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Persistent psychological well-being predicts improved self-rated health over 9–10 years: Longitudinal evidence from MIDUS

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Abstract

Psychological well-being has been linked with better health, but mostly with cross-sectional evidence. Using MIDUS, a national sample of US adults ($N = 4963$), longitudinal profiles of well-being were used to predict cross-time change in self-reported health over 9–10 years. Well-being was largely stable, although adults differed in whether they had persistently high versus persistently low or moderate levels of well-being. After adjusting for sociodemographic factors, those with persistently high well-being reported better health (subjective health, chronic conditions, symptoms, and functional impairment) across time compared to those with persistently low well-being. Furthermore, persistently high well-being was protective of improved health especially among the educationally disadvantaged. The findings underscore the importance of intervention and educational programs designed to promote well-being for greater segments of society.

Keywords

health changes, protective benefits, stability of well-being

Growing research documents links between positive psychological functioning and multiple aspects of physical health (Pressman and Cohen, 2005), including mortality (Chida and Steptoe, 2008), cardiovascular disease (Boehm and Kubzansky, 2012), biological risk factors for disease (Friedman et al., 2007; Ryff et al., 2006; Tsenkova et al., 2008), infectious illness (Cohen et al., 2006), and dementia and disability in later life (Boyle et al., 2010a, 2010b). Most evidence to date, however, has been cross-sectional in nature. Longitudinal data are required to determine whether *change* in multiple indices of health, assessed over a 9- to 10-year period, can be predicted from *cumulative profiles* (i.e. persistently high vs persistently low levels) of psychological well-being (PWB).

We focus on eudaimonic well-being (Ryff, 1989; Ryff and Keyes, 1995), built on the integration of developmental, existential, and humanistic theories as well as distant input from Aristotle (Ryff, 2014; Ryff and Singer, 2006). The model includes multiple dimensions, such as having a sense of purpose in life, experiencing personal growth, and enjoying quality social relationships with others. Prior cross-sectional evidence has linked the scales with a range of health outcomes, including chronic medical conditions (Friedman and Ryff, 2012), sleep quality (Friedman, 2011; Friedman et al., 2005), inflammation (Friedman et al., 2007; Morozink et al., 2010), cardiovascular risk (Boehm and Kubzansky, 2012), and endocrine function (Ryff et al., 2004). Well-being has also been found to moderate relationships between various kinds of adversity, including educational disadvantage (Morozink et al., 2010), chronic conditions (Friedman and Ryff, 2012), sleep quality (Friedman, 2011; Friedman et al., 2005), and inflammation. Limited longitudinal work has been conducted, although high purpose in life has been linked prospectively with reduced risk of morbidity and mortality (Boyle et al., 2009, 2010a, 2010b; Hill and Turiano, 2014; Kim et al., 2013a,

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2013b) as well as with greater use of preventive health services (Kim et al., 2014).

The current investigation connects longitudinal profiles of well-being to change in self-reported physical health assessed over a 9- to 10-year period. Whether high well-being across time is protective of better health in the context of adversity, defined as low educational standing, is also examined. Educational gradients in health have been well documented, with low education predictive of elevated risk of disease and mortality (Adler et al., 1994; Crimmins and Saito, 2001; Lantz et al., 1998). Nonetheless, high levels of PWB have been linked with reduced inflammation (interleukin-6) among educationally disadvantaged adults (Morozink et al., 2010). Such work adds to the growing body of research documenting the health benefits of psychological and social strengths among those lacking high economic or educational standing (Lachman and Weaver, 1998; Miller et al., 2011; Turiano et al., 2014). The focus on socioeconomic adversity in the present inquiry thus provides a more stringent test of whether health benefits of persistently high well-being are evident in vulnerable (socio-economically disadvantaged) segments of the population.

We utilize multiple self-report indicators of physical health: self-rated health, chronic conditions, physical symptoms, and functional limitations. Self-rated health is a subjective global assessment of health status and in multiple studies and countries has been robustly linked to health outcomes, including mortality (Idler and Benyamini, 1997; Jylhä, 2009), independently of objective health measures. Furthermore, dynamic profiles of self-rated health have been linked with psychosocial factors. In a longitudinal study of Taiwan elders, consistently low self-rated health across a 14-year period was predicted by higher baseline scores on the Center for Epidemiologic Studies Depression (CES-D) scale (Lee et al., 2012). For more specific health assessments, such as chronic conditions and physical symptoms, the associations with well-being tend to be bi-directional, with lower baseline levels of well-being predicting subsequent poorer health as well as poorer health predicting lower well-being (Steptoe et al., 2015). Importantly, clinical studies have shown that participant reports of chronic illnesses closely match administrative data and medical records (Katz et al., 1996; Kriegsman et al., 1996). Finally, higher levels of PWB, including purpose in life, have been associated with reduced risk of disability (Boyle et al., 2010b; Ostir et al., 2000). This diverse array of physical health indicators, all commonly used in life course studies, is valuable for clarifying whether persistently high well-being is predictive of better cross-time health in particular domains or shows broader impact across all four indicators.

Although longitudinal analyses frequently use baseline measures of well-being to predict subsequent change in health, our analyses focus instead on *cumulative profiles of well-being*. The rationale is that most respondents had highly stable profiles of well-being across time, although at notably different levels (low, medium, and high). Key hypotheses were that (1) those with *persistently high* PWB would show better health at Time 2 (controlling for Time 1 health) compared to those with persistently low or moderate levels of PWB, and (2) persistently high (vs low) well-being would moderate the linkages between educational status and cross-time health. That is, stable high PWB would predict better Time 2 health especially among the educationally disadvantaged, thus demonstrating protective health benefits of high PWB in vulnerable subgroups. To determine whether the cumulative well-being approach affords substantive advances over use of baseline well-being alone, findings from the two approaches were also compared.

Methods

Sample

Participants were from the Midlife in the United States (MIDUS) survey, conducted in 1995–1996 and 2004–2005. A national sample of 7108 non-institutionalized adults included a random digit dialing (RDD) telephone survey, with oversampling in five cities (related to geographic-specific agendas) (n=4244), plus a sibling sample of the main-sample respondents (n=950). Also included was a national twin sample (n=1914; 957 pairs), generated by screening a representative national sample of approximately 50,000 households for the presence of a twin (as part of ongoing national omnibus surveys). The baseline survey employed a 30-minute phone interview followed by two Self-Administered Questionnaires (SAQs), mailed to individuals after completing the phone interview. Response rates for the phone survey were: RDD sample (70%), siblings (64%), and twins (60%). Among these individuals, response rates for the SAQs were: RDD sample (87%), siblings (81%), and twins (92%).

With support from the National Institute on Aging, a longitudinal follow-up was initiated in 2004. The Time 2 data collection used the original protocol: following successful completion of a 30-minute phone interview, participants were mailed two SAQs. Of the original 7108 participants completing the phone survey at baseline, 4963 (70%) were successfully re-contacted and completed the phone survey 9–10 years later. Adjusted for mortality, the overall retention rate was 75 percent (see Radler and Ryff (2010) for details on attrition). Separate retention rates were: RDD sample (69%), siblings (81%), and twins (81%). Comparison of the longitudinal and baseline MIDUS samples revealed the usual selective bias evident in prior research—namely, that retention rates were higher among those in better health and with more education at baseline as well as among women, Whites, and married individuals (Radler and Ryff, 2010). Approximately, 3900 participants completed the Ryff's PWB scales (Ryff, 1989) at each of the two occasions of measurement and were thus included in analyses that follow. At Time 2, the ages of these participants ranged from 32 to 84 years.

Measures

The demographic variables included baseline characteristics of age (continuous), gender (0 = male, 1 = female), and educational level (1 = no school/some grade school, 12 = PhD, MD, or other professional degree). PWB was measured with six scales (Ryff, 1989): autonomy, environmental mastery, personal growth, positive relations with others, purpose in life, and self-acceptance. Each scale consisted of three items, with a mix of positive and negative items. Respondents indicated the extent (from 1 strongly agree to 7 strongly disagree) to which the statements described them. Negative items were reverse coded so that higher scores reflected more positive appraisals. Summed scores were created from all scales. Table 1 provides summary statistics and cross-time correlations for these measures.

Four physical health outcomes (Time 2) were examined: (1) self-reported physical health (1 = poor, 2 = fair, 3 = good, 4 = very good, and 5 = excellent); (2) number of chronic conditions (such as asthma, stomach problems, and diabetes; range = 0–30); (3) frequency (past 30 days) of physical symptoms such as headaches, joint problems, difficulty sleeping, and so on (0 = not at all, 1 = once a month, 2 = several times a month, 3 = once a week, 4 = several times a week, and 5 = almost every day; range = 0–48); and (4) instrumental activities of daily living (IADL) where higher scores indicated more functional limitations. Summary statistics of health at both Time 1 and Time 2 as well as cross-time correlations for these variables are given in Table 1.

Longitudinal trajectories of well-being

Baseline psychological factors, such as personality traits (e.g. neuroticism, conscientiousness), are often used to predict cross-time health, such as heightened risk of illness or death (Mroczek and Spiro, 2007; Turiano et al., 2012). An alternative approach uses *longitudinal trajectories* of psychosocial factors to predict changing health. This strategy may be particularly useful when psychological factors are highly stable as it allows emphasis on cumulative effects across time. Most MIDUS participants, in fact, had stable profiles of well-being over the 9- to 10-year period: using the index of reliable change (Christensen and Mendoza, 1986), more than 90 percent of respondents did not reliably increase or decrease on any dimension of well-being over 9–10 years. Nonetheless, they were stable at different levels, with some individuals showing persistently high and others persistently low or moderate levels of well-being across time.

Table 1. Descriptive statistics of sociodemographic, psychological well-being, and physical health variables at Time 1 and Time 2 on cases with complete longitudinal data.

	Mean (SD)		Cross-time *r*
	M1	M2	
Age	47.3 (12.4)	56.2 (12.4)	.99
Education	7.1 (2.5)	7.2 (2.5)	.88
% Male	48%	47%	
Autonomy	16.4 (3.2)	16.5 (3.1)	.45
Environmental mastery	16.3 (3.4)	16.8 (3.2)	.45
Personal growth	17.9 (3.0)	17.2 (3.2)	.44
Positive relations	16.3 (4.0)	16.8 (3.8)	.50
Purpose in life	16.7 (3.5)	16.2 (3.4)	.57
Self-acceptance	16.7 (3.4)	16.3 (3.8)	.56
Subjective health	3.6 (.9)	3.5 (1.0)	.52
Chronic conditions	2.3 (2.4)	2.4 (2.6)	.56
Health symptoms	9.2 (7.1)	12.8 (7.6)	.56
Functional health (IADL)	1.5 (.7)	1.8 (0.9)	.61

IADL: instrumental activities of daily living; SD: standard deviation.

To classify respondents into cumulative subgroups, a typology was created wherein each respondent was jointly characterized based on Time 1 and Time 2 well-being. Such cross-classification could be done in multiple ways (i.e. using tertiles, quartiles, or quintiles of distributions at each time point). We examined all three possibilities and ultimately selected quartiles so as to produce a typology of change and stability that was neither too undifferentiated (tertiles) nor too granular (quintiles). That is, the goal was to find the optimal balance between using overly loose (large subgroups) versus overly strict (small cell sizes) cross-time classification criteria.

As illustrated in Figure 1, quartiles made it possible to identify respondents who were stable (at low, medium, and high levels) across the two waves as well as those who increased or decreased across time. Change was defined as moving upward, or downward, 2+ quartiles from Time 1 to Time 2. We chose this criterion based on its comparability with reliable change index (Christensen and Mendoza, 1986), which is slightly more conservative. Thus, our resulting typology classified the majority (78%–83%) of respondents as stable at low, medium, or high levels, with the rest (17%–22%) classified as increasing or decreasing. Contrasts between these categorical groups were then used to predict changing profiles of health.

Results

Stepwise multiple regression analyses were performed using the four Time 2 health variables as outcomes. In the first step, age, education, gender, and Time 1 health were entered. By entering the Time 1 health, the dependent variable (Time 2 health) focused on residualized change in health. In the second step, dummy-coded variables for PWB were entered, with stable hi serving as the referent category compared to the other groups (stable low (stable lo), stable mid, increasing, and decreasing). In the tables that follow, no contrasts of stable hi with increasing are included because few such effects were obtained across the four outcome variables. To test whether persistently high well-being afforded greater protective health benefits among the less educated, a third step entered interaction term of education with stable lo versus stable hi. Significant interactions were graphed using the derived regression equation for each model. Middle, low, and high education levels in such graphs were, respectively, defined as the mean and 1 standard deviation below and above the mean.

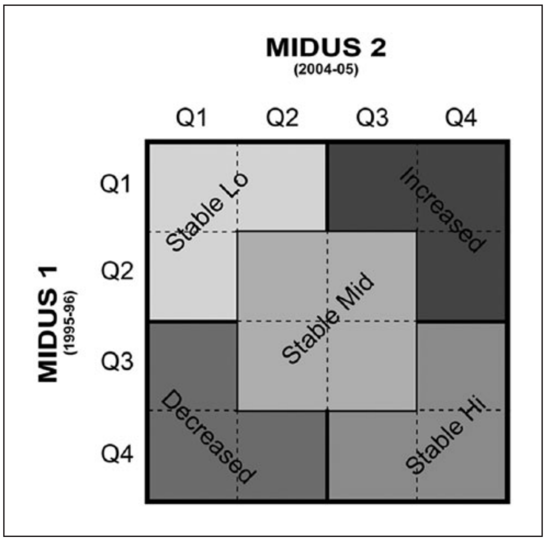

Figure 1. Longitudinal trajectories of well-being via cross-classification of scores (displayed with quartiles) obtained at MIDUS 1 and MIDUS 2.

Subjective health

Table 2 shows results of hierarchical regression analyses predicting Time 2 subjective health from cumulative profiles of PWB, after adjusting for education, age, gender, and Time 1 health. For all six scales of well-being (as well as for the overall composite), those with stable lo profiles had worse cross-time health compared to those with stable hi well-being. In addition, for three domains of well-being (environmental mastery, purpose in life, and self-acceptance), those with stable mid well-being had significantly worse cross-time health compared to those with stable hi well-being. For all scales except autonomy, those with decreasing well-being had poorer health at Time 2 (net of Time 1) compared to those with stable hi well-being.

Interaction analyses contrasting stable lo versus hi well-being at different levels of education showed significant

Table 2. Hierarchical regression predicting Time 2 subjective health from longitudinal trajectories of psychological well-being (stable hi is referent category).

	Step 2[a]			Step 3
	Stable hi versus stable lo	Stable hi versus stable mid	Stable hi versus decreasing	Interaction with education (stable hi vs stable lo)
Autonomy				
β =	−.064***	−.004	−.022	.100*
	$R^2\Delta$ = .004**			$R^2\Delta$ = ns
Environmental mastery				
β =	−.184***	−.091***	.111***	.121*
	$R^2\Delta$ = .024***			$R^2\Delta$ = .002*
Personal growth				
β =	−.106***	−.028	−.068**	.098*
	$R^2\Delta$ = .010			$R^2\Delta$ = ns
Positive relations				
β =	−.104***	−.015	−.053***	.120*
	$R^2\Delta$ = .009***			$R^2\Delta$ = ns
Purpose in life				
β =	−.094***	−.043**	−.051**	.031
	$R^2\Delta$ = .008***			$R^2\Delta$ = ns
Self-acceptance				
β =	−.136***	−.059**	−.074**	.041
	$R^2\Delta$ = .014***			$R^2\Delta$ = ns

*p<.05, **p<.01, ***p<.001.
[a]Betas for control variables entered in Step 1 (ΔR^2=.307) were education (.151***), age (−.094***), gender (.024), and Time 1 subjective health (.482***).

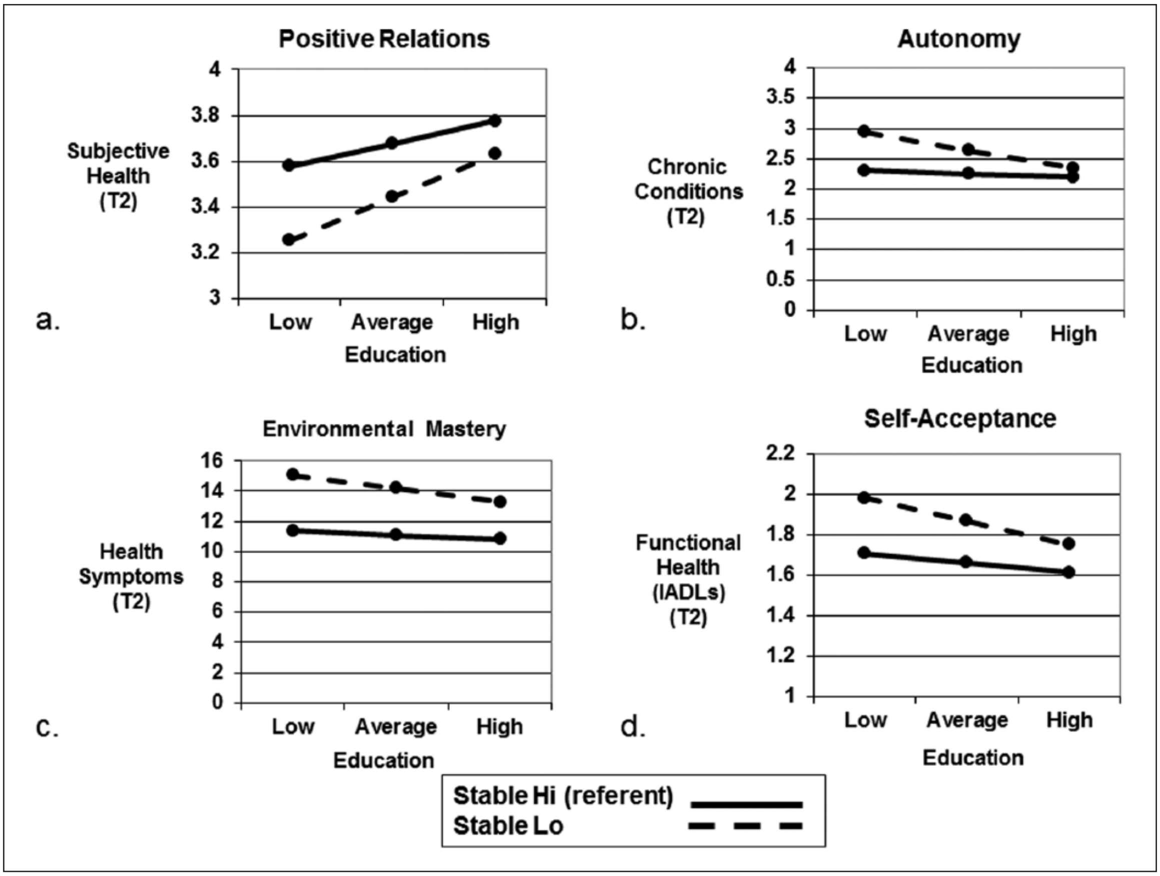

Figure 2. Significant interaction effects of psychological well-being trajectories and education on (a) subjective health, (b) chronic conditions, (c) health symptoms, and (d) functional health.

effects for autonomy, environmental mastery, personal growth, and positive relations with others. The pattern, illustrated for positive relations in Figure 2(a), shows the predicted protective influence: among those with stable hi positive relations, there is little difference in Time 2 health as a function of education, whereas among those with stable lo quality ties to others, those with limited educational attainment had poorer health compared to those with higher educational standing. This same pattern was also evident for autonomy, environmental mastery, and personal growth.

Chronic conditions

Table 3 shows the results of hierarchical regression analyses predicting Time 2 chronic conditions from cumulative profiles of PWB, after controlling for education, age, gender, and Time 1 chronic conditions. Across all dimensions of well-being (as well as for the overall composite), those with stable lo well-being showed greater increments in chronic conditions compared to those with stable hi well-being. In addition, for environmental mastery and self-acceptance, those with stable mid well-being had significantly greater increments in chronic conditions compared to those with stable hi well-being. For all scales of well-being except autonomy, those with decreasing profiles of well-being also showed significantly greater increments in chronic conditions compared to those with stable hi well-being.

Interaction analyses contrasting stable hi versus stable lo well-being at different levels of education revealed a significant effect only for autonomy. The effect, illustrated in Figure 2(b), shows that among those with stable hi autonomy, educational status does not matter in predicting cross-time changes in chronic conditions. However, among those with stable lo autonomy, there is a gradient in chronic conditions wherein less educated show greater increments across time compared to those with high educational standing. Thus, persistently high autonomy served as a protective factor against cross-time increments in chronic conditions among the less educated.

Health symptoms

Table 4 shows results of hierarchical regression analyses predicting Time 2 health symptoms from cumulative profiles of PWB, after controlling for education, age, gender, and Time 1 health symptoms. Cross-time increments in health symptoms were significantly higher for those with stable lo compared to stable hi well-being across all six dimensions of PWB (as

Table 3. Hierarchical regression predicting Time 2 chronic conditions from longitudinal trajectories of psychological well-being (stable hi is referent category).

	Step 2[a]			Step 3
	Stable hi versus stable lo	Stable hi versus stable mid	Stable hi versus decreasing	Interaction with education (stable hi vs stable lo)
Autonomy				
$\beta =$	.066	.021	.028	−.125*
	$R^2\Delta = .003$**			$R^2\Delta = .002$*
Environmental mastery				
$\beta =$	.137***	.066***	.076***	−.077
	$R^2\Delta = .013$***			$R^2\Delta =$ ns
Personal growth				
$\beta =$	.073***	.021	.042**	−.006
	$R^2\Delta = .005$***			$R^2\Delta =$ ns
Positive relations				
$\beta =$	.099***	.023	.038**	−.081
	$R^2\Delta = .007$***			$R^2\Delta =$ ns
Purpose in life				
$\beta =$	.064***	.023	.037*	−.014
	$R^2\Delta = .004$***			$R^2\Delta =$ ns
Self-acceptance				
$\beta =$	.104***	.042**	.061***	−.026
	$R^2\Delta = .008$***			$R^2\Delta =$ ns

*$p<.05$, **$p<.01$, ***$p<.001$.
[a]Betas for control variables entered in Step 1 (ΔR^2=.307) were education (.151***), age (−.094***), gender (.024), and Time 1 subjective health (.482***).

Table 4. Hierarchical regression predicting Time 2 health symptoms from longitudinal trajectories of psychological well-being (stable hi is referent category).

	Step 2[a]			Step 3
	Stable hi versus stable lo	Stable hi versus stable mid	Stable hi versus decreasing	Interaction with education (stable hi vs stable lo)
Autonomy				
$\beta =$	.103***	.058**	.058***	−.136**
	$R^2\Delta = .007$***			$R^2\Delta = .002$*
Environmental mastery				
$\beta =$	.180***	.108***	.115***	−.104*
	$R^2\Delta = .025$***			$R^2\Delta = .002$*
Personal growth				
$\beta =$	.099***	.056***	.059***	−.063
	$R^2\Delta = .008$***			$R^2\Delta =$ ns
Positive relations				
$\beta =$	.098***	.029	.059***	−.059
	$R^2\Delta = .009$***			$R^2\Delta = .002$*
Purpose in life				
$\beta =$	.049**	.015	.030	.009
	$R^2\Delta = .003$**			$R^2\Delta =$ ns
Self-acceptance				
$\beta =$	.128***	.067***	.087***	−.071
	$R^2\Delta = .013$***			$R^2\Delta =$ ns

*$p<.05$, **$p<.01$, ***$p<.001$.
[a]Betas for control variables entered in Step 1 (ΔR^2=.307) were education (.151***), age (−.094***), gender (.024), and Time 1 subjective health (.482***).

Table 5. Hierarchical regression predicting Time 2 functional health (instrumental activities of daily living) from longitudinal trajectories of psychological well-being (stable hi is referent category).

	Step 2[a]			Step 3
	Stable hi versus stable lo	Stable hi versus stable mid	Stable hi versus decreasing	Interaction with education (stable hi vs stable lo)
Autonomy				
β =	.040**	.013	.018	−.003
	$R^2\Delta$ = ns			$R^2\Delta$ = ns
Environmental mastery				
β =	.129***	.063***	.072***	−.142**
	$R^2\Delta$ = .012***			$R^2\Delta$ = .002
Personal growth				
β =	.080***	.020	.044**	−.067
	$R^2\Delta$ = .006***			$R^2\Delta$ = ns
Positive relations				
β =	.069***	.000	.030***	−.021
	$R^2\Delta$ = .005***			$R^2\Delta$ = ns
Purpose in life				
β =	.068***	.011	.030*	−.009
	$R^2\Delta$ = .004***			$R^2\Delta$ = ns
Self-acceptance				
β =	.102***	.054***	.053***	−.098*
	$R^2\Delta$ = .009***			$R^2\Delta$ = ns

**p*<.05, ***p*<.01, ****p*<.001.
[a]Betas for control variables entered in Step 1 (ΔR^2=.307) were education (.151***), age (−.094***), gender (.024), and Time 1 subjective health (.482***).

well as for the overall composite). In addition, those with stable mid well-being had significantly greater increments in health symptoms compared to those with stable hi well-being for four dimensions of well-being (autonomy, environmental mastery, personal growth, and self-acceptance). For all scales of well-being except purpose in life, those with decreasing profiles of well-being also showed significantly greater increments in health symptoms across time compared to those with stable hi well-being.

Interaction analyses contrasting stable hi versus stable lo well-being at different levels of education revealed significant effects for autonomy and environmental mastery. This effect is illustrated for environmental mastery in Figure 2(c) and shows that among those with stable lo environmental mastery, there is a gradient in which the less educated show greater increments in health symptoms across time compared to those with higher educational standing. Alternatively, persistently high environmental mastery served as a protective buffer against cross-time increments in symptoms conditions among the less educated. The same pattern was obtained for autonomy.

Functional health (IADLs)

Table 5 shows results of hierarchical regression analyses predicting Time 2 measures of functional health (IADLs) from cumulative profiles of PWB, after controlling for education, age, gender, and Time 1 IADLs. Cross-time increments functional health limitations were significantly higher for those with stable lo compared to stable hi well-being across all six dimensions of PWB (as well as for the overall composite). In addition, for environmental mastery and self-acceptance, those with stable mid-level well-being also had significantly greater increments in functional limitations compared to those with persistently high well-being. For all scales of well-being except autonomy, those with decreasing profiles of well-being also showed significantly greater increments in functional health limitations compared to those with stable hi well-being.

Interaction analyses contrasting stable hi versus stable lo well-being at different levels of education revealed significant effects for environmental mastery and self-acceptance. The effect for self-acceptance is illustrated in Figure 2(d) and shows that among those with stable lo self-acceptance, there is an educational gradient such that those with less education show greater increments in IADLs across time compared to those with higher educational standing. However, among those with persistently high self-acceptance, educational status does little to differentiate cross-time increments in functional impairment, thus illustrating a protective influence among the less educated. The same pattern was evident for environmental mastery.

Supplemental analyses

Because the above analyses reflect an unconventional approach (both due to the emphasis on varieties of stability and due to the use of a typology), two additional sets of analyses were conducted to evaluate comparative utility vis-à-vis typical analytic strategies. First, to examine whether baseline levels of PWB have as much predictive influence in predicting cross-time health as cumulative profiles of well-being, separate regression analyses were run using the baseline well-being (separately for all six PWB scales) as an independent variable entered at step 2, rather than the categorical cross-time groups. Such analyses tested whether varieties of stability constitute an advance over what can be learned from using baseline levels of well-being in predicting subsequent health change. In every instance, the cross-time typology (i.e. cumulative profiles) had more explanatory power than the baseline measures (measured by change in R^2 at step 2 when the trajectory set or, alternatively, the baseline variable was entered); that is – the cumulative well-being approach explained between 1.1 and 4.5 times more variance than baseline measures alone. Specifically, of the 24 regression models run, over a third (9 models) explained 2 to 3 times the variance as baseline measures only, and nearly half (11 models) explained 3 to 4+ times the variance compared to baseline measures only. Thus, cumulative assessments of well-being performed notably better than baseline assessments in accounting for variance in changing health.

Second, another set of regression analyses tested the alternative implied causal directionality—namely, where baseline levels of health (four different indicators) predicted cross-time changes in PWB (six different dimensions). In the majority of these analyses (87%), the well-being typology explained substantially more variance (ranging from 2 to 4+ times as much) in cross-time health than the reverse. This result likely reflects the fact that self-reported health showed greater cross-time variability, whereas PWB was largely stable for the majority of respondents.

Finally, because the MIDUS study includes twin pairs and siblings of the RDD sample members, assumptions of independent observations are violated. To address whether such familial dependencies biased the results, mixed effects models with random intercepts for family clusters were used to re-run the analyses. All conclusions drawn from the mixed effects models were unchanged from those reported above.

Discussion

The purpose of this investigation was to examine whether cumulative profiles of PWB would predict better health, measured with multiple indices over a 9- to 10-year period. Most respondents showed stable profiles of well-being; thus, the key question was whether those with persistently high well-being would have better cross-time health compared to those who had persistently low or moderate well-being. The results provided robust support for this hypothesis, net of sociodemographic factors (educational status, age, and gender) known to be linked to both well-being and health. Thus, for all outcomes (subjective health, chronic conditions, symptoms, and functional impairment), those with persistently high levels of autonomy, environmental mastery, personal growth, positive relations with others, purpose in life, and self-acceptance had better unfolding health (after adjusting for baseline health) than those with persistently low levels of well-being.

Furthermore, those with persistently high compared to persistently moderate well-being had better health, albeit for fewer outcomes. For environmental mastery and self-acceptance, differences between persistently high versus moderate well-being were significant for all health measures. For autonomy and personal growth, such effects were evident in predicting fewer increments in health symptoms across time, while for purpose in life, the same pattern occurred in predicting better subjective health across time. These effects underscore that the health advantages of well-being are not restricted to extreme group contrasts (high vs low), but also pertain to high versus moderate contrasts, thereby underscoring gradient-like benefits to experiencing PWB.

Although fewer adults showed change in well-being across time, those with declining profiles had negative health changes (increments in chronic conditions and functional impairment, decrements in subjective health) compared to adults with persistently high well-being. This pattern was evident for all aspects of well-being except autonomy. Similarly, for all aspects of well-being except purpose in life, those with declining profiles had worse health symptoms over time compared to those with stable hi well-being. The overarching message was that maintenance of high well-being translated to advantaged profiles of health 9–10 years later, compared to those who chronically lacked well-being, or were declining on well-being across time, or even those with only moderate levels of well-being (effects less pervasive in this comparison).

Further analyses addressed whether persistently high well-being was protective of better health among those who are socioeconomically disadvantaged. This query extends research on educational gradients in health (Adler et al., 1994; Crimmins and Saito, 2001; Lantz et al., 1998) where emerging evidence indicates that PWB may serve as a buffer against the adverse health consequents of low educational attainment (Lachman and Weaver, 1998; Miller et al., 2011; Morozink et al., 2010; Turiano et al., 2014). As predicted, interaction analyses showed that the typical educational gradient in subjective health was reduced among low education adults with persistently high levels of autonomy, environmental mastery, personal growth, and positive relations with others. Similarly, persistently high levels of autonomy were protective against increments in chronic conditions and health symptoms among less educated adults, while persistently high environmental mastery was protective against increments in health symptoms and functional impairment among those with low educational standing. Finally, persistently high levels of self-acceptance among the less educated protected against increments in functional impairment. Thus, extensive interaction effects provided support that persistently high well-being is especially protective of better health across time among the educationally disadvantaged.

The overall pattern of results extends contrasts between cumulative advantage and cumulative adversity that have long been prominent in life course research (Alwin and Wray, 2005; Dannefer, 2003). Merton (1968) once described the compounding of strengths over time as the Matthew effect, drawn from the biblical passage "unto everyone that hath be given, and he shall have abundance." Cumulative advantage has typically been applied to socioeconomic status, where the pluses of greater education and income have been shown to translate to progressively greater health disparities over time (Mirowsky and Ross, 2008; Ross and Wu, 1996). This investigation formulated cumulative advantage differently—namely, in terms of PWB, which was found to be largely stable over time. Underscoring varieties of stability, some individuals showed persistently high levels of autonomy, mastery, self-acceptance, and so on, across time, while others revealed persistently low, or moderate, levels of well-being. Fewer respondents evidenced gains or losses in their well-being over time. After controlling for baseline levels in health, the central message was that unfolding profiles of subjective health, chronic conditions, health symptoms, and functional impairment were better among those who enjoyed persistently high well-being across time. Pushing the query further, interaction effects showed the protective influence of persistently high well-being among educationally disadvantaged individuals known to have greater risk of subsequent health decline.

This investigation has several limitations. First, selective attrition is in the background of any longitudinal investigation: those present at the second wave of MIDUS were in better health and had higher educational standing compared to their baseline counterparts who dropped out (Radler and Ryff, 2010). This selection bias suggests that results may have been stronger (particularly the interaction analyses) had more disadvantaged individuals remained in the longitudinal follow-up. Second, only two time points were assessed, and they were common for measuring both well-being and health. Although the 9- to 10-year lag constitutes a notable advance over short-term efforts to link well-being to future health (e.g. Su et al., 2014), the possibility that cross-time changes in health could also be affecting unfolding profiles of well-being cannot be fully ruled out. That said, the choice to use cumulative well-being as a predictor of changing health status was strengthened by the fact that well-being was largely stable across time, while health status on average was declining. In addition, comparative analyses clarified that far more variance in outcomes was explained using cumulative profiles of well-being to predict health than using baseline health to predict subsequent changes in well-being. Third, although cumulative indices of well-being accounted for more variance in cross-time health than baseline well-being, the variance accounted for after adjusting for initial (Time 1) health status was limited. Similar small effect sizes have been noted in other studies where psychological characteristics (e.g. traits, positive affect) have been used to predict major life outcomes, such as socioeconomic standing (Roberts et al., 2007), as well as morbidity and mortality (Chapman et al., 2010; Chida and Steptoe, 2008; Pressman and Cohen, 2005). The accompanying argument is that practical significance may nonetheless be evident.

Practical significance may be particularly true for PWB where mounting research documents that it is protective against Alzheimer's disease and mild cognitive impairment (Boyle et al., 2010a), functional cognitive decline in the face of organic pathology in the brain (Boyle et al., 2012), stroke (Kim et al., 2013b), myocardial infarction (Kim et al., 2013a), and mortality (Boyle et al., 2009; Hill and Turiano, 2014). Other work is explicating the neural circuitry, showing that those with higher well-being are slower to evaluate negative stimuli and have reduced amygdala activation (Van Reekum et al., 2007). Those with high purpose in life have also shown better recovery profiles after emotional provocation in the laboratory (Schaefer et al., 2013), while overall well-being has been linked with sustained activation of reward circuitry (e.g. ventral striatum) when viewing positive stimuli as well as lower cortisol output over 4 days (Heller et al., 2013).

In light of the above evidence, an important question is what can be done to enhance experiences of PWB for greater segments of the population. The cross-time stability in reported well-being may suggest a kind of fatalism wherein some are blessed with high well-being over time, and others not. This interpretation is challenged by clinical applications and educational interventions that have grown up around PWB (see Ryff (2014) for a review). Such work documents that even among those who suffer from chronic major depression or anxiety, recovery from emotional distress can be achieved and sustained over the long term *by promoting experiences of well-being* (Fava et al., 1998, 2004, 2005; Ruini et al., 2009; Ruini and Fava, 2009; Ruini and Ryff, in press). Thus, those with low well-being are not inherently disadvantaged and doomed to a life of psychological ill-being with adverse physical health consequents likely to follow. What longitudinal analyses of the sort reported herein offer are strategies to identify those individuals most in need of such treatments.

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