., 2010; Kildal et al., 2004; Willebrand et al., 2004). Some authors have argued that rumination is a key to both neuroticism and depression, but other studies have indicated that rumination may be related to depression independently of neuroticism (Hankin et al., 2007; Hong et al., 2010). Thus, it is insufficiently clear whether the recovery from depressive mood after burns is worse for individuals with high levels of neuroticism and those with maladaptive cognitive emotion regulation strategies such as rumination. Longitudinal studies are needed to elucidate the potential influence of cognitive emotion regulation and neuroticism on the subsequent course of depression.

Current outcome studies in burn populations do not suggest a major role of burn severity in depression (Thombs et al., 2006) but the effects may hold for a subset of patients who have difficulty accepting (the consequences of) their scars. Burn severity has been found a predictor of quality of life in the vast majority of burn studies (Moi et al., 2007; Oster et al., 2009; Van Loey et al., 2012). The functional problems associated with severe burns (Esselman et al., 2006) and the associated dependency on others may increase the risk for depressive symptoms. In most previous studies, however, the lack of statistical power may have prevented reliable conclusions on the relation between burn extent and depression (Thombs et al., 2006). It is also possible that burn severity was not a significant factor in previous depression studies because it was often operationalized by total body surface area burned (TBSA), which includes both superficial wounds and deep dermal wounds, whereas the final extent of scarring is highly dependent on the depth of the wounds. Larger prospective studies are needed to better understand this relationship.

The aim of this study was to examine depressive symptoms in individuals with burns, beginning in the hospital and following the subjects prospectively for

2 years, and to examine the potential predictive role of neuroticism and cognitive emotion regulation strategies. It was hypothesized that the number of surgical interventions, neuroticism, and maladaptive cognitive emotion regulation, such as rumination, and low positive reappraisal would be associated with higher levels of depressive symptoms and a poorer long-term outcome.

Materials and methods

This study was approved by the Ethics Committees of the Martini Hospital, Groningen, the Netherlands, and the University of Ghent, Belgium. The study was performed according to the principles of the Helsinki declaration.

Participants

The study participants were consecutive adult patients with burns admitted to one of six Dutch or Belgian burn centers between April 2003 and April 2005. Patients were eligible to participate if they were 18 years of age or older, spoke Dutch, stayed in the hospital for 72 h or longer, and were not suffering from cognitive dysfunction or burns as a result of a suicide attempt. During the study period, 311 patients were eligible to participate. Fifty-one patients (16 %) declined participation. Written informed consent was obtained from 260 patients, but 18 patients were found to have incomplete files, leaving 242 persons for the analyses. Of the 242 patients, 234 (97 %) completed the BDI-II at 3 weeks, 191 (79 %) at 6 months, 162 (67 %) at 1 year, and 116 (48 %) at 2 years post-burn. The sample included 175 male (72 %) and 67 female (28 %) participants. The mean age was 38.8 (SD 12.6), and the mean number of operations was 1.5 (SD 2.1), ranging from 0 to 16. The average length of the hospitalization period was 23.7 days (22.5), and the mean TBSA was 12.5 % (11.4). This study was part of larger study (Van Loey et al., 2012).

Procedure

The local researcher invited the patients to participate in the study. All patients who provided their written informed consent received questionnaires during their hospitalization and subsequently at six, nine, 12, and 24 months post-burn. After a patient left the burn center, questionnaires were mailed to the patient's home address, including a stamped return envelope. Patients who failed to return the questionnaire within 2 weeks were contacted by telephone as a reminder to return the questionnaires. No further efforts were taken to increase the response rate.

Measures

Depressive symptoms

Depressive symptoms were assessed in-hospital and at six, 12, and 24 months post-burn using the 21-item Beck Depression Inventory (BDI-II) (Beck et al., 2002). The BDI-II items are rated from 0 to 3. The total summed score can range from 0 to 63, with higher scores indicating more depressive symptoms. The BDI-II provides cut-off scores as an indication of no depression (BDI-II $\leq$13), mild depression (BDI-II $\geq$14 and $\leq$19), moderate depression (BDI-II $\geq$20 and $\leq$28), and severe depression (BDI-II $\geq$29). The psychometric properties of the Dutch BDI-II are fair (Beck et al, 2002). Dutch reference norms have been provided (Roelofs et al., 2013).

Cognitive emotion regulation

Cognitive emotion regulation was assessed at 9 months post-burn using the 36-item Cognitive Emotion Regulation Questionnaire (CERQ) (Garnefski & Kraaij, 2007). The scale measures nine cognitive emotion regulation styles, each comprising four items: self-blame, acceptance, rumination, positive refocusing, refocus on planning, positive reappraisal, perspective taking, catastrophizing, and other-blame. The items are scored on a 5-point Likert scale ranging from 1 (almost never) to 5 (almost always). The instrument has fair psychometric properties, including good factorial validity and reliability, with Cronbach's alpha ranging from 0.75 to 0.87 (Garnefski & Kraaij, 2007).

Personality characteristics

The level of neuroticism was measured in-hospital using the neuroticism subscale of the 107-item Amsterdam Biographic Questionnaire (ABV) (Wilde, 1970). Items are scored 'yes', '?', or 'no'. The instrument has fair psychometric properties, including satisfactory test–retest reliability and a good Cronbach's alpha for neuroticism (0.82) (Wilde, 1970).

Demographics and injury characteristics

Information on age, gender, length of stay in hospital, TBSA, and the number of operations was recorded from the medical file. TBSA comprises the sum of the estimated percentage of partial and full thickness burns. The number of operations refers to the total number of surgeries required during the acute healing phase and is assumed to reflect the extent and depth of the burn wounds.

Data analysis

To compare patients who did and did not have missing values, we tested the characteristics of patients using *t* tests and a χ^2 test. Descriptive statistics were used to analyze the rates of prevalence of depressive symptoms. Associations between depressive symptoms and predictor variables were examined using Pearson correlations. A *t* test was performed to compare the prevalence rate of depressive symptoms to a Dutch norm population.

To examine the post-burn course and predictors of depressive symptoms, latent growth modeling (LGM) was performed using lavaan version 0.5–13 (Rosseel, 2012). LGM was considered appropriate to test the significance of the several predictors because this type of analyses is able to examine individual growth trajectories over time, where individuals are allowed to have different starting points (random intercept model) and different growth rates (random slope model). The model is depicted in Fig. 1 showing that we will examine the possible effect of demographic variables, the number of operations, and neuroticism and cognitive emotion regulation strategies on the starting point (in-hospital) depressive symptoms and the change of depressive symptoms over a 24-month period. LGM does not assume equal numbers of observations across time. All patients who completed at least one BDI-II during the study period were included in the analyses; thus, all available information remains in the analyses. Furthermore, we used full information maximum likelihood to deal with the missing data (Arbuckle, 1996). Goodness-of-fit indicators used in this study were the Root Mean Square Error of Approximation (RMSEA), that should have values between 0.05 and 0.08, the Comparative Fit Index (CFI) that should show values above 0.90 and the Tucker-Lewis Index (TLI) with target values above 0.90 as the thresholds for acceptable but moderately fitting models. Thresholds for well-fitting models are RMSEA <0.05, TLI and CFI >0.95. It should be noted that the CFIs, TLIs and RMSEAs are based on the rescaled χ^2 as robust maximum likelihood (MLR) was used as the estimator.

We examined the effects in three models. First, in Model 0 we examined the baseline levels and the course of the repeatedly measured depressive symptoms nested within persons.

Second, in Model 1 we tested the added predictive value of gender, age, the number of surgical procedures as a measure of burn severity, neuroticism, and cognitive emotion regulation styles on baseline depressive symptoms and depressive symptoms over time. The R^2 statistic was used to provide information on the proportion of variance in the observed measures that was explained by the latent growth factors. To accommodate for the measurement point, the factor loading between intercept and the depression measures was fixed at 0, 6, 12, and 24 (months). The model was estimated by robust maximum likelihood, which can handle data non-normality. The model test statistic was corrected by the Yuan-Bentler scaled test statistic (Yuan & Bentler, 2000) and robust standard errors were

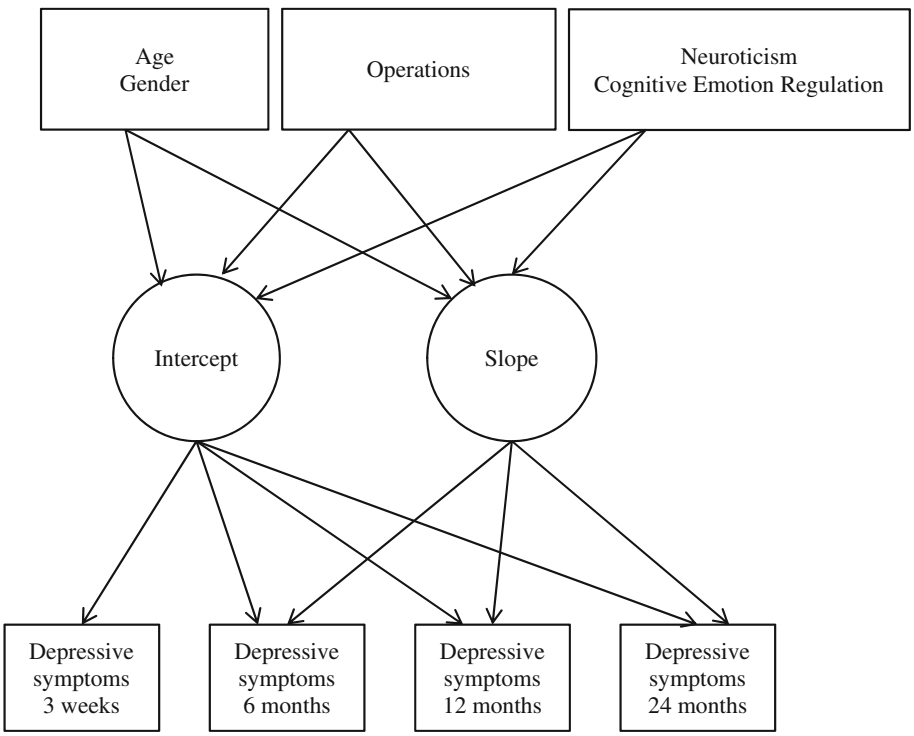

Fig. 1 Representation of the two-factor latent growth model, predicting the initial level and the rate of change in depressive symptoms

computed using the Huber-White method (Huber, 1967; White, 1982). The significance of effects was determined by dividing the estimates by the standard error. The significance of the variances was tested by employing the likelihood ratio test. Statistical significance was defined at the 95 % confidence level.

Third, in Model 2 we examined the mediating role of rumination between neuroticism and the course of depressive symptoms. More in detail, we tested the effect (regression coefficient) of neuroticism on rumination (a) and the effect of rumination on the course of depressive symptoms (b). A statistically significant indirect effect (a*b) indicates the presence of an interaction effect. Note that this significance is based on 1,000 bootstrap samples, since the distribution of a*b is not normal. The total effect (a*b + c) takes also into account the unique effect of neuroticism on the course of depressive symptoms.

Results

Attrition

Analyses comparing respondents who completed all assessments to those who dropped out did not show significant differences regarding gender, length of hospitalization, TBSA, the number of operations and, positive refocusing ($p > .10$). For four variables, significance levels of $p < .10$ were found: compared with those who completed all assessments, drop-outs were younger (the mean ages was 36.3 years ($SD = 13.4$) vs 39.9 years ($SD = 12.1$), $t(240) = -2.076$, $p = .04$) and showed a tendency to have higher mean baseline depression scores (10.41 ($SD = 11.34$)) vs 7.90 ($SD = 7.28$), $t(101.83) = 1.773$, $p = .08$). Furthermore, those who dropped out had higher levels of neuroticism ($M = 55.5$ ($SD = 27.2$)) versus those who completed all measurements ($M = 47.0$ ($SD = 24.1$), $t(204) = 2.379$, $p = .018$). Although no difference was found at the 12 months dropout analysis, at 24 months post burn, those with higher rumination levels were also found to dropout more often ($M = 9.4$ ($SD = 4.0$) vs $M = 8.1$ ($SD = 3.4$), $t(168) = 2.379$, $p = .019$).

Prevalence of depressive symptoms in a 2-year period

Table 1 presents the severity of depressive symptoms at each time point. The results show that the majority of the individuals with burns did not report depressive symptoms. Approximately one-quarter of the respondents showed mild to severe symptoms 3 weeks after the burn event. Six months after the burn event, approximately 20 % of the respondents reported mild to severe depressive symptoms, and in the years thereafter, the percentage of mild to severe depressive symptoms further declined to 12 % at the 2-year follow-up. The overall level of depressive symptoms for the population with burns (see Table 2) was low as compared to Dutch norms ($M = 10.6$ ($SD = 10.1$), $t(7{,}740) = -2.73$, $p = .003$) (Roelofs et al., 2013).

Table 2 shows the Pearson correlations among all of the variables. The repeated depression measures were highly correlated, especially the measures at the 6- to 24-month follow-ups, indicating that the rank order of depressive symptoms became more stable with the passage of time. Table 2 further shows that rumination and neuroticism were moderately to strongly correlated with the repeated measurements of depressive symptoms. The correlations between positive refocusing and depressive symptoms were small. Whereas the association between neuroticism and depressive symptoms tended to decrease with time, the correlations between the single assessment of rumination and depressive symptoms over time continued to exhibit approximately the same magnitude. The correlation between rumination and neuroticism was of moderate magnitude, indicating that these variables represent overlapping but distinct concepts. Table 2 shows statistically significant correlations between burn extent (both number of operations and TBSA) and rumination, but no significant correlations were found between burn extent and neuroticism and positive refocusing.

Latent growth modeling

First, we tested the adequacy of the LGM. The model provided evidence for significant variance on the intercept (19.998, $SE = 6.56$) but not on the slope (0.003,

Table 1 Severity of depressive symptoms at four post-burn time points

Beck Depression Inventory-version II (BDI-II) scores reflecting no (≤13), mild (≥14 and ≤19), moderate (≥20 and ≤28), and (BDI-II ≥29) depression

Depression severity	3 Weeks (n = 234) n (%)	6 Months (n = 191) n (%)	12 Months (n = 162) n (%)	24 Months (n = 116) n (%)
No	188 (78)	153 (80)	137 (84)	101 (88)
Mild	27 (11)	23 (12)	13 (8)	10 (8)
Moderate	18 (7)	8 (4)	8 (5)	3 (3)
Severe	9 (4)	7 (4)	5 (3)	1 (1)

Table 2 Pearson correlations, means, and standard deviations (SD) for depressive symptoms and predictor variables

Measure	1	2	3	4	5	6	7	8	9	10	11
1. BDI 3	–	0.63**	0.56**	0.47**	0.58**	0.36**	−0.14	0.24**	0.19**	−0.07	0.30**
2. BDI 6		–	0.74**	0.69**	0.53**	0.46**	−0.15	0.24**	0.17*	−0.07	0.17*
3. BDI 12			–	0.80**	0.37**	0.56**	−0.21*	0.21**	0.10	−0.04	0.20*
4. BDI 24				–	0.23*	0.41**	−0.14	0.28**	0.17	0.08	0.11
5. ABV-N					–	0.33**	−0.07	0.03	−0.05	−0.13	0.20**
6. CERQ-R						–	0.05	0.20**	0.24**	−0.13	0.19*
7. CERQ-PR							–	0.05	0.10	−0.16*	0.09
8. Operations								–	0.54**	−0.02	0.07
9. TBSA									–	−0.07	0.06
10. Age										–	0.02
11. Gender											–
M	8.68	8.02	7.25	5.44	51.1	8.57	11.01	1.45	12.51	38.79	
SD	8.82	8.85	8.60	6.83	25.94	3.70	4.36	2.15	11.40	12.62	

BDI = Beck Depression Inventory, figure corresponds with respective time points in months; ABV-N = Amsterdam Biographic Questionnaire-Neuroticism; CERQ = Cognitive Emotion Regulation Questionnaire, -R = rumination, -PR = positive refocusing; TBSA = total body surface area burned

** $p < .01$ (2-tailed); * $p < .05$ (2-tailed)

Table 3 Estimates for latent growth models of the predictors of depressive symptoms

	Model 0 Estimate (SE)	Model 1 Estimate (SE)	Model 2 Estimate (SE)
Intercept	8.728 (0.552)*	−1.663 (2.230)	−1.547 (2.239)
Gender		2.629 (1.020)*	2.789 (1.020)*
Age		−0.008 (0.029)	−0.011 (0.029)
Operations		0.777 (0.156)**	0.830 (0.149)**
Neuroticism		0.154 (0.021)**	0.154 (0.021)**
Rumination		0.550 (0.177)*	0.538 (0.178)*
Positive refocusing		−0.332 (0.122)*	−0.336 (0.122)*
Slope	−0.089 (0.029)*	−0.091 (0.115)	−0.088 (0.115)
Gender		−0.096 (0.056)	−0.096 (0.056)
Age		0.002 (0.002)	0.002 (0.002)
Operations		−0.010 (0.012)	−0.011 (0.012)
Neuroticism (c)		−0.005 (0.001)**	−0.005 (0.001)**
Rumination (b)		0.029 (0.011)*	0.029 (0.011)*
Positive refocusing		−0.005 (0.006)	−0.005 (0.006)
Rumination–neuroticism (a)			0.049 (0.010)**
Indirect effect (a*b)			0.001 (0.001)*
Total effect (a*b + c)			−0.003 (0.001)*
Model fit			
χ^2	22.861 (8), $p = .004$	40.380 (20), $p = .004$	53.082 (24), $p = .001$
CFI	0.912	0.949	0.933
TLI	0.934	0.923	0.902
RMSEA	0.088 (CI 0.059–0.117)	0.065 (CI 0.040–0.088)	0.070 (CI 0.049–0.092)

** Two-tailed p value <.001; * two-tailed p value <.01, SE of indirect effect was based on 1,000 bootstrap draws

$SE = 0.018$), indicating that there were individual differences in baseline levels of depressive symptoms and that the majority of individuals had approximately the same growth rate; for 89 % of the subjects the slope was negative reflecting a decrease of depressive symptoms. The test of the linear time course of depressive symptoms was significant, whereas the quadratic time effect was not. As shown in Table 3, Model 0, the mean baseline level of depressive symptoms (mean intercept) was 8.73. The mean change over time (mean slope) was −0.089, indicating that

on average depressive symptoms decreased 0.089 units per month, i.e., about a 2-units decrease during the 24-months period. This decrease is small, indicating an on average stable symptom level.

Model 1 tested the effects of the person variables gender, age, the number of operations, neuroticism, and cognitive emotion regulation styles. The cognitive emotion regulation styles that were not statistically significantly related to depressive symptoms were removed from the model. Gender, the number of operations, neuroticism, rumination, and positive refocusing were statistically significant predictors of the baseline level of depressive symptoms. The average level of depressive symptoms for women was 2.629 higher than the score for men. Having had one more operation was associated with a higher depression score equal to almost one point (0.777) on a scale ranging from 0 (no symptoms) to 63 (severe symptoms) and controlled for the other variable effects. Consistent with the hypothesis, positive refocusing was negatively related to the level of depressive symptoms, whereas neuroticism and rumination were positively related to the level of depressive symptoms.

With respect to tests of the slope in Model 1, neuroticism and rumination significantly influenced the course of depressive symptoms, but distinct dynamics were observed. The interaction of time with neuroticism and rumination suggested that in people with high levels of neuroticism, depressive symptoms decreased slightly across the post-burn interval, whereas in people with high levels of rumination, depressive symptoms significantly increased over time. The model accounted for 65 and 88 % of the variance in depressive symptoms on the intercept and slope, respectively. The model indices indicated an adequate fit: $\chi^2 = 40.380$ ($df = 20$), $p = .004$, CFI = 0.949, TLI = 0.923, RMSEA = 0.065 (CI 0.040–0.088).

An indirect effect on the slope was tested between neuroticism and depressive symptoms with rumination as the mediator (Table 3, Model 2). We found a small but significant indirect effect (0.001 ($SE = 0.001$), $p = .025$), indicating that rumination partly mediates the relationship between neuroticism and the course of depressive symptoms.

Discussion

This article encompasses one of few studies investigating depressive symptoms in individuals with burns beginning in the hospital with a 2-year follow-up period in a relatively large sample. Furthermore, this study is the first to examine the longitudinal association of cognitive emotion regulation strategies and neuroticism with the course of depressive symptoms in this patient population. The results show that approximately one of every four patients with burn injuries had depressive symptoms after 3 weeks and that approximately one of eight participants had depressive symptoms 2 years after the burn event. Although in-hospital prevalence rates were somewhat higher, the long-term outcome is fairly consistent with structured interview outcomes that have reported rates of 10–16 % 1–4 years after the burn event (Dyster-Aas et al., 2008; Ter Smitten et al., 2011). Consistent with previous studies, depressive symptoms tended to be stable across the 2 years of the study (Andrews et al., 2010; Ptacek et al., 2002; Wiechman et al., 2001). In particular, depressive symptoms from 6 months onward were found to be highly correlated with subsequent depressive symptoms ($r \geq .80$). The stability of depressive symptoms underlines the importance of identifying and treating individuals with depressive symptoms in an early phase.

Conceptual models of depression emphasize the importance of impaired cognitive emotion regulation strategies, particularly the detrimental effect of rumination (Joormann & Gotlib, 2010; Koster et al., 2011). The current prospective analysis supports these models as the increase in depressive symptoms during the post-burn interval was related to the tendency to ruminate. This finding suggests the deteriorating role of this cognitive emotion regulation strategy in depressive symptoms following burns, which is consistent with prior studies (e.g., Hong et al., 2010) that highlight rumination as a vulnerability factor for both greater severity and longer duration of depressive symptoms. Furthermore, although the correlation coefficients were small, the latent growth analysis shows that individuals with low levels of positive refocusing ability exhibited higher levels of depressive symptoms in addition to the effects of neuroticism and rumination. A sensitivity analysis revealed that this effect was robust. These findings are consistent with previous studies indicating that positive refocusing is associated with less depressive symptoms (e.g., Gross & John, 2003). The results may also suggest that multiple strategies play a role in the persistence and alleviation of depressive mood (Garnefski et al., 2001).

Neuroticism, which was controlled for cognitive emotion regulation strategies, was found to be associated with higher levels of in-hospital depressive symptoms, but the association of the single assessment of neuroticism with the repeated measures of depressive symptoms reduced with the passage of time. This effect, however, might have to do with the higher attrition rate of persons scoring high on neuroticism. This study found evidence for rumination acting as a partial mediator in the relationship between neuroticism and the course of depressive symptoms. Although it was a small effect, it may indicate that individuals with high levels of neuroticism are at risk for more

intense symptom levels immediately after the burn event but that this effect may diminish among those who do not engage in rumination. Moreover, the significant correlation between rumination and burn extent, but not between neuroticism and burn extent, may support that neuroticism is a trait associated with depressive symptoms, whereas rumination may be activated in response to a burn event. It should be noted that neuroticism was measured within the first month after the burn event and may have been inflated by the depressive reaction to the burn event. However, the level of neuroticism that was measured during an episode of depression was argued to be a 'real' reflection of the construct (Costa et al., 2005). Similarly, the tendency to ruminate is considered a stable vulnerability factor that also remains elevated during periods of low depressive mood (Nolen-Hoeksema et al., 2008). Overall, our findings support the role of both neuroticism and rumination in predicting depressive symptoms following burns.

One of the open questions in the field of burn research is whether the severity of burns and the associated scarring are risk factors for psychopathology and negative affect. This study found an effect of the number of operations (as an indicator of burn severity and likely scarring) on depressive symptoms even after controlling for psychological variables. Prior studies have identified an effect of the number of operations and TBSA on the persistence of posttraumatic stress symptoms (McKibben et al., 2008; Van Loey et al., 2003). However, our results also contradict findings in other depression studies in this population that failed to find such a relationship (Andrews et al., 2010; Thombs et al., 2006). The statistical analyses used and the relatively large sample may partly explain these contrasting findings. This result calls for further research to better understand this relationship and for ongoing clinical attention to the role of scarring in depression therapy.

In support of the abovementioned statements, there was also a statistically significant correlation between the number of operations and rumination, suggesting that the severity of burns may aggravate rumination or that individuals who are inclined to rumination have difficulty disengaging from the consequences of the burn event (e.g., the scars or the associated functional limitations). Self-focused attention has been found to increase negative affect (Mor & Winquist, 2002) and may be a factor of significance in relation to depressive symptoms following burns. Another explanation of this correlation may relate to the social effect of living with scars that can elicit social stigmatization and rejection (Lawrence et al., 2006b). In particular, negative social reactions may encourage rumination and the maintenance of depressive symptoms (Barnett & Gotlib, 1988; Pearson et al., 2011). To some extent, these notions are supported by studies showing moderate correlations among depression, self-esteem, and scars (Lawrence et al. 2012), but none of the previous studies investigated rumination as a potential moderating factor. The current study suggests that a focus on rumination in relation to depressive symptoms may offer tools that may be helpful in burn care practice.

Finally, the group of persons with burns showed on average lower scores on depressive symptoms than the Dutch norm population. This is likely due to the exclusion of patients who, for example, had burns caused by suicide attempts. In addition, there were large differences in gender rates as the burn cohort comprised 28 % females whereas the norm group included 57 % females. Consistent with the Dutch norm population (Roelofs et al., 2013), female gender was found a risk factor for the development of depressive symptoms. A comparison group with equal gender rates would add to a more adequate comparison.

Some limitations of the study must be noted. First, this study did not use a structured clinical interview to diagnose (major) depression. Rather, the BDI-II indicates the severity of depressive symptoms. Patients with severe premorbid psychiatric problems (e.g., self-inflicted burns) were excluded, which restricts the range of generalization of the findings. In addition, there was a high drop-out rate 2 years following a burn event, and patients with more depressive symptoms in the hospital and higher scores on neuroticism and rumination were more likely to withdraw from the study. Consequently, the reported prevalence rates of depressive symptoms at the longer-term follow-up may be an underestimation of the depressive symptoms occurring after a burn event. Finally, the cognitive emotion regulation styles that were used as a predictor of depressive symptoms were measured approximately 9 months following a burn event. Although the coefficients of correlation between emotion regulation styles and the repeated assessments of depressive symptoms were of the same magnitude, it is uncertain that results would have been similar when these styles would have been assessed earlier in time.

Some clinical implications can be derived. The present findings suggest that individuals with burns who are at risk for developing depressive symptoms may be identifiable during the sub-acute phase of recovery. In particular, patients showing high levels of neuroticism and rumination as well as low levels of cognitive refocusing appear to be at risk for chronic depressive symptoms. Therefore, routine psychological screening during hospitalization is recommended. Cognitive-behavioral interventions aimed at these cognitive emotion regulation strategies may be useful to prevent the persistence of depressive symptoms. Positive or at least neutral distractions to encourage patients to stop ruminating are recommended (Nolen-Hoeksema et al., 2008). Other strategies could include a focus on targeting positive refocusing and cognitive control in which people

learn to question their own (automatic) negative thoughts and replace them with more helpful thoughts (Baert et al., 2010; Demeyer et al., 2012). However, more research is needed clarifying vulnerability factors and the underlying mechanisms in the maintenance of depressive symptoms following burns. This knowledge may be of use in therapies for this specific patient group. With reference to previous recommendations in the burn literature (Lawrence et al., 2004), interventions that help patients to accept their scars may be of particular importance in this population and may assist in reducing long-term depressive symptoms.

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