Health and Energy Outlook Predict Health Outcomes 20 Years Later

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Abstract

Research has shown that older adults who rate their health and energy more positively have better health outcomes. However, the mechanisms underlying this relationship have not been formally tested, especially in a long-term longitudinal, full adult lifespan sample. We used data from the Midlife in the United States (MIDUS) study to investigate whether outlooks regarding one's health and energy assessed at Wave 1 (M1) would be associated with health outcomes (health limitations, chronic conditions) 20 years later at Wave 3 (M3). At M1, participants were asked to rate their past (10 years prior) and future (10 years hence) health and energy on a scale from 0 to 10. To determine outlook, we computed a difference score by subtracting participants' past rating from their future rating. We found that health and energy outlook was negatively associated with residual change in health at M3, such that those with more positive outlooks experienced fewer increases in health limitations over time. Participant age and sex did not interact with this relationship, but education did, suggesting a positive health outlook may be more important for those with lower levels of education. Mediation analysis revealed that positive health behaviors (more frequent physical activity, less smoking) partially mediated the relationship between positive outlook and better health outcomes. Finally, positive energy outlook was associated with a 6% decrease in mortality risk before accounting for baseline health. We discuss factors that appear to underlie the relationship between health/energy outlook and future health outcomes and consider implications for interventions.

Public Significance Statement

Past research has demonstrated that older adults who hold positive self-perceptions of aging have more favorable health outcomes. In a similar vein, the current work shows that outlooks regarding one's health and energy can predict one's health in the future, regardless of age and sex, and positive health behaviors mediate this relationship. This work suggests that interventions targeting health and energy beliefs earlier in the lifespan could help adults live healthier lives in the long run.

Keywords: health outlook, energy outlook, health limitations, education, longevity

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As the population grows older, more individuals are inevitably exposed to negative stereotypes of aging (Lamont et al., 2015). Ageism is prevalent in our society (Nelson, 2016) and has downstream consequences for older adults' cognition (Hess et al., 2003), health (Levy et al., 2008; Weiss, 2018), and self-perceptions (Kotter-Grühn & Hess, 2012; Diehl et al., 2023). However, those who are able to develop positive self-perceptions of their aging can expect a variety of health benefits (Levy & Meyers, 2004; Levy et al., 2006). Here, we explore whether a positive outlook of one's health and energy is related to better health outcomes 20 years later.

According to stereotype embodiment theory, age stereotypes are internalized when their integration from the prevailing culture leads to self-perceptions that influence functioning and health (Levy, 2009). While it is common for older adults to embody negative age stereotypes and consequently suffer detrimental health outcomes, the inverse holds true as well and those with positive self-perceptions of aging may experience positive health outcomes. For example, individuals with positive self-perceptions of aging practice more preventative health behaviors (e.g., taking prescribed medications, eating a healthier diet; Levy & Meyers, 2004). They may also recover faster from disease (i.e., acute myocardial infarction; Levy et al., 2006). Critically, those with more positive self-perceptions of their aging have even been found to live longer. In a pair of studies based on the Ohio Longitudinal Study of Aging and Retirement, researchers found that participants with more positive self-perceptions at baseline had better functional health over 20 years (Levy, Slade, & Kasl, 2002) and lived up to 7.5 years longer than those with negative self-perceptions of aging (Levy et al., 2002).

Relatedly, self-reported health and energy have been linked to later health outcomes. However, while self-perceptions of aging are often based on exogenous factors (i.e.,

stereotypes), self-reported health and energy are based on more endogenous factors (i.e., biomarkers, internal sensations). In epidemiology, self-reported health measures have often been used to evaluate perceived health status. These subjective measures are believed to reflect a person's integrated perception of health, including its biological, social, and psychological facets, thus they may be more sensitive in health monitoring than external measures of health (Miilunpalo et al., 1997). Several studies have found that those who rate their health more negatively have an increased risk of mortality (Mossey & Shapiro, 1982; Idler & Benyamini, 1997; Walker et al., 2004; Benyamini & Burns, 2020). For example, Lee (2000) found that older adults who judged their health less favorably were more likely to experience functional ability declines (i.e., difficulty managing money, bathing/dressing, doing heavy housework) and death in a seven year follow-up. On a similar note, an individual's perception of their energy level may be an indicator of global health status (Ehrenkratz et al., 2021). To our knowledge, only one study has examined whether self-reported energy levels are predictive of health and mortality. Sprague and colleagues (2021) found that those who reported more energy declines over eight years were at higher risk of mobility disability (i.e., difficulty walking ¼ mile) and death.

What factors might account for the relationship between self-reported health and energy and future health outcomes? Many argue that these self-ratings are essentially self-fulfilling prophecies. Those who rate their health and energy more highly may be more physically and socially active (Benyamini et al., 2011; Ehrenkratz et al., 2021). As such, they may accumulate more physical and psychological resources that contribute to their better health and well-being over time (Wurm et al. 2013). In contrast, negative outlooks could lead to a vicious cycle that consumes resources and accelerates disease processes (Benyamini & Burns, 2020). For example, those who report having poorer health and lower levels of energy, especially due to their age,

may not engage in preventative health behaviors (i.e., exercising more, quitting smoking) because they lack motivation or feel their condition is inevitable (Lachman et al., 2018; Levy & Myers, 2004).

While this past research is invaluable, it is not as comprehensive as it could be. Most of these studies were only conducted with older adults, usually those 60 years old and older. They included participants from specific regions of the United States, and outside of the work by Levy and colleagues (2002), longitudinal studies only had a follow-up period of 5-10 years on average. Furthermore, while health behaviors have been correlated with both self-rated health/energy and health outcomes previously (Benyamini, 2011; Benyamini et al., 2011; Ehrenkratz et al., 2021), to our knowledge, they have not been formally tested as mediators for this relationship. In the current work, we aimed to address these gaps by using a nationally representative, full adult lifespan sample that spans 20 years. Health and energy outlooks were collected in the 1990s and we measured health outcomes 20 years later in the 2010s. We hypothesized that those with more positive outlooks of their health and energy would experience fewer increases in health limitations and chronic conditions over time compared to those with more negative outlooks. Given differences in health (Yashin et al., 2007; Macintyre et al., 1996; Davies et al., 2018) and the potential for outlook to differentially affect individuals from different sociodemographic backgrounds, we investigated the moderating effect of age, sex and education on the observed relationship. Next, we tested for mediation and predicted that health behaviors (physical activity and smoking) would serve as an underlying mechanism for the relationship between health/energy outlook and health outcomes. Finally, as a follow-up analysis, we examined whether outlook would predict mortality.

Method

Transparency and Openness

We report how we determined our sample size and describe all manipulations and measures in the study. The de-identified data, materials, and analytic code are available online (see Author's Note). This study's design, hypotheses, and analytic plan were not pre-registered.

Participants

Data were drawn from the first (M1: 1995-1996), second (M2: 2004-2005), and third (M3: 2013-2014) waves of the Midlife in the United States (MIDUS) Study, a nationally representative longitudinal cohort study designed to investigate the biopsychosocial factors that influence the physical, cognitive, and mental health of individuals across the adult lifespan (Radler & Ryff, 2010). Participants were included in our sample if they had health and energy outlook data at M1, physical activity and smoking data at M2, and health outcome data at M3. Thus, our analysis sample consisted of 1,881 individuals (M_{age} = 46.5, range = 24-74, 95% white, 52.4% women; see Table 1). Participants that did not have health outcome data at M3 (n = 903) were excluded from analysis and were older, less educated, had more negative outlooks and poorer baseline health outcomes on average (see Supplemental Table 1). The MIDUS Study was approved by the University of Wisconsin-Madison Institutional Review Board (Protocol # 2016-1051).

Measures

Health and Energy Outlook. Outlooks, or individuals' viewpoints or attitudes about their health and energy, were measured at M1. Participants were asked to rate their health and

energy on a scale from 0 to 10 at different time points – the past and the future. For example, the past health prompt asked, “Looking back 10 years ago, how would you rate your health at that time?”, while the future energy prompt asked, “How energetic do you think you will be 10 years from now?” (see Supplemental Table 2 for full prompts). To create an outlook measure that represented a 20 year difference, modelling the actual gap between M1 and M3 outcomes, we computed a difference score by subtracting past from future ratings (for similar uses of difference scores, see Sprangers et al., 1999; Gunasekara et al., 2012; Meyer et al., 2013; Vogelsang, 2014). Thus, if participants thought their health/energy would decline over the 20 years between the past and the future, they earned a negative score, indicating a negative outlook. However, if participants thought their health/energy would increase between the past and the future, they earned a positive score, indicating a positive outlook. Outlooks ranged from -10 to 10.

Health Limitations. Health limitations were measured at M1 and M3 using nine items from the Physical Functioning subscale of the SF-36 Health Survey (Stewart et al., 1992). Participants were given a list of everyday activities—climbing stairs, carrying groceries, bathing/dressing, bending/kneeling, walking more than one mile, walking one block, walking several blocks, moderate activity (e.g., bowling), vigorous activity (e.g., running)—and had to rate how much their health limited them in those activities on a scale from 1 (not at all) to 4 (a lot). We averaged participants’ ratings of each activity to create one health limitation score and transformed these values using the formula ((Health Limitations Value - 1) / 3) * 100, so that they ranged from 0 to 100 (as suggested by the developer of the SF-36 in Stewart et al., 1992), where higher numbers indicate greater health limitations (see Supplemental Figure 1A for health limitations distribution).

Chronic Conditions. Chronic conditions were measured at M1 and M3. Participants were asked whether they experienced any of 31 possible conditions, including asthma, thyroid disease, stomach trouble, sleep problems, and high blood pressure. Responses were coded as "no" = 0 and "yes" = 1. Scores ranged from 0 to 31, such that higher numbers indicate a greater number of chronic conditions (see Supplemental Figure 1B for chronic conditions distribution).

Health Behaviors. We evaluated two health behaviors – physical activity and smoking – at M2 as possible mediators. For the physical activity measure, participants were asked how often they engaged in moderate and vigorous physical activity over the summer and winter months on a scale from 1 (never) to 6 (several times a week). We averaged these frequencies to create one physical activity score, where higher numbers indicate more frequent physical activity. For the smoking measure, participants were asked (1) if they have ever smoked cigarettes regularly and (2) if they currently smoke cigarettes regularly. Current smokers were given a 0, those who have smoked regularly in the past (but not currently) were given a 1, and those who have never smoked regularly were given a 2. Thus, higher numbers indicate less smoking.

Covariates. Age, sex, and education were included as covariates in our models. M1 health limitations and M1 chronic conditions were also included as covariates in order to establish a baseline and measure residual change in those health outcomes.

Mortality. The MIDUS Core Mortality data includes information on all known MIDUS Core decedents through the end of 2022. Mortality tracing was conducted by the University of Wisconsin Survey Center. Methods included mortality closeout interviews during fielding surveys, National Death Index searches, online tracing resources, and ongoing longitudinal sample maintenance (Ryff et al., 2024). Of the 1,881 participants in our study

sample, 340 (18%) died over the follow-up period. The average age of death was 80.57 years (*SD* = 9.63).

Statistical Analyses

Analyses were performed using SPSS (IBM Corp, 2023) and R (v4.2.0; R Core Team, 2022). An α of 0.05 was used as a threshold for statistical significance in all analyses (i.e., $p < .05$). Multiple linear regression was used to assess the relationship between health/energy outlook and health outcomes longitudinally. M3 health limitations and M3 chronic conditions were the outcome variables and health/energy outlook, age, sex, education, and baseline health outcomes (M1 health limitations, M1 chronic conditions) were predictors, respectively. Age, sex, and education were entered as interaction terms in separate models. Predictors and moderating variables were mean centered prior to analysis.

For visualization purposes, we created positive (those who predicted health/energy maintenance and improvement) and negative (those who predicted health/energy decline) outlook groups. A series of t-tests were used to compare mean differences between these outlook groups across time. Paired-samples t-tests evaluated within person changes in health limitations and chronic conditions from M1 to M3. Independent-samples t-tests evaluated between group (positive vs. negative) differences at each time point and variance in the twenty-year change between those with positive and negative outlooks.

Parallel mediation using ordinary least squares path analysis was conducted with the PROCESS Macro for SPSS (Version 4.2; Hayes, 2022). M1 health and energy outlook were predictors, M2 health behaviors (physical activity and smoking) were mediators, and M3 health limitations and chronic conditions were outcome variables in respective models. We controlled

for baseline health limitations in respective models to measure residual change in health limitations. Demographic variables were added as covariates. The indirect effect was tested with 5,000 bootstrap resamples.

Cox proportional hazard regressions were used to evaluate the relationship between health/energy outlook and mortality. We used age at death (i.e., attained age) as the time metric and status (alive, deceased) as the event. We tested the proportionality assumption across the predictors and found all of them to be proportional. Model 1 included health and energy, respectively, and subsequent models included other covariates that were added sequentially: sex and education (Model 2) and health limitations and chronic conditions (Model 3).

Results

Descriptive Statistics

Table 1 summarizes sample demographics and descriptive statistics, while Table 2 provides correlations for key variables. Overall, health and energy outlook scores were only slightly negative, -0.94 and -1.45, respectively, indicating that, on average, participants expected their health and energy to marginally decrease over time. Health limitation scores increased from 12 to 29 from M1 to M3 ($t(1880) = -28.58$, $p < .001$, 95% CI = [-18.25, -15.91]) and chronic conditions increased from 2 to 3 over the same time period ($t(1880) = -13.55$, $p < .001$, 95% CI = [-.907, -.677]).

Health Limitations

Participants who expected their health to improve or stay the same ($n = 744$) had fewer health limitations at M1 ($M = 8.82$, $SD = 15.61$) and M3 ($M = 24.30$, $SD = 27.80$) than those who

expected their health to worsen (*n* = 1137; M1: *M* = 14.65, *SD* = 19.71; M3: *M* = 32.77, *SD* = 29.62), M1: *t*(1879) = 7.13, *p* < .001, 95% CI = [4.23, 7.44]; M3: *t*(1879) = 6.30, *p* < .001, 95% CI = [5.83, 11.11] (see Figure 1a). Longitudinally, linear regression revealed that health outlook was negatively associated with residual change in health limitations, *b* = -.575, *SE* = .262, *t* = -2.20, *p* = .028 (see Table 3). A t-test confirmed that those with a positive outlook (*M* = 15.48, *SD* = 23.83) had less change over time compared to those with a negative outlook (*M* = 18.12, *SD* = 27.16), *t*(1879) = 2.22, *p* = .013, 95% CI = [.308, 4.97]. In other words, those with more positive outlooks of their health reported fewer health limitations at both occasions and experienced less change in those limitations over 20 years than those with a negative outlook.

Similarly, participants who expected their energy to increase or stay the same (*n* = 623) had fewer health limitations at M1 (*M* = 9.34, *SD* = 16.36) and M3 (*M* = 24.59, *SD* = 28.29) than those who expected their energy to decrease (*n* =1258; M1: *M* = 13.83, *SD* = 19.18; M3: *M* = 31.81, *SD* = 29.37), M1: *t*(1879) = 5.29, *p* < .001, 95% CI = [2.83, 6.16]; M3: *t*(1879) = 5.15, *p* < .001, 95% CI = [4.47, 9.98] (see Figure 1b). Longitudinally, linear regression showed that energy outlook was negatively associated with residual change in health limitations, *b* = -.579, *SE* = .253, *t* = -2.29, *p* = .022 (see Table 3). Accordingly, a t-test revealed that those with a positive outlook (*M* = 15.25, *SD* = 24.98) had less change over time than those with a negative outlook (*M* = 17.98, *SD* = 26.34), *t*(1879) = 2.15, *p* = .016, 95% CI = [.243, 5.22]. Thus, those with more positive outlooks of their energy reported fewer health limitations at both time points and experienced less change in those limitations over two decades compared to those with more negative outlooks.

Figure 1

Health Limitations Results

Note. Participants with more positive health (a) and energy outlooks (b) experienced fewer health limitations at M1 and M3 and less change in those limitations compared to those with negative outlooks.

Chronic Conditions

Participants who expected their health to improve or stay the same (n = 744) had fewer chronic conditions at M1 (M = 2.23, SD = 2.30) and M3 (M = 3.00, SD = 2.60) than those who expected their health to worsen (n = 1137; M1: M = 2.62, SD = 2.49; M3: M = 3.42, SD = 2.89), M1: $t(1879) = 3.40$, $p < .001$, 95% CI = [.163, .610]; M3: $t(1879) = 3.21$, $p < .001$, 95% CI = [.164, .678] (see Figure 2a). Longitudinally, linear regression revealed that health outlook was negatively associated with chronic conditions after controlling for demographic variables (b = -.090, SE = .028, t = -3.22, p = .001), but not baseline chronic conditions (b = -.032, SE = .025, t = -1.29, p = .196; see Table 3). A follow-up t-test showed that there was no difference in the amount of change for those with positive and negative outlooks, $t(1879) = .293$, $p = .385$, 95%

CI = [-.195, .263]. Thus, health outlook predicted the number of chronic conditions at both time points, but not change in those conditions over time.

Participants who expected their energy to increase or stay the same (n = 623) had fewer chronic conditions at M1 (M = 2.09, SD = 2.25) and M3 (M = 2.98, SD = 2.68) than those who expected their energy to decrease (n = 1258; M1: M = 2.65, SD = 2.48; M3: M = 3.39, SD = 2.82), M1: $t(1879) = 4.70$, $p < .001$, 95% CI = [.323, .785]; M3: $t(1879) = 3.04$, $p = .001$, 95% CI = [.146, .681] (see Figure 2b). Longitudinally, linear regression showed that energy outlook was negatively associated with chronic conditions after controlling for demographic variables (b = -.094, SE = .027, t = -3.47, $p < .001$), but not baseline chronic conditions (b = -.018, SE = .024, t = -.777, p = .437; see Table 3). Accordingly, a t-test revealed that there was no difference in the amount of change for those with positive and negative outlooks, $t(1879) = -1.13$, $p = .129$, 95% CI = [-.384, .103]. In other words, energy outlook predicted the number of chronic conditions at both time points, but not change in those conditions over time.

Figure 2

Chronic Conditions Results

Note. Participants with more positive health (a) and energy outlooks (b) had fewer chronic conditions at M1 and M3. However, outlook did not predict change in chronic conditions over time.

Interactions with Age, Sex, and Education

Health Limitations

We added interaction terms to the regression models for each of the covariates separately. Age did not interact with health (b = .006, SE = .022, t = .251, p = .802) or energy (b = -.015, SE = .021, t = -.699, p = .485) outlook effects on health limitations. Likewise, sex did not interact with health (b = .050, SE = .510, t = .098, p = .922) or energy (b = -.047, SE = .495, t = -.094, p = .925) outlook effects on health limitations. Thus, men and women from across the adult lifespan – not just older adults – benefitted from having a more positive health and energy outlook (see Supplemental Table 3).

While there wasn't an education by energy outlook interaction (b = -.002, SE = .100, t = -.024, p = .981), there was a significant education by health outlook interaction, b = .317, SE =

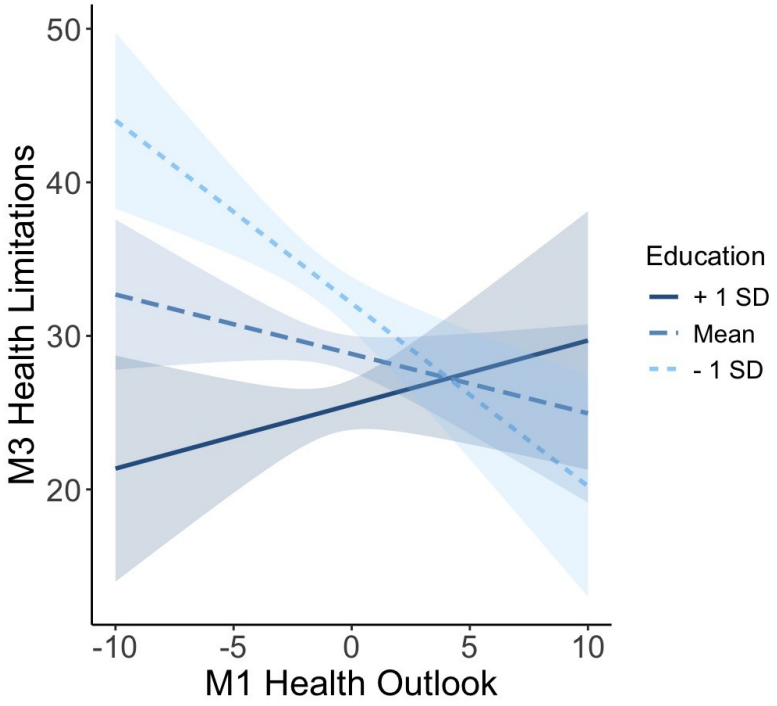
.095, $t = 3.35$, $p < .001$ (see Table 2). We used simple slopes analysis to probe this interaction and found that the relationship was only significant for those with lower levels of education ($b = -1.19$, $p < .001$, 95% CI = [-1.82, -0.57]), not moderate ($b = -0.39$, $p = .150$, 95% CI = [-0.91, 0.14]) or higher ($b = 0.42$, $p = .290$, 95% CI = [-0.36, 1.19]) levels of education (see Figure 3). Thus, a positive health outlook was more predictive of health in those with lower educational attainment; these individuals had health limitations that were more comparable to those with higher educational attainment.

Chronic Conditions

We saw a similar pattern of results for chronic conditions. Age did not interact with health ($b = -.0003$, $SE = .002$, $t = .164$, $p = .870$) or energy ($b = -.002$, $SE = .002$, $t = -.982$, $p = .326$) outlook effects on chronic conditions. Likewise, education did not interact with health ($b = .017$, $SE = .009$, $t = 1.85$, $p = .064$) or energy ($b = .004$, $SE = .010$, $t = .368$, $p = .713$) outlook effects. Finally, sex did not interact with health ($b = .050$, $SE = .049$, $t = 1.03$, $p = .302$), or energy ($b = .024$, $SE = .047$, $t = .500$, $p = .618$) outlook effects on chronic conditions. See Supplemental Table 3 for full results.

Figure 3

Education by Health Outlook Interaction



Note. Interaction plot showing the moderating effect of education on M3 health limitations (controlling for baseline health limitations). Lines represent low (1 SD below the mean), moderate (mean), and high (1 SD above the mean) levels of education with 95% confidence bands. There was a significant interaction, such that a positive health outlook was more predictive of having fewer health limitations in those with lower educational attainment.

Mediation Analysis

Health Limitations

Parallel mediation analysis revealed that health behaviors partially mediate the relationship between health outlook and change in health limitations (c': b = -.857, SE = .269, t = -3.19, p = .002), accounting for 16.8% of the variance (see Figure 4a). Health outlook was not associated with physical activity (a_1: b = .023, SE = .014, t = 1.65, p = .098), but it was positively associated with less smoking (a_2: b = .023, SE = .008, t = 2.94, p = .003). Physical activity (b_1: b

= -2.97, *SE* = .456, *t* = -6.51, *p* < .001) and less smoking (b_2: *b* = -4.72, *SE* = .811, *t* = -5.82, *p* < .001) were negatively associated with change in health limitations. The 95% bootstrap confidence interval for the smoking indirect effect (*CI* = -.198, -.027) did not include zero, suggesting smoking is a significant mediator of the observed relationship. The physical activity indirect effect was not significant (*CI* = -.153, .013). In other words, having a positive health outlook predicts positive health behaviors (less smoking), which in turn predict fewer increases in functional health limitations in the future.

Parallel mediation analysis revealed that health behaviors partially mediate the relationship between energy outlook and change in health limitations (c': *b* = -.825, *SE* = .258, *t* = -3.20, *p* = .001), accounting for 16.8% of the variance (see Figure 4b). Energy outlook was positively associated with physical activity (a_1: *b* = .033, *SE* = .013, *t* = 2.49, *p* = .013) and less smoking (a_2: *b* = .020, *SE* = .007, *t* = 2.74, *p* = .006). Physical activity (b_1: *b* = -2.88, *SE* = .452, *t* = -6.38, *p* < .001) and less smoking (b_2: *b* = -3.64, *SE* = .822, *t* = -4.43, *p* < .001) were negatively associated with change in health limitations. The 95% bootstrap confidence interval for the total indirect effect (*CI* = -.274, -.070) did not include zero, suggesting physical activity and smoking are significant mediators of the observed relationship. In other words, having a positive energy outlook predicts positive health behaviors (more frequent physical activity, less smoking), which predict fewer increases in health limitations 20 years later.

Chronic Conditions

Parallel mediation analysis revealed that health behaviors partially mediate the relationship between health outlook and chronic conditions (c': *b* = -.082, *SE* = .028, *t* = -2.91, *p* = .004), accounting for 9.7% of the variance (see Figure 4c). Health outlook was positively associated with physical activity (a_1: *b* = .029, *SE* = .013, *t* = 2.16, *p* = .031) and less smoking (a_2:

b = .020, *SE* = .007, *t* = 2.63, *p* = .009). Physical activity (b_1: *b* = -.096, *SE* = .049, *t* = -1.96, *p* = .050) and less smoking (b_2: *b* = -.311, *SE* = .087, *t* = -3.55, *p* < .001) were negatively associated with chronic conditions. The 95% bootstrap confidence interval for the smoking indirect effect (*CI* = -.013, -.001) did not include zero, suggesting smoking is a significant mediator of the observed relationship. The physical activity indirect effect was not significant (*CI* = -.008, .003). In other words, having a positive health outlook predicts positive health behaviors (less smoking), which in turn predict fewer chronic conditions in the future.

Parallel mediation analysis revealed that health behaviors partially mediate the relationship between energy outlook and chronic conditions (c': *b* = -.083, *SE* = .027, *t* = -3.07, *p* = .002), accounting for 11.4% of the variance (see Figure 4d). Energy outlook was positively associated with physical activity (a_1: *b* = .035, *SE* = .013, *t* = 2.75, *p* = .006) and less smoking (a_2: *b* = .024, *SE* = .007, *t* = 3.40, *p* < .001). Physical activity (b_1: *b* = -.094, *SE* = .049, *t* = -1.91, *p* = .056) and less smoking (b_2: *b* = -.305, *SE* = .088, *t* = -3.49, *p* < .001) were negatively associated with chronic conditions. The 95% bootstrap confidence interval for the smoking indirect effect (*CI* = -.014, -.002) did not include zero, suggesting smoking is a significant mediator of the observed relationship. The physical activity indirect effect was not significant (*CI* = -.008, .0001). In other words, having a positive energy outlook predicts positive health behaviors, which predict fewer chronic conditions 20 years later.

Figure 4

Parallel Mediation Models

Note. Path diagrams of the mediating effects of health behaviors on health outcomes. a, b, c' and c are path coefficients representing unstandardized regression weights. The a paths represent the effect of outlook on health behaviors. The b paths represent the effect of health behaviors on health outcomes. The c' paths represent the direct effect of outlook on health outcomes. The c paths represent the total effect of outlook on health outcomes. *p < 0.05, **p < 0.01,***p < 0.001.

Survival Analysis

Participants' energy outlook, but not health outlook (HR = 1.04, 95% CI [0.99, 1.09], p = .118), was associated with a decreased risk of mortality. Model 1 showed that every one point increase in energy outlook was associated with a 5.9% decrease in mortality risk, HR = 0.943, 95% CI [0.90, 0.99], p = .017. This relationship was only slightly attenuated after controlling for demographics (Model 2: HR = 0.951, 95% CI [0.91, 0.99], p = .041). Unsurprisingly, this association dropped to a non-significant 1.6% decrease in mortality risk after adding baseline health limitations and chronic conditions (Model 3: HR = 0.984, 95% CI [0.94, 1.03], p = .518). Thus, while energy outlook is related to mortality, baseline health is a stronger predictor of one's survival. See Supplemental Table 4 for full survival analysis results.

Discussion

The aim of the present study was to investigate whether having a positive health and energy outlook is associated with better health outcomes two decades later. We found that those with more positive outlooks had fewer increases in health limitations over time. Education interacted with this relationship, such that having a positive health outlook was more predictive

of fewer health limitations among those with lower levels of education. Age and sex did not interact with this relationship, suggesting that men and women from across the lifespan may benefit from having positive outlooks of their health and energy. Health behaviors (physical activity and smoking) partially mediated the relationship between health and energy outlook and health outcomes. Finally, having a positive energy outlook was associated with a 6% decrease in mortality risk before accounting for baseline health.

Our hypothesis regarding change was not confirmed with chronic conditions. Positive health and energy outlook predicted the number of chronic conditions at M1 and M3, but not change in those conditions over time. Health limitations may fluctuate depending on attitudes and behaviors; a positive health/energy outlook could motivate individuals to exercise more, resulting in maintenance of functional health. In contrast, chronic conditions are, by definition, persistent and although outlook is related to the number of conditions and may affect adherence to treatment (e.g., taking blood pressure medicine for hypertension or statins for high cholesterol), it is unlikely to eliminate a chronic condition. Thus, if you have a chronic condition at M1, you are very likely to have it M3, regardless of your outlook. This is what likely limits the predictive power outlook has on change in chronic conditions.

Additionally, we found some differences between health and energy outlook. While most of our results were the same between the two outlooks, only health outlook interacted with education to predict health limitations and only energy outlook was associated with decreased risk of mortality (before accounting for baseline health). Health and energy outlook are significantly correlated ($r = .468$, $p < .001$) and self-rated health and energy are treated similarly in the literature, but they may differ conceptually. For example, self-rated energy may be highly influenced by feelings of fatigue or exhaustion, which may or may not be tied to health

conditions (Sprague et al., 2021). Thus, a negative energy outlook would indicate expectations for a decline in vitality or vigor, whether or not one also expects a decline in health. In contrast, health outlook may reflect a more general assessment of overall health (Miilunpalo et al., 1997). These subtle differences may be what are driving the inconsistent results between health and energy outlook.

We found that having a positive health outlook was more important for those with lower levels of education. Research has shown that educational attainment has a large influence on health. For example, those with higher levels of education experience better mental and physical health and lower incidence of disability and mortality compared to those with lower levels of education (Ross & Wu, 1995). This association is often attributed to various socioeconomic and lifestyle factors; individuals with lower education are less likely to have a job or health insurance, and smoking and physical inactivity is more prevalent among this population (Woolf & Braverman, 2011). As higher education is a protective factor in itself, the additional benefit of a positive health outlook is likely limited among those with high educational attainment. According to the compensatory leveling hypothesis, the health benefits of a college degree would be least pronounced among the most advantaged. Rather, those who are disadvantaged are the ones who stand the most to gain (Schafer et al., 2013). This likely explains why the health limitations of those with a lower education but positive health outlook looked more similar to those with a higher education; without the intrinsic benefits of a higher education, positive outlook was an important predictor of better functional health and individuals with lower education had more room for improvement.

We identified one possible mechanism for the relationship between a positive health and energy outlook and future health outcomes. Positive outlooks were more predictive of positive

health behaviors (more frequent physical activity, less smoking), which were in turn more predictive of fewer health limitations and chronic conditions. However, there are likely many other complex factors at play in this relationship. For example, in the self-perceptions of aging literature, one study found that will to live, or the belief that the benefits of one's life outweighs the hardships, partially mediated the relationship between self-perceptions and survival (Levy et al., 2002). When tested experimentally, researchers found that older adults subliminally exposed to positive age stereotypes were significantly more likely to accept life-prolonging medical intervention in a hypothetical scenario than those exposed to negative age stereotypes (Levy et al., 2000). Thus, it may be that having a positive view of aging, or in our case, a positive outlook of one's health and energy, tips the will-to-live balance and leads individuals to consider the various benefits of life instead of the hardships.

Cognitive processes such as these certainly may be at play in self-rated health and energy judgments as well. One study found that the relationship between self-rated health and mortality was weaker in individuals with cognitive impairment. As cognitive ability declined, age, sex, and physical functioning became more important predictors of mortality, likely because those with greater cognitive impairment are less able to integrate the elements that contribute to self-rated health (i.e., past health behaviors, family history, physical activity; Walker et al., 2004). Thus, more research is needed to further elucidate the mechanisms involved in the relationship between health and energy outlook and later health outcomes. Our work suggests that outlook is a useful tool that gets at the internal cognitive and physical processes that cannot necessarily be measured objectively. Self-rated health and energy outlook could very well be "finely tuned indicator(s) of physiological well-being" (Mossey & Shapiro, 1982) that demonstrate a robust awareness of aging (Diehl et al., 2014).

Despite its strengths, our study had some limitations that should be addressed. First, we cannot evaluate the reciprocal relationship between outlook and health outcomes. Because participants' health and energy outlooks were only assessed at M1, we cannot determine if one's health status predicts their outlook longitudinally. Similarly, while we examined health behaviors as a mediator at a separate, later time point to address mechanisms, we cannot rule out the possibility of reverse causality; engaging in healthy behaviors could lead individuals to have more positive health and energy outlooks. Second, while we control for baseline health limitations and chronic conditions in our study, there are likely other unmeasured variables that could be contributing to our results. Future work should investigate additional baseline factors that could affect the relationship between health and energy outlook and health outcomes. Finally, there is the issue of selective attrition. Individuals with poorer health and more negative health and energy outlooks dropped out of the study after M1. This ultimately limits the generalizability of our results.

Overall, we found that those with a more positive outlook of their health and energy had better health outcomes twenty years later. These findings have important implications for interventions. Due to their pervasiveness, negative age stereotypes are highly entrenched in the makeup of our society. In fact, a meta-analysis of the behavioral outcomes of positive and negative age stereotypes found that negative effects were almost three times larger than positive effects (Meisner, 2012). Thus, targeting older adults' health and energy beliefs may be more effective than targeting general beliefs about aging. Interventions could focus on ending the "vicious cycle" and improving outlook by encouraging changes in health behaviors and social engagement. Additionally, as having a positive outlook was beneficial for adults from across the

lifespan, targeting these beliefs early (i.e., in younger and middle adulthood) may be the key to helping individuals live longer, healthier lives.

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Table 1

Participant Characteristics

Variables	Mean (*SD*)
Age	46.49 (11.10)
Sex	52.4% women, 47.6% men
Years of Education	14.23 (2.54)
Health Outlook	-0.94 (2.21)
Energy Outlook	-1.45 (2.30)
M2 Physical Activity	3.22 (1.29)
M2 Smoking	1.19 (.72)
M1 Health Limitations	12.34 (18.41)
M3 Health Limitations	29.42 (29.21)*
M1 Chronic Conditions	2.46 (2.42)
M3 Chronic Conditions	3.26 (2.79)*

Note. Health and Energy outlooks ranged from -10 to 10. Physical Activity ranged from 1 to 6. Smoking ranged from 0 to 2. Health Limitations ranged from 0 to 100. Chronic Conditions ranged from 0 to 31. *There was a significant increase in health limitations and chronic conditions between M1 and M3.

Table 2

Correlations Between Key Study Variables

	1	2	3	4	5	6	7	8	9	10
Factors	*r*	*r*	*r*	*r*	*r*	*r*	*r*	*r*	*r*	*r*
1. Health Outlook	--									
2. Energy Outlook	.468***	--								
3. Age	-.140***	-.183***	--							
4. Sex	.031	.017	-.059*	--						
5. Education	.131***	.067**	-.030	-.136***	--					
6. M2 Physical Activity	.078***	.101***	-.217***	-.126***	.056*	--				
7. M2 Smoking	.084***	.085***	.021	-.018	.225***	.056*	--			
8. M1 Health Limitations	-.239***	-.259***	.183***	.172***	-.162***	-.176***	-.078***	--		
9. M3 Health Limitations	-.189***	-.202***	.335***	.138***	-.224***	-.219***	-.162***	.484***	--	
10. M1 Chronic Conditions	-.120***	-.155***	.155***	.168***	-.108***	-.089***	-.107***	.413***	.360***	--
11. M3 Chronic Conditions	-.115***	-.125***	.239***	.149***	-.150***	-.127***	-.107***	.346***	.527***	.533***

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

Table 3

Regression Models for M3 Health Limitations and M3 Chronic Conditions

			M3 Health Limitations		**M3 Chronic Conditions**	
		Predictors	***b* (*SE*)**	***95% CI***	***b* (*SE*)**	***95% CI***
Health Outlook Models	Model 1	(Intercept)	6.32 (4.61)	-2.73, 15.36	.640 (.441)	.225, 1.50
		M1 Health Outlook	**-.575 (.262)***	-1.09, -.062	-.032 (.025)	-.080, .016
		M1 Age	**.677 (.051)*****	.576, .777	**.041 (.005)*****	.031, .050
		M1 Sex	**3.96 (1.14)*****	1.72, 6.20	**.375 (.109)*****	.162, .589
		M1 Education	**-1.59 (.224)*****	-2.03, -1.15	**-.088 (.021)*****	-.130, -.046
		M1 Health Limitations	**.622 (.032)*****	.559, .685	---	---
		M1 Chronic Conditions	---	---	**.558 (.023)*****	.513, .603
	Model 2	(Intercept)	**-16.14 (3.05)*****	-22.11, -10.16	**-.602 (.290)***	-1.17, -.033
		M1 Health Outlook	-.387 (.267)	-.910, .136	-.021 (.025)	-.071, .028
		M1 Age	**.680 (.051)*****	.579, .780	**.041 (.005)*****	.031, .050
		M1 Sex	**4.00 (1.14)*****	1.77, 6.24	**.376 (.109)*****	.162, .589
		M1 Education	**-1.60 (.224)*****	-2.04, -1.16	**-.088 (.021)*****	-.130, -.047
		M1 Health Limitations	**.618 (.032)*****	.555, .681	---	---
		M1 Chronic Conditions	---	---	**.559 (.023)*****	.514, .603
		M1 Health Outlook X M1 Education	**.317 (.095)*****	.132, .503	.017 (.009)	-.001, .035
Energy Outlook Models	Model 1	(Intercept)	6.88 (4.60)	-2.13, 15.90	.679 (.439)	-.183, 1.54
		M1 Energy Outlook	**-.579 (.253)***	-1.08, -.083	-.018 (.024)	-.065, .028
		M1 Age	**.671 (.052)*****	.570, .772	**.041 (.005)*****	.031, .050
		M1 Sex	**3.91 (1.14)*****	1.68, 6.15	**.370 (.109)*****	.157, .584
		M1 Education	**-1.62 (.223)*****	-2.06, -1.19	**-.091 (.021)*****	-.132, -.049
		M1 Health Limitations	**.620 (.032)*****	.556, .683	---	---
		M1 Chronic Conditions	---	---	**.559 (.023)*****	.514, .603

Model 2	(Intercept)	**-15.38 (3.07)*** **	-21.40, -9.37	**-.588 (.292)***	-1.16, -.015
	M1 Energy Outlook	**-.581 (.260)***	-1.09, -.071	-.016 (.024)	-.064, .032
	M1 Age	**.671 (.052)*** **	.570, .772	**.041 (.005)*** **	.031, .051
	M1 Sex	**3.91 (1.14)*** **	1.68, 6.15	**.370 (.109)*** **	.156, .583
	M1 Education	**-1.62 (.223)*** **	-2.06, -1.19	**-.090 (.021)*** **	-.132, -.049
	M1 Health Limitations	**.620 (.032)*** **	.556, .683	---	---
	M1 Chronic Conditions	---	---	**.559 (.023)*** **	.514, .603
	M1 Energy Outlook X M1 Education	-.002 (.100)	-.198, .193	.004 (.010)	-.015, .022

Note. M1 = MIDUS 1. M3 = MIDUS 3. *b* = unstandardized coefficient. *SE* = standard error. 95% CI = 95% confidence interval.

Significant regressions are bolded. *$p < .05$. ** $p < .01$. *** $p < .001$.