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Research paper

Changes in depression domains as predictors of return to work in common mental disorders

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ABSTRACT

Background: Depression highly impairs function and reduces quality of life. Therefore, both symptomatic and functional recovery are important treatment goals. Depression consists of several cognitive, somatic, and affective symptom factors that differently affect function. However, it is unclear whether changes in these domains predict return to work (RTW) after treatment.

Methods: Data were collected during treatment from patients on full or partial sick leave reporting depression symptoms ($N = 300$) at an out-patient clinic. Information on work status was assessed pre- and post-treatment and at 6 months follow-up. Multiple logistic regression was used to investigate if residualized changes in symptom factors predicted full RTW, controlling for gender, education level, and age.

Results: Changes (as symptom improvement) in the cognitive, somatic, and affective factor scores each significantly predicted full RTW post-treatment and at follow-up for patients on full and partial sick leave, even after controlling for gender, education level, and age. The change in the somatic factor explained the largest proportion of variance for full work post-treatment in patients on full sick-leave, while change in the cognitive factor explained most unique variance for patients on graded sick leave.

Limitations: The sample consisted of a majority of women with a relatively high level of education. This study should be replicated in more heterogeneous samples.

Conclusion: Changes in depression symptom domains are significant predictors for RTW work post-treatment. The change in the somatic factor explained the largest proportion of variance in patients on full sick leave and thus may particularly influence RTW after treatment.

1. Introduction

Depression is a common mental disorder that leads to a significant reduction in quality of life and impaired daily functioning for affected individuals (Harvey et al., 2017; Lagerveld et al., 2010; Lerner et al., 2011; Spijker et al., 2004). This disorder often has a recurrent course, resulting in negative long-term welfare consequences (Bockting et al., 2015). Approximately 25% of all women and 17% of all men experience an episode of major depression disorder during their life (Kessler et al., 2010). Thus, depression has a substantial social and economic impact on society, which is estimated at $210.5 billion per year in the USA alone (Greenberg et al., 2021). Workplace costs account for the largest proportion of the growing economic burden of depression (Greenberg et al., 2021). In Europe, the costs related to the effects of depression on the employment rate were estimated to be approximately 176 billion EUR in 2015, representing an equivalent of 1.2% of GDP across EU countries as a whole (OECD & EU, 2018).

The core symptoms of depression include low mood and loss of interest, combined with other symptoms such as feelings of inadequacy and hopelessness, concentration difficulties, fatigue, and sleep problems. These symptoms substantially impair psychosocial functioning (Evans-Lacko and Knapp, 2016; Knight et al., 2021; Nieuwenhuijsen

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et al., 2020). Even sub-clinical levels of depression have a considerable negative effect on work function, and this relationship increases strongly with the severity and number of symptoms (Beck et al., 2011; Cuijpers et al., 2007). As a result, depression has become a leading cause of long-term sickness absence and disability in most developed countries (Beck et al., 2011; Cuijpers et al., 2007). Patients struggling with depression report that retaining a premorbid level of function is one of the most important criterions for recovery, making a return to work (RTW) an important treatment goal for patients on sick leave due to depression (Chevance et al., 2020; McKnight and Kashdan, 2009; Zimmerman et al., 2006). Improved psychosocial functioning and work participation can even strengthen the recovery process and prevent a relapse of depression (Sheehan et al., 2017).

Depression is a highly heterogeneous disorder consisting of different clusters of symptoms (Dunlop et al., 2018). Research indicates that these symptom domains have varied effects on work function and absence (Johnston et al., 2019). Beck et al. (2011) found that sad mood, one of the core symptoms of depression, has a strong effect on both absenteeism and work function. Fried and Nesse (2014) showed that sad mood and concentration difficulties collectively accounted for over 35% of the work impairment in a group of working individuals with depression, which indicates that the degree of impairment is related to the nature and type of depressive symptoms (Fried and Nesse, 2014). A recent study of a group of employees with depression by Johnston et al. (2019) found that somatic symptoms, such as sleep difficulties, appetite, and fatigue were associated with absenteeism during the 28 previous days. In contrast, symptoms of a more cognitive nature, such as self-criticism and anhedonia, were related to reduced work function (Johnston et al., 2019). These results indicate that clusters of depressive symptoms have unique associations with absence from work. However, the study by Johnston retrospectively investigated the associations between work absences and depressive symptoms measured at one specific timepoint, and there is a lack of studies on how changes in depressive domains predict RTW (Ervasti et al., 2017; Johnston et al., 2019). Thus, there is a distinct need for additional knowledge on whether and how changes in clusters of depressive symptoms during therapy affect RTW. Such information may provide a more nuanced understanding of the RTW process for patients on sick leave due to depression (Johnston et al., 2019).

The RTW process for patients with depression is multifactorial and depends on several individual, clinical, work-related, and sociodemographic factors (Arends et al., 2014; Endo et al., 2015; Ervasti et al., 2017; Ervasti et al., 2013; Hori et al., 2019; Sandin et al., 2021). In spite of this complexity, a previous large systematic review and meta-analysis suggested that the characteristics of clinical depression, such as the severity of symptoms and psychiatric comorbidities, are the most consistent predictors of RTW (Ervasti et al., 2017). However, the majority of studies included in the review were cross-sectional and did not investigate the associations between changes in the depression symptoms during treatment and work status. Additionally, all of the studies used summed depression scale scores, which may conceal the differential impact of unique depressive symptoms on RTW. Thus, the effects of changes in the different depression symptoms in relation to the RTW process need to be explored in more detail. This information may have important, practical implications for patients and clinicians when making treatment plans that aim to increase functional recovery (Ervasti et al., 2017).

A large range of valid self-reported scales are used to evaluate depressive symptoms (Dunlop et al., 2018). These scales usually measure the severity of depression as a single entity using a sum-score. However, numerous factor analytic studies suggest it is possible to identify factors with clusters of symptoms that reflect multiple underlying symptom domains (Dunlop et al., 2018). Studies of factor solutions for depression usually identify models with between two and five factors that typically consist of three general domains, namely cognitive, affective, and somatic factors (Huang and Chen, 2015; Høstmælingen et al., 2021; McElroy et al., 2018). Researchers have suggested that use of these three symptom factors in conjunction with the total depression score helps to more precisely assess clinical changes and monitor the effects of interventions (Faro and Pereira, 2020; Huang and Chen, 2015; McElroy et al., 2018). Nevertheless, the roles of these depressive symptom factors in the context of work absence remain relatively unexamined.

To the best of our knowledge, no studies have yet explored how changes in the depression symptom factors during therapy are related to RTW. Therefore, the aim of the current study was to investigate if changes in the cognitive, somatic, and affective depression factor scores between pre- and post-treatment in patients on sick leave predict a full RTW at the end of treatment and at 6-months follow-up, after controlling for gender, education level, and age. This is an initial step towards understanding how changes in different depression domains are related to RTW.

Based on previous studies, we hypothesize that changes in all three symptom factors would predict RTW and that, in particular an improvement in the somatic factors (e.g., symptoms of fatigue, sleep disturbances) would have a unique contribution on the RTW for patients on full sick leave compared to the other depression factors.

2. Methods

2.1. Setting and participants

Data were collected between 2013 and 2016 in a naturalistic observational study during "The Norwegian studies of psychological treatment and work" (NOR-WORK) project conducted at Diakonhjemmet Hospital in Oslo, Norway. The study sample consisted of patients ($N = 300$) on sick leave due to depression and anxiety who received work-focused therapy. To be eligible for inclusion in the study, participants had to have a Beck Depression Inventory (BDI-II) score above the clinical cut-off for depression ($\geq$14) at baseline (Seggar et al., 2002). Patients with severe mental disorders (e.g., bipolar disorder, psychosis, or cluster A and B personality disorders), substance abuse, or a high suicide risk were excluded. In accordance with the intake procedures at the clinic, patients with severe diagnoses were referred to more suitable treatment in other clinics at the hospital. The participants in the study were followed prospectively from intake at pre-treatment until 6 months post-treatment. General practitioners (GP) referred the patients to the clinic and certified their sick leave. The participants in the study were on either full sick leave ($n = 155$) or on partial sick leave ($n = 145$). The patients on full sick leave were on 100% sick leave pre-treatment. In the group on partial sick leave, 22 patients were on between 20 and 39% sick leave; 66 patients, between 40 and 59%; 30 patients, between 60 and 79%; and 16 patients, 80%. Partial sick leave is strongly promoted in Norway and allows workers to attend work for a percentage of time that corresponds to their remaining work capacity (Markussen et al., 2012). The intervention consisted of either metacognitive therapy (MCT) or cognitive therapy (CBT) and work focus. CBT generally focuses on challenging the validity and function of maladaptive negative automatic thoughts, reducing emotional distress, and modifying problematic behaviors (Hofmann et al., 2012). MCT targets psychological processes such as rumination, worry, threat monitoring and maladaptive coping behaviors through modifying meta cognitions (Fisher and Wells, 2009). Occupational interventions were flexibly integrated during therapy, such as workplace assessments and drafting of RTW plans that were communicated to each patient's GP. The treatment interventions in the current study have been described in (Gjengedal et al., 2020). The therapists were regularly supervised; however, adherence to treatment protocols was not monitored as this study was a naturalistic observational study in a regular outpatient clinic. In cooperation with the patients, the therapists developed individual treatment plans based on each patients's' preferences and their primary diagnosis according to disorder-specific manuals, as defined by the Norwegian

national guidelines and the UK National Institute for Health and Clinical Excellence (National Collaborating Centre for Mental, 2010). Medication was prescribed by the patients' GPs in accordance with the national Norwegian clinical guidelines and was not recorded in this study. The therapists assessed the participants' primary diagnoses according to the criteria of the International Classification of Diseases-10 (ICD-10). The primary diagnosis was current or recurrent depressive disorder (53.7%), anxiety disorder (16.7%), mixed anxiety and depression (11.7%), and adjustment disorder (11%). The remaining (6.9%) of participants had another primary diagnosis, such as an eating disorder, hypochondria, or PTSD. Secondary diagnoses were not recorded in this study.

2.2. Ethical approval

This study qualified as health-service research and was therefore exempt from Institutional Review Board (IRB) approval, but was approved by the Norwegian Data Protection Office at the Hospital (ref. nr.: 2015/15606). Patients signed an informed consent form before entering the study and could withdraw their consent without providing any explanation at any time. The study was conducted according to the principles of the Helsinki Declaration.

2.3. Measures

2.3.1. The Beck Depression Inventory-Second edition (BDI-II) is one of the most widely used self-reported measures for estimating the presence and severity of the symptoms of depression (Beck et al., 1996). The scale contains 21 self-evaluated items that are rated on a 4-point Likert scale ranging from 0 to 3. The responses are summed to yield a score that ranges from 0 to 63, with a higher score indicating a greater severity of depression in the last two weeks. The recommended cut-off for minimal depression is 13, scores of 14–19, 20–28, and 29–63 indicate mild, moderate, and severe depression, respectively (Beck et al., 1988). The Cronbach's alpha coefficient of the BDI-II in the present study was 0.83 pre- treatment and 0.94 post-treatment. The independent variables in this study consisted of residualized changes in BDI-II factors comprising cognitive, somatic, and affective symptoms identified in previous comprehensive studies (Beck et al., 2002; McElroy et al., 2018). Table 3 defines the BDI-II symptoms in each factor.

2.3.2. Work status post-treatment was reported by the patients using questionnaires. At the 6-month follow-up, data were derived from the National Social Insurance Register (NAV-registry), which ensured no loss to follow-up. We used a dichotomous classification: patients working 100% at post-treatment and 6-months follow-up were coded as 1 and patients on any percentage of sick-leave were coded as 0.

2.4. Statistical analysis

Data were analyzed using SPSS version 25.0 (IBM Corp., 2017). We evaluated the internal reliability of the continuous measures in the BDI-II by calculating Cronbach's alpha. Effect sizes were calculated using Cohen's *d* for average of variances (Cohen, 1988). As shown in Table 3, BDI-II scores were assigned for three factors (cognitive, affective, somatic) according to the bifactor model presented by Beck et al. (2002), as the validity of this model received support in a recent comprehensive analysis of a similar patient population (Beck et al., 2002; McElroy et al., 2018). To avoid the potential limited variance in the pre- or post-scores, we used the residualized change scores for each symptom factor as independent variables. Residualized change scores are commonly used in the research literature to adjust for the problem that high pre-scores are likely to show more change when assessed a second time (Allison, 1990; Bovin et al., 2017; Roelofs et al., 2009). Residualized change scores reflect the residual variance in the independent variable that is not predicted by the same variable measured at an earlier timepoint. What remains is the residual gain score, i.e., the amount of gain that is not due to the influence of the initial pre-treatment score (Allison, 1990). The relationship between full RTW and residualized BDI-II change scores were examined with logistic regression analysis.

Participants in the study could be on either partial or full sick leave before treatment. Previous research indicated that patients on partial sick leave during treatment may have a higher probability of returning to full-time employment compared to those on full sick leave (Lagerveld and Houtman, 2014; Lagerveld et al., 2012). Therefore, the group of patients on full sick leave and on partial sick leave were examined separately. Independent *t*-tests were conducted to determine if there were any differences in age, pre- and post-treatment scores, and changes in the total BDI-II or cognitive, somatic, and affective factor scores during treatment between the groups on full and partial sick leave. The Chi-square test was used to determine if there were significant differences in gender between groups.

We assessed whether the residualized changes in the symptom factor scores predicted full RTW at post-treatment and 6-months after treatment using four multivariable logistic regression analyses. Firstly, we assessed the predictive ability of the change in each factor independently while controlling for gender, education level, and age. Secondly, the changes in the scores for all three factors were entered in the same step to assess the proportion of unique variance explained by the change in each individual factor when we controlled for gender, education level and age. Multicollinearity was explored using the variance influence factor (VIF). The mean VIF score was 2.17, which indicated no problem with multicollinearity in the statistical models. The number of missing values on the BDI-II questionnaires was low (mean, 2%; range, 1.5 and 3.4% on the items). Little's MCAR test showed non-significant results ($p = .74$), which indicated that the data was missing in a completely random manner (Li, 2013). Since the proportion of missing data was below 5% and the missing data were completely randomly distributed, we replaced the missing values with weighted means.

3. Results

3.1. Demographic variables, work status, and symptoms of depression

Table 1 shows the demographic characteristics of the study cohort ($N = 300$). The mean participant age was 39.3 years, and there were more females (75.3%) than males (24.7%). There were no significant gender differences between the groups on full and on partial sick leave ($p > .05$).

Table 1 shows that both groups reported symptoms of moderate depression at pre-treatment. At post-treatment, the reported symptom levels were below the cut-off for minimal depression. Independent sample *t*-tests showed there was no significant difference in the pre and

Table 1
Demographic characteristics of the study cohort at pre- and post-treatment ($N = 300$).

Variable	*N* (%)	Mean (SD)
Age, years	300	39.4 (10.4)
Gender		
Female	226 (75.3)	
Male	74 (24.7)	
Marital status		
Living with a partner	183(61.0)	
Living alone	117(39.0)	
Education		
Primary school	8 (2.7)	
Senior high school	64 (21.3)	
University/college	218 (72.7)	
BDI-II total score		
Full sick leave		
Pre-treatment	155	27.99 (8.57)
Post-treatment	154	13.72 (11.16)
Partial sick leave		
Pre-treatment	145	26.87 (7.94)
Post-treatment	142	12.18 (9.00)

post BDI-II scores between the patients on full and partial sick leave.

Table 2 shows that, among patients on full sick leave at pre-treatment, 29.0% were fully working post-treatment and 70.3%, at 6-months follow-up. In the group on partial sick-leave at pre-treatment, 56.6% were fully working post-treatment and 80.0%, at 6-months follow-up. Table 4 shows the high effect sizes and significant differences between the pre- and post- scores for all factors.

3.2. Gender, age, and pre- and post-BDI-II scores as predictors for full RTW

The total pre-BDI-II scores did not significantly predict full RTW at post-treatment or at 6-months follow-up in either the group on full sick leave or the group on partial sick leave, when controlling for gender, education level, and age,

However, the BDI-II post-score was significantly associated with full RTW at post-treatment (OR = 0.93, 95% CI: [0.88, 0.97], $p < .001$, OR = 0.92, 95% CI: [0.88, 0.97], $p < .001$) and at 6-months follow-up (OR = 0.95, 95% CI:[0.92, 0.98], $p < .001$, OR = 0.93, 95% CI: [0.89, 0.98], $p < .01$) among both the patients on full sick leave and partial sick leave, respectively, after controlling for gender, education level, and age. Gender, education level, and age were not significantly associated with full RTW in any models.

3.3. Predictive abilities of the changes in the depression symptom factor scores for patients on full sick leave at pre-treatment

Table 5 shows that greater residualized changes (as symptom reduction) in the cognitive, somatic, and affective factor scores significantly predicted full RTW at post-treatment, when controlling for gender, education level, and age. In separate multivariate analyses of each factor, the residualized change in the somatic factor score explained the largest proportion of variance (25%), while the change in the cognitive factor score explained the least (18%). In the model where the residualized changes in the three factor scores, gender, education level, and age were entered in the same step, only the change in the somatic factor score (OR = 0.16, $p < .05$) predicted significant unique variance in full RTW at post-treatment; this model explained 26% of the variance post-treatment.

At 6-months follow-up, the residualized changes in all of the cognitive, somatic, and affective factor scores were significant predictors of full RTW work in separate analyses, when controlling for gender, education level, and age. The change in the somatic factor explained the largest amount of variance (15%), while the change in the cognitive factor explained a smaller amount of variance (12%). In the model where the changes in all three factor scores were entered in the same step, none of the changes explained significant unique variance at 6-months follow-up. Gender, education level, and age did not predict a full RTW in any of the models.

Table 2
Patients' work status at pre- and post-treatment and at 6-months follow-up (N = 300).

Work status pre-treatment	*n*		Full work	Partial sick leave	Full sick leave	Other
			n (%)	*n* (%)	*n* (%)	*n* (%)
Full sick leave	155	Post-treatment	45 (29.0)	55 (35.5)	40 (25.8)	15 (9.7)
		6 months follow-up	109 (70.3)	11 (7.1)	16 (10.3)	19 (12.3)
Partial sick leave	145	Post-treatment	82 (56.6)	36 (24.8)	7 (4.8)	20 (13.8)
		6 months follow-up	116 (80.0)	12 (8.3)	8 (5.5)	9 (6.2)

Note. Other = long term disability or unknown.

Table 3
Specifications of the factors[a] in the Beck Depression Inventory-II used as independent variables in logistic regression analysis.

Cognitive factor	Somatic factor	Affective factor
3 Past failures	10 Crying	1 Sadness
5 Guilty feelings	11 Agitation	2 Pessimism
6 Punishment feelings	15 Loss of energy	4 Loss of pleasure
7 Self-dislike	16 Changes in sleep patterns	9 Suicidal thoughts or wishes
8 Self-criticalness	17 Irritability	12 Loss of interest
13 Indecisiveness	18 Changes in appetite	
14 Worthlessness	19 Concentration difficulty	
	20 Tiredness or fatigue	
	21 Loss of interest in sex	

[a] Factor model 5 from McElroy et al. (2018).

Table 4
Paired sample *t*-tests and effect-sizes comparing mean item scores for the BDI-II cognitive, somatic, and affective factors pre- and post-treatment.

	N	Pre-scores (SD)	N	Post-scores (SD)	*t*-Test	Cohen's *d*
Cognitive factor						
Full sick leave	155	1.33 (0.59)	154	0.65 (0.60)	12.44***	1.14
Partial sick leave	145	1.29 (0.55)	142	0.55 (0.50)	14.67***	1.42
Somatic factor						
Full sick leave	155	1.46 (0.43)	154	0.74 (0.58)	17.16***	1.40
Partial sick leave	145	1.38 (0.40)	142	0.69 (0.48)	15.30***	1.58
Affective factor						
Full sick leave	155	1.10 (0.44)	154	0.50 (0.51)	14.61***	1.26
Partial sick leave	145	1.09 (0.46)	142	0.44 (0.44)	14.84***	1.44

Paired-sample *t*-tests and effect-sizes (Cohen's *d*) were used to compare mean item scores on the factors scores pre- and post-treatment.
*** $p < .001$.

3.4. Predictive abilities of the changes in the depression symptom factor scores for patients on partial sick leave

As shown in Table 6, in the group of patients on partial sick leave at pre-treatment, greater residualized changes (as symptom reduction) in the cognitive, somatic, and affective factor scores were all associated with full RTW at post-treatment.

In multivariate analyses where the residualized changes in these factors were analyzed separately when controlling for gender, education level, and age, the change in the cognitive factor score explained the most variance (20%), while the change in the affective factor score explained the least variance (9%). In the model where the residualized change in all three factor scores were entered in the same step, only the change in the cognitive factor predicted full RTW; this model explained 22% of the unique variance at post-treatment.

At 6-months follow-up, the residualized changes in all of the cognitive, somatic, and affective factor scores were significant predictors of full RTW in separate analyses, when controlling for gender, education level, and age. The change in the cognitive factor explained the largest amount of unique variance (13%), while the change in the somatic factor explained a smaller amount of variance (8%). In the model where the residualized changes in all three factor scores were entered in the same step, none of the changes explained unique variance at follow-up. Gender, education level, and age did not predict full RTW in any of the

Table 5
Four separate multiple logistic regression analyses of prediction of full RTW based on residualized change scores in the cognitive, somatic, and affective BDI-II factors for patients on full sick leave ($n = 154$).

	Post - treatment				6-months follow-up			
	N	R^2	OR	95% Cl	N	R^2	OR	95% Cl
	154	0.18			154	0.12		
Change cognitive factor			0.26***	[0.11–0.60]			0.39**	[0.20–0.74]
Gender			0.58	[0.24–1.41]			0.69	[0.31–1.55]
Education level			2.02	[0.81–5.02]			1.68	[0.77–3.68]
Age			0.98	[0.95–1.01]			0.98	[0.95–1.01]
	154	0.25			154	0.15		
Change somatic factor			0.13***	[0.05–0.34]			0.26***	[0.12–0.58]
Gender			0.51	[0.21–1.27]			0.63	[0.28–1.43]
Education level			1.66	[0.65–4.26]			1.43	[0.64–3.21]
Age			0.98	[0.95–1.2]			0.98	[0.95–1.01]
	154	0.20			154	0.13		
Change affective factor			0.14***	[0.04–0.43]			0.28**	[0.13–0.64]
Gender			0.58	[0.24–1.43]			0.74	[0.33–1.65]
Education level			1.78	[0.70–4.48]			1.56	[0.71–3.46]
Age			0.98	[0.95–1.02]			0.98	[0.95–1.02]
	154	0.25			154	0.16		
Change cognitive factor			1.22	[0.34–4.43]			0.93	[0.31–2.81]
Change somatic factor			0.16*	[0.04–0.76]			0.37	[0.10–1.45]
Change affective factor			0.49	[0.10–2.42]			0.70	[0.17–2.88]
Gender			0.52	[0.21–1.29]			0.65	[0.28–1.48]
Education level			1.61	[0.62–4.16]			1.43	[0.64–3.22]
Age			0.98	[0.95–1.02]			0.98	[0.95–1.02]

Residualized change scores on the factor are defined as reduction in the symptoms from pre-to post-treatment. Full return to work was the dependent variable. Gender: 0 = female, 1 = male.
* $p \leq .05$.
** $p \leq .01$.
*** $p < .001$.

models.

4. Discussion

This study investigated if residualized changes in cognitive, somatic, and affective depression factors are associated with full RTW post-treatment and at 6-months follow-up in patients on full and partial sick leave at pre-treatment. In line with our hypothesis, we found that reductions in the symptoms in all three factors predicted RTW post-treatment after controlling for gender, education level, and age in patients on either full or partial sick leave. Of the three depression factors, the residualized change in the somatic factor explained the largest proportion of unique variance in RTW post-treatment in patients on full sick leave (25%), while the cognitive factor explained the largest proportion of unique variance (20%) for patients working on partial sick leave.

The predictive value of changes in the depression symptom factors for RTW is relatively unexamined. Our results indicate that for patients on full sick leave before treatment, a reduction in the somatic domain at post-treatment—such as sleep problems fatigue, tiredness, and concentration difficulties—accounts for unique variance in the RTW that is not explained by the two other symptom factors. Therefore, an improvement in the somatic depression factor score seems to be particularly important for RTW at post-treatment in workers on full sick leave with depressive symptoms. These results are consistent with previous cross-sectional studies that reported associations between depressive symptoms of a somatic nature (e.g., sleep disorders and fatigue) and reduced work functioning (Fried and Nesse, 2014). Although patients out of work due to sick leave receive potentially effective treatment, the likelihood of RTW after treatment is lower for individuals who experience a smaller improvement in somatic depressive symptoms. In line with these findings, the patients in one study reported that a lack of energy, tension, and concentration difficulties most significantly interfered with their occupational functioning, which underlines the importance of addressing these symptoms during treatment (Lam et al., 2012).

For the patients working with partial sick leave, improvement in the cognitive factor explained most unique variance. Similarly, in a recent cross-sectional study, Johnston et al. (2019) found that somatic symptoms particularly influenced work absence in a large group of employees with depression, while symptoms of a cognitive nature contributed most to reduced work function for those who were working (Johnston et al., 2019). The findings of the current study extend the previous cross-sectional studies by Fried and Nesse (2014) and Johnston et al. (2019), as this prospective study included a therapeutic intervention.

A potential clinical implication of our findings may be that therapists should especially pay attention to the changes in somatic depressive symptoms in conjunction with the total depression score for patients on full sick leave. For patients working partially on graded sick leave, a decrease in cognitive symptoms seems to be particularly important for an increase to full work.

In the longitudinal analysis at 6 months after treatment, the residualized changes in the somatic factor (15%) separately explained most of the unique variance in the group of patients on full sick leave at pre-treatment, while the cognitive factor (13%) explained most of the variance in patients working partially on graded sick leave. In the model where the changes in all three factor scores were entered in the same step, none of the changes explained unique variance longitudinally. There may be several explanations for this observation. For example, over time, the changes in all domains predict the same variance in RTW. Another likely reason is that a large proportion of the patients had returned fully to work 6 months after treatment (75%), which limited the variance in the dichotomous outcome variable. These results indicate that the changes in somatic, cognitive, and affective symptoms play central roles in the RTW from a longitudinal perspective. Thus,

Table 6
Four separate multiple logistic regression analyses of prediction of full RTW based on the residualized change scores in the cognitive, somatic, and affective BDI-II factors for patients on partial sick leave ($n = 142$).

	Post - treatment				6-months follow-up			
	N	R^2	OR	95% Cl	N	R^2	OR	95% Cl
	142	0.20			142	0.13		
Change cognitive factor			0.17***	[0.07–0.40]			0.23**	[0.09–0.59]
Gender			0.89	[0.37–2.11]			1.04	[0.38–2.90]
Education			0.58	[0.25–1.35]			1.62	[0.64–4.13]
Age			0.97	[0.94–1.01]			0.98	[0.93–1.02]
	142	0.16			142	0.08		
Change somatic factor			0.21***	[0.09–0.49]			0.38*	[0.16–0.90]
Gender			0.96	[0.40–2.30]			1.16	[0.42–3.21]
Education			0.59	[0.25–1.35]			1.64	[0.65–4.09]
Age			0.98	[0.95–1.02]			0.99	[0.94–1.03]
	142	0.09			142	0.10		
Change affective factor			0.31***	[0.13–0.75]			0.27**	[0.10–0.72]
Gender			0.95	[0.41–2.21]			1.20	[0.43–3.33]
Education			0.61	[0.27–1.37]			1.61	[0.64–4.03]
Age			0.98	[0.95–1.02]			0.99	[0.94–1.03]
	142	0.22			142	0.14		
Gender			0.91	[0.38–2.20]			1.09	[0.39–3.08]
Education			0.57	[0.24–1.35]			1.59	[0.62–4.08]
Age			0.97	[0.93–1.01]			0.98	[0.93–1.03]
Change cognitive factor			0.21*	[0.06–0.71]			0.28	[0.08–1.08]
Change somatic factor			0.36	[0.11–1.19]			1.19	[0.31–4.52]
Change affective factor			1.95	[0.52–7.35]			0.60	[0.14–2.59]

Residualized change scores on the factor are defined as reduction in the symptoms from pre-to post-treatment. Full return to work was the dependent variable Gender: 0 = female, 1 = male.
* $p \leq .05$.
** $p \leq .01$.
*** $p < .001$.

therapists should be aware of the changes in all of these symptom domains, as well as the severity of the total depression score.

Høstmælingen et al. (2021) also found that the somatic and cognitive factors of the BDI-II constituted separate, salient dimensions of a bifactor model of chronic depression, when the symptoms were measured at one time-point (Høstmælingen et al., 2021). Our current study expands on those findings, and indicates the intervention used in this study contributes to changes in similar symptom domains. Furthermore, a reduction in the somatic domain—which consists of fatigue and sleep problems, and the cognitive symptoms related to e.g., self-criticalness—may be especially important to RTW. These results are important, since there is a lack of evidence on the associations between improvement in specific depression symptoms during psychological treatment and work-related outcomes (Ervasti et al., 2017; Lagerveld et al., 2010; Nieuwenhuijsen et al., 2020). The current study begins to explore the relationship between improvement in domains of depression symptoms and functional recovery. Consistent with previous research, our results suggest that this may be a promising area for future research (Dewa et al., 2019).

The treatment in this study yielded large, equivalent changes in all three underlying domains and in the total depression score. Overall, the study cohort suffered moderate levels of depression symptoms at pre-treatment and reported minimal levels of depression at post-treatment, indicating that the therapy effectively reduced the symptoms of depression. The participants in this study were exposed to two manualized psychotherapy techniques (CBT/MCT) in parallel with a work focus. Future studies could explore the relationships between the depression symptom domains and RTW for individuals receiving other psychotherapeutic interventions or e.g., antidepressant medication (Dunlop et al., 2018; Knight et al., 2018; Knight et al., 2021; Wang and Boros, 2021; Zhou et al., 2020).

Gender, education level, and age were not associated with full RTW in this study. A recent meta-analysis reported inconsistent results across studies regarding the association between gender and RTW after depression. Some studies found no association between gender and RTW, while others reported that being either male or female were risk factors for a slower RTW (Ervasti et al., 2017). Older age has been found to be a robust predictor for a slower RTW (Ervasti et al., 2017).

Previous studies have reported conflicting results with respect to education levels (Ervasti et al., 2013). Studies indicate that a lower education level is associated with an increased risk of work disability (Ervasti et al., 2013) and that high socioeconomic status, as measured using education level, predict longer duration until RTW (Nieuwenhuijsen et al., 2006). A potential explanation for the results of the current study may be that the large changes in the symptom scores contributed more to the patients' ability to RTW than gender, education level, and age.

This study focused on the changes in depressive symptom domains, gender, education level, age and RTW. Several other factors such as somatic health conditions and the characteristics of the participants' work situations may also be of relevance to RTW (Arends et al., 2014; Endo et al., 2015; Ervasti et al., 2017; Ervasti et al., 2013). An important limitation of the current study is that there is no unified agreement about the factor structure of the BDI-II, thus the structure may differ depending on the cohort studied (Huang and Chen, 2015). Therefore, we used a model that was validated in a recent comprehensive study of a similar cohort to assign the BDI-II symptoms to factors comprising cognitive, somatic, and affective symptoms (McElroy et al., 2018). Nevertheless, the diversity in the factor solutions within the BDI-II is well-documented, which suggests the factor structure may be somewhat unclear (Dunlop et al., 2018; Huang and Chen, 2015).

The levels of depressive symptoms can be measured using several different validated scales (Fried, 2017; Fried and Nesse, 2015b). These scales include various symptoms, and may thus yield somewhat different

factor solutions and also differently illustrate how the changes in symptoms may be related to RTW. Furthermore, we examined work function using a one-point dichotomous variable, which limited variance. Alternatively, more fine-grained and continuous measures of work participation could be used.

The current study is an important first step towards exploring the associations between improvements in groups of depression symptoms and RTW. Future studies could investigate the possible associations and interactions between changes in the separate symptoms (Fried and Nesse, 2015a; Johnston et al., 2019). Furthermore, the impact of different individual symptoms of depression on work status could be studied using network analysis (Borsboom, 2017). Recent research found that the various depressive symptoms are interconnected via complex networks, and a change in one domain may causally affect other domains (Borsboom and Cramer, 2013; Boschloo et al., 2019). A potential connection is that a reduction in the levels of work-related cognitive rumination and worry among the participants in the current study may contribute to a reduction in fatigue and concentration difficulties.

Finally, our sample from an outpatient clinic consisted of a majority of women with relatively high levels of education, which may limit the generalizability of these findings. In the current study, all patients had depressive symptoms above what is considered the clinical level, but a proportion of patients had anxiety disorders as primary diagnoses. This may have influenced the findings, but also represents the typical heterogeneity of patients treated at outpatient clinics for sick-listed patients. Further, this study had a naturalistic design, a large sample size, and a pragmatic longitudinal outcome measure, which provides high ecological validity.

In summary, this study suggests that the residualized changes in cognitive, somatic, and affective depression factors during therapy predict full RTW at the end of treatment, regardless of gender, age, and education level. For patients on full sick leave, the improvement in the somatic symptom factor explained unique variance that is not accounted for by the cognitive and affective factors. This indicates therapists should pay particular attention to a lack of improvement in somatic symptoms, as these have unique importance to RTW. For patients working partially on graded sick leave, the results suggest that improvement in the cognitive symptom domains may be uniquely associated with increased work participation. Overall, these results represent preliminary findings that may improve our understanding of what constitutes effective change to help patients RTW and recover after functionally disabling depression.

CRediT authorship contribution statement

RGHG led the writing of the article, was responsible for the study design and analyses.

KO managed the datafiles, contributed to analyses and writing. KS contributed to study design and writing. SER contributed to design and writing. MTB was responsible for data collection and contributed to writing. HDL contributed to project development and writing.

SL developed the intervention, the study design and contributed to writing. OH contributed to design, analyses and writing. All authors read and approved the final manuscript.

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Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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