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BRIEF REPORT

The Reciprocal Relationship Between Depression and Physical Morbidity: The Role of Subjective Age

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Objectives: The study aims to examine whether the reciprocal effects of physical morbidity and depression are moderated by subjective age—that is, individuals' perception of themselves as young or old. ***Method:*** Data from the first two waves of the Midlife in the United States study (1995–6, T1; 2004–6, T2; http://midus.wisc.edu/) were analyzed using a cross-lagged design. We assessed 3,591 individuals who participated in both waves and provided full data on all the relevant variables (mean age at T1 = 47.4). Depression and the number of chronic illnesses (the indicator of physical morbidity) were measured at both waves and were tested as predictors and outcomes in a cross-lagged model. The moderating role of subjective age was assessed by examining whether T1 variables interacted with subjective age in predicting T2 outcomes. ***Results:*** Subjective age moderated the T1 depression–T2 morbidity relationship, so that the relationship was stronger for those with older subjective age. Subjective age did not moderate the T1 morbidity–T2 depression relationship. ***Conclusion:*** Older subjective age could be a risk factor for experiencing greater physical morbidity following depression.

Keywords: physical morbidity, health, depression, subjective age, longitudinal

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A large body of literature has established the reciprocal effects of physical and mental health (Lindwall, Larsman, & Hagger, 2011). Accordingly, physical morbidity increases depression, while depression increases the risk of physical morbidity, rehospitalization, and mortality (Blazer, 2003; Kessler, 2012). Studies suggest that the strength of the association between physical morbidity and depression could be modified by social and psychological factors. However, the mechanisms that lie at the base of these relationships remain elusive (Segel-Karpas, 2015; Sullivan, LaCroix, Russo, & Walker, 2001). In this study, we suggest that subjective age could modify the reciprocal effects of physical morbidity and depression.

Drawing on the popular notion that people are only as old as they feel, Kastenbaum, Derbin, Sabatini, and Artt (1972) suggested studying how old individuals seem in their own eyes as a domain of functional age. The term *subjective age* is used to describe the self-perception of individuals' age in relation to their chronological age (Stephan, Sutin, & Terracciano, 2015). Subjective age can be seen as one construct that subsumed under the umbrella term of *subjective aging* that also includes self-perceptions of aging, old-age stereotypes, and awareness of age-related change (Diehl et al., 2014). Feeling younger than one's chronological age is considered an adaptive coping strategy in a society that often devaluates old age (Westerhof & Wurm, 2015), and indeed most older adults report feeling younger than their age (Kotter-Grühn, Kornadt, & Stephan, 2015). Feeling older than one's chronological age could indicate greater perceived vulnerability to age-related decline in health (Kotter-Grühn & Hess, 2012). Relatedly, the stereotype embodiment theory (Levy, 2009) maintains that aging adults gradually internalize the stereotypical views society holds against older adults, as well as their own personal negative views. When these views become more relevant as the individual ages, they begin to operate unconsciously through multiple pathways, and negatively affect the individual's well-being. An older subjective age can be seen as an internalization of negative (often health-related) age stereotypes.

A growing body of literature demonstrates that an older subjective age associates with various detrimental outcomes. It relates to experienced health problems (Kotter-Grühn, Neupert, & Stephan, 2015), worse functional health, increased biological aging (Stephan et al., 2015), and health-risk behaviors (Westerhof & Wurm, 2015). It is also related to poorer mental health (Choi & DiNitto, 2014). The relatively moderate associations between subjective age and physical/mental health (including physical morbid-

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ity and depressive symptoms) suggest that subjective age is a related yet a separate construct.

In this paper, we focus on the moderating role of subjective age, examining its effects on the reciprocal relationships between depression and physical morbidity. Unlike most previous works, which have focused on the effect of subjective age on future functioning, we propose to examine how one's age identity works in tandem with other constructs to predict health outcomes. In this conceptualization, one's age identity, baseline functioning, and their potential combined effect are considered when predicting future functioning. The few works that did look at the moderating role of subjective age found that older age identity strengthened the adverse effect of posttraumatic symptoms on successful aging (Shrira, Palgi, Ben-Ezra, Hoffman, & Bodner, 2016), and was related to higher levels of distress as predicted by subjective nearness to death (Shrira, Bodner, & Palgi, 2014).

Perceiving oneself as older than ones age could amplify the reciprocal effects between depressive symptoms and physical morbidity, as the two latter variables could be viewed more negatively due to internalized age stereotypes reflected by an older age identity (Kotter-Grühn & Hess, 2012). Moreover, the perception of depression or physical morbidity as an inevitable part of aging that corresponds with one's self-perception of old age could inhibit help-seeking behaviors, harm health preserving behaviors, and aggravate health-risk behaviors (cf. Wienert et al., 2015), thus worsening the reciprocal effects of depression and physical morbidity. Hence, we hypothesize that older subjective age strengthens the effect of (H1) physical morbidity on depression and (H2) depression on physical morbidity.

Method

Participants and Procedure

Data were derived from the first two waves of the Midlife in the United States (MIDUS) study (http://midus.wisc.edu/)—a national, representative, longitudinal panel study of community-dwelling adults. Data were collected in 1995–96 (T1; $N = 7{,}100$) and 2004–06 (T2; $N = 4{,}955$), respectively, using a random digit dialing. Participants with full data on the study variables were included in the analyses ($N = 3{,}591$). At T1, mean age was 47.28 and 44.6% were male (see Table 1). University of Haifa's Institutional Review Board approved the use of these data.

Attrition analysis revealed that compared to T1-only participants, both-waves participants were more educated ($M = 13.23$ vs. 14.11, $t_{[3997]} = -13.04$, Cohen's $d = -.34$), and had fewer chronic illnesses ($M = 2.01$ vs. 2.23, $t_{[2743]} = 3.91$, Cohen's $d = 0.13$). Among those who participated in both waves, compared to those with incomplete data, those with complete data were more likely to be females (51.3% vs. 53.3%, $\chi^2(1) = 17.91$, $\varphi = -.05$), married (65.7% vs. 70.4%, $\chi^2(1) = 163.68$, $\varphi = .15$), white (90.7% vs. 93%, $\chi^2(1) = 112.21$, $\varphi = .135$) and nondepressed (86.7% vs. 87.7%, $\chi^2(1) = 14.72$, $\varphi = -.04$) ($p < .001$ for all comparisons).

Measures

Depression. Diagnosis of major depression in the last 12 month (no major/major depression) according to *DSM–III–R* criteria (APA, 1987) was based on the Composite International Diagnostic Interview Short Form scale (CIDI-SF). The scale was constructed to capture the DSM requirements, according to which the symptoms will result in clinically significant distress, or functional impairment. Hence, the insights gained from the study might have direct implications for the clinical population. The variable was coded such that 0 indicated no depression, and 1 indicated probable major depression.

Physical morbidity. Chronic medical conditions respondents had experienced or had been treated for in the last 12 months were summed. The list included 28 physical conditions (e.g., heart problems, cancer, diabetes, bone or joint diseases, and thyroid disease). As less than 5% had six chronic conditions or more, the latter were aggregated into one category (= 6). We tested the same model using the square root of the number of conditions to reduce skewness. Results remained stable, and are available in the online supplemental material.

Subjective age. Respondents were asked to state how old they felt most of the time. Subjective age score at T1 reflects proportional discrepancy from chronological age—the difference between felt age and chronological age, divided by chronological age (Stephan, Chalabaev, Kotter-Grühn, & Jaconelli, 2013). Higher scores reflect an older age identity.

Control variables. Those included age, gender, number of school years, marital status (0 = not married; 1 = married or in

Table 1
Descriptive Statistics and Correlations Between the Study Variables

Variable	*M*/%	*SD*	1	2	3	4	5	6	7	8	9
1. Age T1	47.28	12.39	–								
2. Gender (1 = male)	44.6%	–	.02	–							
3. Married (1 = yes)	72%	–	.06**	.09***	–						
4. Race (1 = White)	93.7%	–	.04*	.05**	.10***	–					
5. Education	14.21	2.58	−.10***	.13***	−.03	.02	–				
6. Subjective age T1	−.15	.19	−.26***	.02	.01	.01	−.05**	–			
7. Depression T1 (1 = depressed)	12%	–	−.11***	−.07***	−.11***	−.01	−.04*	.14***	–		
8. Depression T2 (1 = depressed)	10%	–	−.11***	−.12***	−.02	−.01	−.07***	.12***	.27***	–	
9. Physical morbidity T1	2.01	1.85	.18***	−.13***	−.06***	−.045**	−.13***	.11***	.16***	.15***	–
10. Physical morbidity T2	2.06	1.83	.26***	−.11***	−.05***	−.04***	−.14***	.09***	.12***	.17***	.54***

Note. $N = 3{,}591$.
* $p < .01$. ** $p < .05$. *** $p < .001$.

cohabit), and race (1 = White; 0 = non-White), as these were previously found to correlate with either depression or physical morbidity (cf. Blazer, 2003).

Analysis

We used structural equation modeling with AMOS 21, constructing a cross-lagged autoregressive design. The model simultaneously tested a regression path from T1 depression to T2 morbidity, and from T1 morbidity to T2 depression, allowing the error terms of the same wave variables to covary. To test whether the reciprocal effects of depression and morbidity are moderated by subjective age, we included the effects of two interaction terms between T1 main predictors (morbidity and depression) and subjective age on T2 outcomes. The T1 variables were regressed on the five control variables, which were related to one another. After examining the modification indices, we improved model fit by allowing the error terms of age to covary with the two interaction terms and with T2 depression and morbidity, and by allowing covariance between the errors of the interaction terms themselves.

Results

Table 1 presents descriptive statistics and correlations for the study variables. T1 depression is significantly correlated with T2 depression and morbidity (r = .27 and .12, respectively). T1 morbidity is significantly correlated with depression at T1 and T2 (r = .16 and .15, respectively), and with T2 morbidity (r = .54). Subjective age is weakly correlated with T1 and T2 depression (r = .14 and .12, respectively), and with T1 and T2 morbidity (r = .11 and .09, respectively; $p < .001$ for all correlations).

Our model (NFI = .98, TLI = .97, CFI = .99, RMSEA = .035) showed that subjective age moderates the effect of T1 depression on T2 morbidity (b = .18, $p < .01$), but not the effect of T1 morbidity on T2 depression (b = .01, $p > .05$) (Table 2). We therefore generated two groups based on subjective age: those who felt younger than, or at, their chronological age (n = 3,186) and those who felt older (n = 405). The effect of T1 depression on T2 morbidity was b = .22, β = .04, $p < .05$, and b = .63, β = .13, $p < .001$, for those with younger and older subjective age, respectively. We then constrained the path between depression and morbidity to be equal between the groups, and compared the fit indices between the constrained and unconstrained models. Results suggested that for the T1 depression–T2 morbidity path the unconstrained model fitted the data significantly better than the constrained model ($\Delta\chi^2$ = 3.92, $p < .05$). Six and 14% of the variance in T2 depression was accounted for by the predictors in the younger and older subjective age groups, respectively; 27% and 33% of the variance in T2 morbidity was explained by the predictors in the younger and older subjective age groups, respectively. All results remained stable when imputing missing data (See online supplemental material).

Discussion

Our findings suggest that older subjective age aggravates the effect of depression on morbidity, thus contributing to the literature on the reciprocal effects of physical morbidity and depression (Blazer, 2003), and on subjective age (Westerhof & Wurm, 2015). The perception of oneself as old and viewing depressive symptoms as a normal part of the aging process could inhibit support-seeking behaviors, and thus exacerbate the negative effect of depression on physical morbidity. Furthermore, depression, morbidity, and older subjective age could all deplete one's coping resources, leaving the person more vulnerable to risk factors. The moderating effect of subjective age on the physical morbidity–depression link is not

Table 2
Selected Parameters for the Cross-Lagged Model

			Main model (all respondents)				Younger subjective age		Older subjective age	
Covariance			B	*SE*	LLCI	ULCI	B	*SE*	B	*SE*
Depression T1	↔	Morbidity T1	.11***	.01	.09	.13	.07***	.01	.17***	.04
Depression T2	↔	Morbidity T2	.04***	.01	.02	.05	.03***	.01	.10**	.03
Regression Weights										
Age	→	Depression T1	−.003***	.00	−.003	−.002	−.002***	.00	.00	.002
Age	→	Morbidity T1	.03***	.002	.02	.03	.03***	.003	.07***	.01
Gender (1 = male)	→	Depression T1	−.03***	.01	−.05	−.02	−.03*	.01	−.11*	.05
Gender (1 = male)	→	Morbidity T1	−.32***	.05	−.40	−.22	−.42***	.06	−.41*	.19
Married (1 = married)	→	Depression T1	−.06***	.01	−.08	−.04	−.06***	.01	−.12*	.05
Married (1 = married)	→	Morbidity T1	−.23***	.06	−.32	−.12	−.20**	.07	−.46*	.21
Race (1 = White)	→	Depression T1	.008	.02	−.03	.04	.005	.02	−.01	.09
Race (1 = White)	→	Morbidity T1	−.18	.10	−.33	−.04	−.26*	.13	−.14	.38
Education	→	Depression T1	−.006***	.002	−.01	−.003	−.004*	.002	−.003	.01
Education	→	Morbidity T1	−.05***	.01	−.07	−.04	−.05***	.01	−.09*	.04
Depression T1	→	Depression T2	.23***	.02	.19	.28	.19***	.02	.31***	.04
Morbidity T1	→	Morbidity T2	.47***	.02	.44	.51	.48***	.01	.47***	.04
Depression T1	→	Morbidity T2	.43****	.09	.27	.61	.22*	.09	.63***	.19
Morbidity T1	→	Depression T2	.02***	.01	.02	.03	.02***	.003	.03*	.01
Subjective age	→	Morbidity T2	.19	.21	−.24	.54				
Subjective age	→	Depression T2	.03	.04	−.05	.11				
Depression T1 * Subjective age	→	Morbidity T2	1.03**	.31	.58	1.64				
Morbidity T1 * Subjective age	→	Depression T2	.01	.01	.003	.04				

* $p < .05$. ** $p < .01$. *** $p < .001$.

significant, perhaps because subjective age—primarily reflecting a state of mind—better interacts with mental status (i.e., depressive symptoms) and less so with physical constitution (i.e., number of illnesses), yet this should be further examined in future studies.

From a clinical perspective, our results suggest that subjective age should be considered when evaluating individuals' risk of physical morbidity following depression. It may also be beneficial to closely track the health behavior of depressed people with older subjective age, as they might be prone to neglect health-promoting behavior and self-care, thus exacerbating the negative effects of depression on their health (cf. Wienert et al., 2015).

A main limitation of this study is our indicator of morbidity that does not capture the severity of the illnesses, their prognosis, or the experienced physical symptoms that accompany them. Future research could benefit from using a more sensitive measurement of morbidity. Second, all our variables were self-reported and hence vulnerable to monomethod bias. However, at least some of the concern could be alleviated by using a relatively strict measurement of depression based on the *DSM–III–R*, and by using chronic illnesses that were likely diagnosed by a physician. Future studies could also use other measures of subjective age, reflecting different facets such as "look age," "do age," and "interests age" (Kastenbaum et al., 1972). Third, although statistically significant, the effect sizes are small. However, for those individuals with older subjective age suffering from depression, even a small increase ($b = .63$) in the number of illnesses, could greatly harm their physical well-being. Fourth, our measurements were taken in a 10-year interval, offering both an advantage and a disadvantage: On the one hand, it suggests that the interaction between T1 variables has a long-term effect. On the other hand, possible fluctuations during the 10-year interval were not captured. Future research could more closely track the independent and intercorrelated developmental trajectories of depression, morbidity and subjective age. Finally, despite its advantages, the longitudinal design does not allow certainty in interpretation of causality. It could be that those who suffered from recurrent episodes of major depression were more likely to feel old and develop physical problems. Similarly, other variables, such as genetic predisposition, could increase one's vulnerability to physical morbidity and depression, resulting in older subjective age. Despite these limitations, this study contributes to the literature. By using a prospective design and examining the role of subjective age in the relationships between physical morbidity and depression, we highlight a possible factor that shapes these relationships, weakening the association for some, and strengthening it for others.

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