

**The relationship of dispositional compassion for others with depressive symptoms
over a 15-year prospective follow-up**

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Abstract

Background: The aim of this study was to investigate (i) the direction of the relationships between dispositional compassion for others and depressive symptoms over a 15-year follow-up in adulthood and (ii) the longitudinal associations of dispositional compassion with total depressive symptoms and various depressive subsymptoms (i.e. negative attitude, performance difficulties, and somatic complaints) from early adulthood to middle age. **Methods:** The participants ($N=1676$) came from the prospective Young Finns Study. Dispositional compassion was assessed with the Temperament and Character Inventory and depressive symptoms with a modified version of the Beck Depression Inventory. The measurements were conducted between 1997–2012 including three measurement points. The data was analyzed using structural equation models and multilevel models for longitudinal design. **Results:** The predictive relationships were more likely to proceed from high dispositional compassion for others to lower depressive symptoms than in the opposite direction. Additionally, high dispositional compassion predicted a lower total score of depressive symptoms and also lower scores of various depressive subsymptoms (negative attitude, performance difficulties, somatic complaints) in early adulthood. These associations, however, weakened over years and became non-significant in middle age. All the findings were sustained after controlling for age, gender, and socioeconomic factors in childhood and adulthood. **Limitations:** Depressive symptoms were mostly mild and non-clinical in our sample. The findings cannot be directly generalized to severe depressive symptomatology. **Conclusions:** When tailoring psychiatric interventions, it is necessary to be aware that compassion for others may lower the risk for the onset and maintenance of depressive symptoms, especially in early adulthood.

1 Introduction

It has been estimated that minor or subclinical depression occur in as many as 12–17% of the population (Fils et al., 2010; Goldney et al., 2004). Those individuals have a substantially increased risk for developing a major depressive disorder later in their life (Cuijpers et al., 2004). Hence, there has been a growing interest for developing early preventive treatments for minor depression. Previously, a meta-analysis concluded that anti-depressive medications seem not to alleviate minor depression effectively (e.g. Barbui et al., 2011).

Regarding psychosocial factors, it is known that there exist a variety of risk factors increasing the vulnerability to depression, such as anxiety, substance abuse, insecure attachment, early adversities (e.g. Bifulco et al., 2002; Harald-Gordon et al., 2012). Recently, however, there has been a growing interest for protective factors that might prevent the course from mild to severe depression. In this context, there is promising evidence for positive psychology interventions as initial treatments for mild depression (e.g. van Zoonen et al., 2014). In particular, compassion and taking care of others are suggested to effectively reduce shame and self-criticism (Gilbert, 2014, 2019). Further, intervention studies have shown that practicing compassion predicts reductions in depressive symptoms (Braehler et al., 2013; Gilbert & Procter, 2006; Judge et al., 2012; Leaviss & Uttley, 2015; Lucre & Corten, 2013). Still, research on long-term associations between dispositional compassion and depression are missing. Hence, more precise knowledge of the link of compassion with depressive symptoms might provide new tools for tailoring early interventions for mild depression in order to prevent the onset of a major depressive disorder.

Compassion is defined as a disposition to feel concern for other's suffering that is followed by the desire to alleviate the suffering and improve other's well-being (Goetz et al., 2010).

Compassion includes two necessary components: an affective component (recognizing other's emotional distress and tolerating it) and a motivational component (motivation to take the appropriate actions to relieve other's negative affective state) (Gilbert, 2017; Gilbert & Mascaro, 2017).

Compassion can be manifested both as temporary compassionate feelings for others that may appear and disappear in accord with situational factors (i.e. compassionate states) or as a more stable trait that endures over time (i.e. dispositional compassion) (Goetz et al., 2010).

Previous research has demonstrated that high dispositional compassion for others is related to lower depressive symptoms (e.g. Balsamo et al., 2013; Richter et al., 2000). However, the current evidence is mostly based on cross-sectional studies. To our knowledge, the longest follow-up in studies investigating the link of compassion to depressive symptoms has been only 12 months (Corruble et al., 2002). Hence, it has remained unclear whether dispositional compassion is associated with depression steadily over age in adulthood or whether age-related changes in this association might occur. Consequently, there has been a strong demand for studies with long-term follow-ups that investigate the relationship of compassion-related concepts and depressive symptoms (e.g. Burnette et al. 2009; Cusi et al., 2011; Schreiter et al., 2013).

Because of the lack of studies with long-term follow-ups and several measurement points, the direction of the relationship between compassion and depressive symptoms have remained largely unclear (Celikel et al., 2010; Cusi et al., 2011; Farmer et al., 2003; Schreiter et al., 2013; Tully et al., 2016). It has been previously suggested that depressive states may cause temporary changes in personality traits (Hirschfeld, 1999; Hur & Kim, 2009). For example, certain compassion-related traits are found to decrease along with the progression of a depressive disorder (e.g. Cusi et al., 2011). These changes in personality traits are suggested to have an adaptive and compensatory role during depressive episodes (Hansenne et al., 1999): for example, lowered compassion for others might enhance care-taking of oneself during an acute depressive state. Additionally, it has been found that depressed

individuals commonly have transient deficits in social cognition and executive functions, such as cognitive flexibility or directing attention, that in turn are related to difficulties in taking others' perspectives (e.g. Eslinger, 1998; McKinnon and Moscovitch, 2007; Schreier et al., 2013).

On the other hand, the relationship may proceed in the opposite direction, i.e. low dispositional compassion might predispose to the development of depressive symptoms. Social intolerance, revengefulness, and difficulties in perspective taking (i.e. indicators of low compassion) may lead to negatively biased interpretations of social situations and eventually result in lowered mood (Balsamo et al., 2013; Cusi et al., 2011; Hur & Kim, 2009). Furthermore, in accordance with the social mentality theory, such psychobiological systems that facilitate one's willingness to caregiving of others provide the basis for one's self-representation (Liotti & Gilbert, 2011).

There exist also a range of psychophysiological mechanisms that may mediate the path from compassion to depression. Compassion-practicing and loving-kindness interventions are related to better coping with stress, for example, lower cortisol levels and weaker inflammatory reactions (e.g. some cytokines) when facing psychosocial stressors (Abelson et al., 2014; Pace et al., 2009). Lower level of inflammation, in turn, is found to decrease the risk for sickness behaviors such as changes in appetite or sleep (Dantzer, 2001) and depression (Dantzer et al., 2008; van den Biggelaar et al., 2007). Additionally, compassionate states are related to more favorable heart rate variability, such as higher respiratory sinus arrhythmia, and lower heart rate (Stellar et al., 2016) that are linked to lower depression (Berntson & Cacioppo, 2004).

Moreover, there is accumulating evidence about the relationship between compassion and neurophysiological processes in the brain (see Seppälä et al., 2017). That is, practicing compassion is related to functional changes in such neural circuitries that contribute to attuning to others' affective states (e.g. amygdala, inferior parietal cortex, nucleus accumbens) (Valk et al., 2017; Weng et al., 2013, 2018). These brain networks, in turn, are shown to be related to depression (e.g. Fitzgerald et al., 2008).

Finally, compassionate states and caring behavior correlate with oxytocin-related genes (Gilbert, 2019; Kogan et al., 2010) and also with the activity of hypothalamus (Immordino-Yang et al., 2009) that plays a role in oxytocin hormone production. Oxytocin production, in turn, is firmly linked to depression (McQuaid et al., 2014). Taken together, this evidence implies that individuals with low dispositional compassion may be more susceptible for experiencing stress, having less favorable health behavior and cardiovascular health, and having less adaptive functioning in depression-related brain networks that all increase their risk for depressive symptoms.

The first aim of the present study was to investigate the direction of the relationships between depressive symptoms and dispositional compassion for others in adulthood, i.e. whether depressive symptoms are more likely to lower the level of dispositional compassion for others or whether high dispositional compassion might protect against the development of depressive symptoms. The second aim was to investigate the longitudinal associations of dispositional compassion for others with total depressive symptoms from early adulthood to middle age. There is accumulating evidence that individuals with depressive disorders include a highly heterogeneous population (Rantala et al., 2017). Thus, it has been emphasized that various depressive symptoms should be investigated separately (Fried & Nesse, 2005). Hence, the current study investigates the relationship of dispositional compassion with various depressive subsymptoms (i.e. negative attitude, performance difficulties, and somatic complaints). We used data from the Young Finns Study that included a 15-year prospective follow-up and several measurement points.

2 Methods

2.1 Participants

The participants were members of the prospective Young Finns Study. The participants were selected

randomly from six birth cohorts (born in 1962, 1965, 1968, 1971, 1974, and 1977) from the population register of the Social Insurance Institution. The original sample included 3596 participants at the baseline measurement in 1980. Since then, eight follow-up measurements have been conducted between 1983 and 2012 (when participants were aged 35–50 years). For the present study, dispositional compassion and depressive symptoms were assessed in 1997, 2001, and 2012; parental socioeconomic factors in 1980; and participants' socioeconomic factors in 2011. We included in the analyses all the participants with data on dispositional compassion, depressive symptoms, and socioeconomic factors in childhood and adulthood in at least one of the measurement times (e.g. data on compassion in 1997, 2001, or 2012). The final data included 1,676 participants.

The Young Finns Study was carried out in accordance with the Declaration of Helsinki. Additionally, all the Finnish universities with medical schools approved the study design. Before participation, all the participants or their parents (for participants aged below 12 years) provided written informed consent after the nature of the procedures had been fully explained. The design and methods of the Young Finns Study is described more precisely elsewhere (Raitakari et al., 2008).

2.2 Measures

Dispositional compassion was evaluated with the version 9 of the Temperament and Character Inventory (TCI, Cloninger, Przybeck, Svrakic, & Wetzel, 1994). In the TCI, dispositional compassion is a subscale of the character dimension Cooperativeness. The scale of dispositional compassion ($\alpha=.86-.87$ in 1997, 2001, and 2012) consists of 10 self-rating statements (e.g. “It gives me pleasure to help others, even if they have treated me badly”). The statements are rated using a 5-point Likert-scale ranging from 1 (completely disagree) to 5 (completely agree). For each measurement time, the total score of dispositional compassion was calculated for all the participants who had data on at least 50%

of the items of the scale. The total scores of dispositional compassion were standardized with the year 1997 (i.e. the first measurement year) mean and standard deviation.

The convergent and discriminant validity of the dispositional compassion scale have been confirmed previously. Specifically, high values of the compassion scale are found to correlate with higher social warmth, altruistic behavior, sociability, and positive emotionality (García et al., 2012; Schmidt et al., 2003). Instead, low values of the compassion scale are related to higher hostility and aggression (García et al., 2012; Lee et al., 2012) and also higher narcissistic (De Fruyt et al., 2006) and psychopathic features (Paal & Bereczkei, 2007). Additionally, the test-retest reliability of the scale is found to be high (e.g. Hansenne et al., 2005). In our sample, the test-retest correlations between the measurement years were as follows: between 1997–2001 $r=.67$; between 2001–2012 $r=.69$; between 1997–2012 $r=.59$.

Depressive symptoms were assessed with a modified version of the Beck Depression Inventory. The modified BDI (mBDI) includes the second mildest statements of the BDI (i.e. the statements that represented the second mildest depressive symptoms in the items of the BDI). The statements are answered with a 5-point Likert-scale ranging from 1 (totally disagree) to 5 (totally agree) ($\alpha=.91-.93$ in 1997, 2001, and 2012). The mBDI includes 3 factors: negative attitude ($\alpha=.78-.84$ in 1997, 2001, and 2012), performance difficulties ($\alpha=.85-.88$), and somatic complaints ($\alpha=.69-.74$). The mBDI is described more precisely elsewhere (Elovainio et al., 2005). Compared to the original BDI-II, the mBDI is found to capture mild and subclinical depressive symptoms more sensitively (e.g. Katainen et al., 1999; Nurmi et al., 1995; Rosenström et al., 2012). For each measurement time, we calculated a total score of depressive symptoms and various depressive subsymptoms (i.e. negative attitude, performance difficulties, and somatic complaints) for all the participants who had data available on at least 50% of the items. The scores of depressive symptoms were standardized with the

year 1997 (i.e. the first measurement year) mean and standard deviation.

Participants' and their parents' socioeconomic factors included education level and annual income. As has been done also previously (Pulkki-Råback et al., 2015), parental educational level was classified into 3 categories (1=comprehensive school, i.e. the first 9 years of school; 2=high school or occupational school; 3=academic, i.e. university or college). Parental annual income included 8 categories (1=less than 15 000 Finnish mark; 8=more than 100 000 Finnish mark). Participants' educational level was assessed using the number of educational years (ranging from 8 to 34). Participants' annual income was assessed with a 13-point scale (1=less than 5 000€ per year; 13=more than 60 000€ per year). We added the socioeconomic factors to the analyses as separate variables. Participants' and their parents' level of income and the number of participants' educational years were standardized (mean=0, standard deviation=1).

2.3 Statistical analyses

We conducted statistical analyses using the version 13.0 of Stata SE. We investigated attrition by comparing the study variables between the included ($N=1676$) and excluded ($N=1920$) participants. The direction of the relationships between dispositional compassion and depressive symptoms were examined using structural equation models with cross-lagged panel design (MLMV estimation). We conducted altogether 4 models: (1) an autoregressive model including only stability coefficients (the variables at each time point were predicted by the same variables at the previous time point) and covariances between dispositional compassion and depressive symptoms at each timepoint; (2) a model that included also the cross-lagged predictive coefficients from dispositional compassion at each time point to depressive symptoms at the next timepoint; (3) a model that included the cross-lagged predictive coefficients in the opposite direction (i.e. from depressive symptoms at each time point to

dispositional compassion at the next timepoint); and (4) a model with the cross-lagged predictive coefficients in both directions between dispositional compassion and depressive symptoms. In the models, we included the scores of various depressive subsymptoms (negative attitude, performance difficulties, somatic complaints) because it has been suggested that various depressive symptoms should be investigated separately (Fried & Nesse, 2005).

We assessed the statistical fit of the models 1–4 by examining the values of the Comparative Fit Index (CFI), the Root-Mean-Square Error of Approximation (RMSEA), and the Bayesian Information Criterion (BIC). Previously, it has been found that adequate values of the CFI range over 0.95, and the value of RMSEA should be below 0.06 (Hu & Bentler, 1999). Moreover, lower scores of the χ^2 test of absolute model fit and the BIC refer to better model-fit (Schreiber et al., 2006).

The longitudinal associations of dispositional compassion with depressive symptoms (measured with the mBDI) were investigated using multilevel models for repeated measurements with maximum likelihood estimation. The multilevel models derive estimates for fixed effects (classic regression coefficients) and random effects (between-individual variation in intercept and slopes). We estimated separate growth curve trajectories for the total score of depressive symptoms and for the scores of various depressive subsymptoms (i.e. negative attitude, performance difficulties, and somatic complaints). Intercept, age, age-squared, dispositional compassion and its age-interactions, gender, and socioeconomic factors in childhood and adulthood were set as fixed effects. Intercept and age were treated also as random effects. Age referred to participant's age in years at each measurement time and ranged from 20 (the age of the youngest study cohort in 1997) to 50 (the age of the oldest study cohort in 2012). In order to reduce potential multicollinearity in the multilevel models, age was centered at age 20.

3 Results

The means, standard deviations, and frequencies of the study variables are shown in Table 1. Attrition analyses revealed that included participants were slightly older (35.69 vs. 35.23, $p < .01$) than excluded participants. Women were more likely to participate than men (51.5% vs. 41.6%, $p < .001$).

Additionally, included participants had slightly higher dispositional compassion (3.69 vs. 3.58, $p < .001$) and a lower score of total depressive symptoms (2.06 vs. 2.16, $p < .001$), depression-related negative attitude (2.08 vs. 2.22, $p < .001$) and performance difficulties (1.99 vs. 2.10, $p < .001$) than excluded participants. There was no attrition bias in depression-related somatic complaints. Regarding socioeconomic factors, included participants had a higher number of educational years (15.53 vs. 14.33, $p < .001$) and their parents had a higher level of income (4.91 vs. 4.68, $p < .001$) and had less likely a low educational level (32.3% vs. 36.8%, $p < .01$), when compared to excluded participants and their parents. There was no attrition bias in the level of income between included and excluded participants.

[Table 1 about here]

Table 2 shows the results of the structural equation models investigating the temporal relationships between dispositional compassion and depressive symptoms. Model 1 (autoregressive model without cross-lagged predictive paths) had acceptable model fit (RMSEA=0.056, CFI=0.959, BIC=64308.345). Nevertheless, model 2 (cross-lagged predictive coefficients from dispositional compassion to depressive symptoms) had significantly better model-fit than model 1 [$\chi^2(\text{model 2 vs. 1})=45.908$, $p < .001$]. This indicated that there were predictive relationships between dispositional compassion and depressive symptoms, besides the associations of each trait with itself across time in an autoregressive model. Furthermore, model 2 had better model-fit than model 3 (cross-lagged predictive coefficients

from depressive symptoms to dispositional compassion), when comparing the values of RMSEA (0.056 in model 2 vs. 0.058 in model 3), CFI (0.963 vs. 0.959), and BIC (64306.981 vs. 64346.727). Hence, the predictive relationships from dispositional compassion to depressive symptoms appeared to be stronger than in the opposite direction. Finally, adding cross-lagged predictive coefficients in both directions between dispositional compassion and depressive symptoms (in model 4) did not improve the model-fit significantly [$\chi^2(\text{model 4 vs. 2})=6.536, p=0.366$]. Taken together, model 2 had better model-fit than models 1, 3, and 4. Hence, the predictive pathways were more likely to proceed from dispositional compassion to depressive symptoms than vice versa. The model 2 is illustrated in Figure 1.

[Table 2 about here]

[Figure 1 about here]

Table 3 presents the results of the multilevel models related to the longitudinal associations of dispositional compassion with depressive symptoms. When predicting the total score of depressive symptoms, it was found that high dispositional compassion was associated with lower depressive symptoms in adulthood. However, as indicated by the negative age-interaction effect, this association was slightly weakened over age and became non-significant in middle age. When predicting various depressive subsymptoms, it was found that high dispositional compassion predicted lower depression-related negative attitude, performance difficulties, and somatic complaints. The associations of dispositional compassion with depression-related performance difficulties and somatic complaints became weaker over age, as indicated by the negative age-interaction effects. Taken together, the

association of high dispositional compassion with total score of depressive symptoms and various depressive subsymptoms appeared to be stronger in early adulthood and become slightly weaker over age. The results of the multilevel models are illustrated in Figures 2a–d.

As additional analyses, we investigated whether there might exist a threshold effect: whether average level of compassion might reach a critical level in middle age, so that increases in the level of compassion might not have any additional protective effect against depression. Hence, we standardized the values of dispositional compassion in 1997, 2001, and 2012 with the year 1997 mean and standard deviation. That is, the scale of compassion was changed to the scale of the first measurement year. All the significant associations remained the same. The associations of dispositional compassion with depressive symptoms still weakened over age and became non-significant in middle age.

[Table 3 about here]

[Figure 2 about here]

4 Discussion

To our knowledge, this was the first study to investigate the relationship of dispositional compassion for others with depressive symptoms over a long-term prospective follow-up with several measurement points. The findings showed that the direction of the relationship was more likely to proceed from dispositional compassion to depressive symptoms than in the opposite direction. That is, high dispositional compassion for others appeared to have a protective effect against the development of

depressive symptoms, but depressive symptoms seemed not to decrease the level of dispositional compassion for others at similar extent. Additionally, we found that high dispositional compassion was related to lower total depressive symptoms and also with lower scores of various depressive subsymptoms (i.e. depression-related negative attitude, performance difficulties, and somatic complaints) in early adulthood. However, the associations of dispositional compassion with depressive symptoms slightly weakened over age in adulthood and became non-significant in middle age. All these findings were sustained after taking into account age, gender, and socioeconomic factors in childhood and adulthood.

Previously, it has been suggested that while depressed individuals commonly feel shame or inferiority to others due to failures in e.g. occupational achievements, depression may not result in feelings of inferiority in the context of care-taking behavior or feeling concern for other's suffering (McEwan, Gilbert, & Duarte, 2012). In line with this, our findings suggested that depressive symptoms may not predict lowered levels of compassion. Instead, our findings suggested that high dispositional compassion for others appeared to have a protective effect against the development of depressive symptoms.

Our findings showed that high compassion for others was associated with lower depression-related negative attitude (i.e. sadness) and also performance difficulties (i.e. social isolation, difficulties in concentration and decision-making, lowered level of functioning). It may be that abilities for social perspective taking and tolerance toward others prevent negatively biased interpretations of interpersonal situations and lower the risk for depressive mood (Balsamo et al., 2013; Cusi et al., 2011; Hur & Kim, 2009). Additionally, as compassion includes a motivational component to alleviate others' suffering (Gilbert, 2017), high compassion is strongly linked to higher prosocial behavior and kindness toward others (e.g. Goetz et al., 2010). Practicing prosocial behavior, in turn, is related to higher social connectedness (e.g. Hutcherson et al., 2008) that buffers against depression (Rantala et al., 2018). Over

the evolution, separation from the social network has been a substantial threat for the life (Rantala et al., 2018). Moreover, it is known that depression-related deficits in concentration or decision-making partly derive from depression-related negative rumination and challenges to detach from an egocentric viewpoint (e.g. Gotlib & Joormann, 2010). High dispositional compassion for others is by definition contrary to egocentric thinking and, thus, may reduce the risk of some depression-related cognitive deficits.

Interestingly, the findings also revealed that high dispositional compassion for others was also related to lower depression-related somatic complaints (e.g. disturbances in sleep or appetite, increased fatigue, physical pains). Previously, it has been suggested that high compassion for others may be related to higher awareness of emotional states and bodily sensations and, in that way, protect against somatization symptoms (Clarke, 2016; Cloninger & Docuku, 2016). Additionally, compassion for others is also linked to such physiological response patterns of parasympathetic nervous system and immune system that lower the risk for somatic complaints. For example, compassion training is related to lower cortisol levels and weaker inflammatory reactions when encountering psychosocial stressors (Abelson et al., 2014; Pace et al., 2009). Additionally, compassion is related to more favorable health behavior (Dantzer, 2001; Gluschkoff et al., 2018) and higher heart rate variability (Stellar et al., 2016). These physiological correlates, in turn, are shown to decrease the risk for depression (Berntson & Cacioppo, 2004; Fitzgerald et al., 2008; McQuaid et al., 2014; Rantala et al., 2017).

Our results suggested that the link of compassion with depressive symptoms was stronger in early adulthood but became non-significant in middle age. In early adulthood, the most essential developmental tasks are strongly related to social functioning, for example, the formation of a romantic relationship or social integration in a working environment (Roisman et al., 2004). Encountering stressful life situations that are not in line with developmental tasks are known to be a strong risk factor

for depression (Rantala et al., 2017). High dispositional compassion is related to better quality of social functioning (Goetz et al., 2010) and, thus, may promote the normative psychosocial development.

By middle age, the social networks have commonly been established and new life tasks take place (Sheldon & Kasser, 2001). For example, individuals may question whether they have chosen meaningful roles in their life. Especially, it has been shown that the need for self-actualization and spirituality significantly increases from middle age onwards (Ivtzan et al., 2013; Wink & Dillon, 2002). Hence, it may be that among individuals with high compassion, the level of self-actualization or self-transcendence needs to increase in middle age to protect against depressive symptoms. Additionally, in middle age, one commonly encounters a variety of novel environmental factors such as aging-related diseases or deaths of close relatives. These environmental factors may increase the population-level incidence of depressive symptoms and, simultaneously, diminish the role of compassion or other personality characteristics for the onset of depression.

On the other hand, since compassion was found to slightly increase over age, the findings might also be explained by a threshold effect. That is, average level of compassion might reach a critical level in middle age, so that increases in the level of compassion might not have any additional protective effect against depression. However, this may not fully explain the findings. In our additional analyses, the values of dispositional compassion in 2001 and 2012 were scaled with the year 1997 level of compassion, and all the associations remained.

With regard to the limitations of our study, it must be taken into consideration that the level of depressive symptoms was mostly mild and non-clinical in our sample. Hence, our findings cannot be directly generalized to populations with severe and clinically significant depressive symptomatology. Nevertheless, a recent review highlighted that more research should be directed at understanding subclinical depression, since it strongly predicts later clinical depression and could provide new tools for tailoring early and preventive interventions (Lee et al., 2018). This was the

primary aim of the present study. Therefore, we also used a modified version of the BDI that is found to capture especially effectively subclinical depressive symptoms in the general population (e.g. Katainen et al., 1999; Rosenström et al., 2012).

The present study had also several substantial strengths. Firstly, we had a prospective 15-year follow-up with several measurement points of dispositional compassion and depressive symptoms. This enabled us to investigate the relationship of dispositional compassion with depressive symptoms from early adulthood to middle age and to disentangle whether the temporal pathways might run from depression to compassion or vice versa. This kind of prospective study has been widely called for previously (e.g. Celikel et al., 2010; Cusi et al., 2011; Farmer et al., 2003; Schreiter et al., 2013; Tully et al., 2016). Secondly, we had a comparatively large population-based sample that likely represented the general population with regard to most of its characteristics. Thirdly, we could control for several potential confounding factors, such as age, gender, and socioeconomic factors in childhood and adulthood. Finally, we used such questionnaires of dispositional compassion and depressive symptoms that have been used also previously and are shown to have high reliability (e.g. Gluschkoff et al., 2018; Hansenne et al., 2005; Katainen et al., 1999; Nurmi et al., 1995).

In clinical practice, it is important to be aware that high dispositional compassion for others may have a protective effect against the development of depressive symptoms, whereas depressive symptoms may not decrease the level of dispositional compassion. Hence, our findings are in line with a previous review (Leaviss & Uttley, 2015) suggesting that increasing compassion through interventions might potentially lower the risk for the onset and maintenance of depressive symptoms. Moreover, the role of dispositional compassion for depressive symptoms may be especially strong among patients in their early adulthood, but weaker among middle-aged patients. When tailoring interventions for depressive patients, it is necessary to be aware that dispositional compassion may not

only lower the risk of the core symptoms of depression (e.g. sadness, pessimism, and guilty), but also with depression-related performance difficulties and somatic complaints.

At a more practical level, compassion training for depressive patients could include both affective and motivational elements. Affective elements refer to practices how to shift attention from negative self-monitoring to recognizing others' emotional states (Kirby & Gilbert, 2017). Further, depressive patients could have behavioral rehearsals to better tolerate other's suffering and to create a non-judgemental attitude toward others' negative affects (Kirby & Gilbert, 2017). Importantly, however, some clinically depressed patients may not be able to directly attain compassionate feelings for their close others and, hence, they may experience failure during these affect-related practices (Gilbert, 2019). In those cases, it may be better to begin with the motivational components (Gilbert, 2019). Motivational components aim to increase depressed patients' abilities to find practical means to alleviate others' suffering. A variety of cognitive-behavioral interventions can be used to increase patients' awareness about the link between their care-taking behavior and others' affective states (Kirby & Gilbert, 2017). Taken together, via these compassion-related practices depressive patients can shift their attention from negative self-rumination to positive care-taking behavior.

Contributors

A.S. and M.H. designed and executed the study and drafted the manuscript. A.S. analyzed the data. M.H. assisted with the data analyses. A.S., M.H., L.K.-J., C.R.C., J.V., M.E., T.L., and O.R. contributed to the interpretation of the results and collaborated with writing the manuscript. L.K.-J., M.H., T.L., and O.R. contributed to the data collection.

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Conflict of interest

None.

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Table 1. The means, standard deviations (SD), and frequencies of the study variables.

	Mean / Frequency (%)	SD	Range
Dispositional compassion in 1997	3.62	0.67	1–5
Total depressive symptoms in 1997 (the mBDI)	2.10	0.65	1–5
Depressive subsymptoms (the mBDI)			
Negative attitude	2.19	0.70	1–5
Performance difficulties	2.07	0.76	1–5
Somatic complaints	2.03	0.71	1–5
Gender (Female)	943 (56.3)		
Age in 1997	27.69	5.01	20–35
Parental educational level			
Comprehensive school (the first 9 years of school)	542 (32.3)		
High school or occupational school	692 (41.3)		
Academic level (university or college)	442 (26.4)		
Parents' annual income	4.91	1.92	1–8
Participants number of educational years	15.53	3.59	8–34
Participants' annual income	7.38	3.08	1–13

Table 2. The goodness-of-fit statistics for the longitudinal models on the predictive relationships of compassion with depressive symptoms.

	χ^2 value	df	p	RMSEA	CFI	BIC	Model comparisons		
							χ^2 difference test	df	p
Model 1	552.361	88	<.001	0.056	0.959	64308.345			
Model 2	506.453	82	<.001	0.056	0.963	64306.981	$\chi^2(2 \text{ vs. } 1)=45.908$	6	<.001
Model 3	546.198	82	<.001	0.058	0.959	64346.727	$\chi^2(3 \text{ vs. } 1)=6.163$	6	0.405
Model 4	499.917	76	<.001	0.058	0.963	64344.991	$\chi^2(4 \text{ vs. } 2)=6.536$	6	0.366

RMSEA = the Root Mean Square Error of Approximation. CFI = the Comparative Fit Index.

BIC = the Bayesian Information Criterion. $N=1676$

Model 1: Autoregressive model (no cross-lagged predictive paths).

Model 2: Cross-lagged predictive paths from dispositional compassion to depressive symptoms.

Model 3: Cross-lagged predictive paths from depressive symptoms to dispositional compassion.

Model 4: Cross-lagged predictive paths in both directions.

Dispositional compassion and depressive symptoms

Table 3. Results of multilevel models with longitudinal design. Estimates (β) with 95% confidence intervals (CI) of compassion and age, when predicting standardized scores of depressive symptoms.

	Depressive subsymptoms							
	Negative attitude		Performance difficulties		Somatic complaints		Total depressive symptoms	
	β	95% CI	β	95% CI	β	95% CI	β	95% CI
Fixed effects								
Intercept	0.14	-0.0056; 0.29	0.064	-0.084; 0.21	-0.021	-0.17; 0.13	0.084	-0.065; 0.23
Compassion	-0.29***	-0.36; -0.22	-0.31***	-0.39; -0.24	-0.24***	-0.33; -0.17	-0.32***	-0.39; -0.25
Age	-0.024***	-0.035; -0.014	-0.018***	-0.029; -0.0081	0.024***	0.013; 0.035	-0.0099	-0.020; 0.00015
Age squared	0.00040*	0.000074; 0.00072	0.00043*	0.00011; 0.00075	-0.00025	-0.00059; 0.000099	0.00026	-0.000055; 0.00057
Compassion* Age	0.0042	-0.0061; 0.015	0.0077	-0.0026; 0.018	0.0083	-0.0027; 0.019	0.0076	-0.0024; 0.018
Compassion* Age squared	-0.00025	-0.00059; 0.000094	-0.00036*	-0.00070; -0.000026	-0.00038*	-0.00075; -0.000017	-0.00037*	-0.00070; -0.000046
Random effects								
Variance of intercept	0.76*	0.70; 0.83	0.71*	0.65; 0.79	0.66*	0.58; 0.75	0.74*	0.68; 0.81
Variance of age	0.028*	0.023; 0.035	0.020*	0.013; 0.030	0.021*	0.013; 0.033	0.026*	0.020; 0.33
Residual variance	0.60*	0.58; 0.63	0.63*	0.60; 0.65	0.69*	0.66; 0.72	0.59*	0.57; 0.61

*** $p < .001$ ** $p < .01$ * $p < .05$ Note: All the models were adjusted for age, gender and socioeconomic factors in childhood and adulthood. $N=1676$

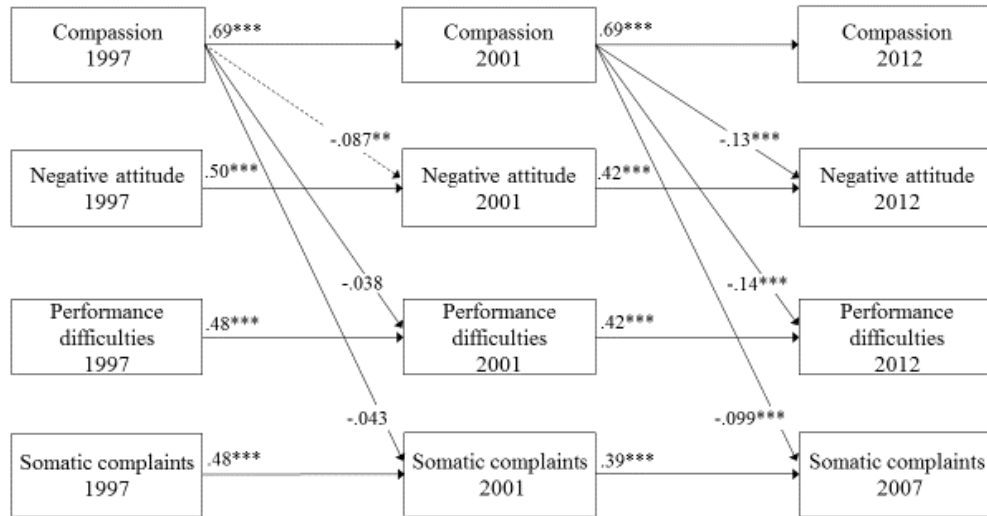
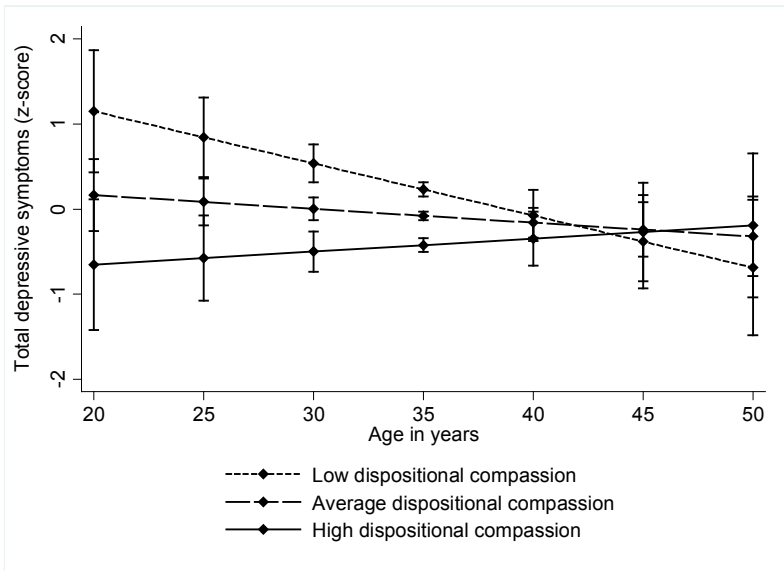
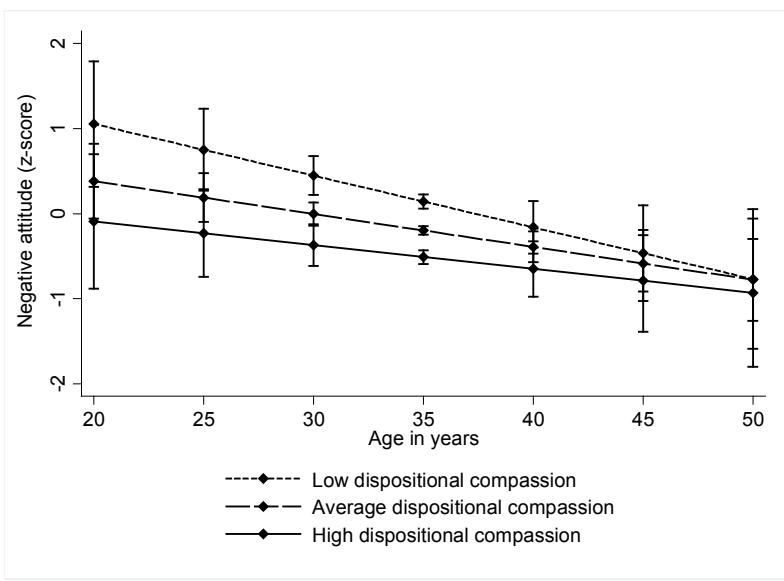


Figure 1. Standardized regression paths of the model 2 (i.e. stability coefficients and the cross-lagged paths from dispositional compassion depressive symptoms). *Note:* For clarity, control variables (age, gender, socioeconomic factors in childhood and adulthood) and the covariances between variables at each time point are not shown in the figure. *** $p < .001$ ** $p < .01$ $N = 1676$

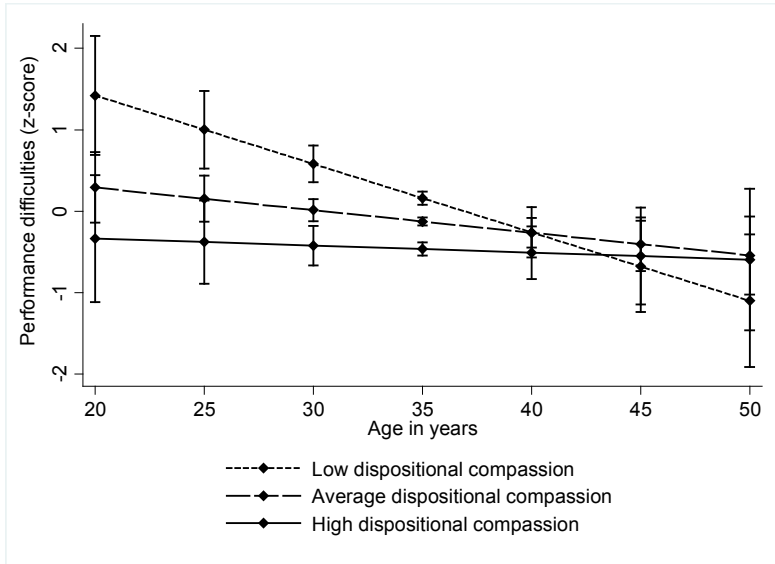
(a) Total depressive symptoms.



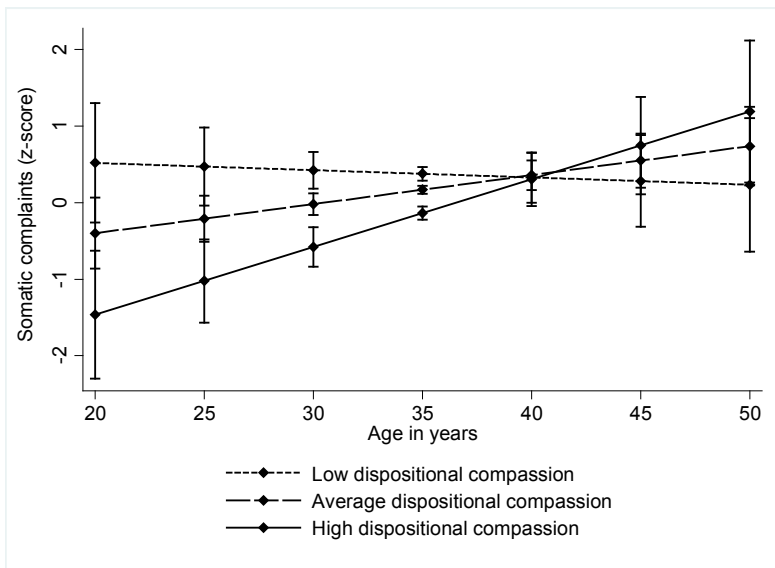
(b) Depression-related negative attitude.



(c) Depression-related performance difficulties.



(d) Depression-related somatic complaints.



Figures 2a–d. Growth trajectories of standardized scores of (a) total score of depressive symptoms, (b) negative attitude, (c) performance difficulties, and (d) somatic complaints separately for participants belonging to the lowest 20%, average, and the highest 20% in dispositional compassion for others. Predicted means with 95% confidence intervals.

