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Agency and subjective health from early adulthood to mid-life: evidence from the prospective Youth Development Study

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Received: 24 December 2021 / Accepted: 9 February 2022
Published online: 25 February 2022

Abstract
Understanding the determinants of subjective or self-rated health (SRH) is of central importance because SRH is a significant correlate of actual health as well as mortality. A large body of research has examined the correlates, antecedents, or presumed determinants of SRH, usually measured at a given time or endpoint. In the present study, we investigate whether individual mastery, a prominent indicator of agency, has a positive effect on SRH over a broad span of the life course. Drawing on longitudinal data from the Youth Development Study (n = 741), we examine the impacts of mastery on SRH over a 24-year period (from ages 21–22 to 45–46). The findings of a fixed effects analysis, controlling time-varying educational attainment, unemployment, age, obesity, serious health diagnoses, and time-constant individual differences, lead us to conclude that mastery is a stable predictor of SRH from early adulthood to mid-life. This study provides evidence that psychological resources influence individuals' subjective assessment of their health, even when objective physical health variables and socioeconomic indicators are taken into account.

1 Introduction

The present study investigates whether individual mastery, a prominent indicator of agency, influences self-rated health (SRH) over a broad span of the life course when physical and mental health conditions, socioeconomic status, and other relevant predictors that are associated with SRH, are controlled. In doing so, this research interrogates the relationship between subjective and actual health, the intrapersonal psychological dynamics that may support a subjective sense of health, and whether the impacts of agency on the subjective sense of health are stable from early adulthood to mid-life.

1.1 Self-rated health and actual health

Measures of subjective or self-rated health (SRH) are widely used in public health surveys, as they are easy to administer (usually with a single item) and have high validity. Numerous studies have found significant relationships between SRH and chronic disease conditions [1, 2], medical diagnoses, including cancer, cardiovascular disease, hypertension, and diabetes; as well as abnormalities in clinical indicators of health, such as blood pressure and glucose metabolism [3]. Significant relationships between SRH and various health-relevant experiences have also been documented, including activity limitations and dependency, pain, and psychological distress [1, 2]. Health behaviors, such as exercise, eating breakfast, and avoidance of smoking are also linked to SRH [1–3]. Being able to engage in such behaviors (e.g., running, swimming, etc.) may even be interpreted subjectively as evidence of good health. Given its high level of construct validity,

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Yamada et al. [3] argue that SRH is a highly comprehensive measure of good health, even more informative than many objective indicators. They note that it is difficult to gauge overall health given "mixed cases of deterioration and improvement in both clinical parameters and lifestyle habits" (p. 461).

Furthermore, many studies have shown that SRH predicts the timing of mortality, even when controlling indicators of physical health, such as the results of physical examination, functional limitations, health care utilization, and other mortality risk factors [4–6].

The research cited above suggests that SRH is a robust correlate of numerous health-related experiences and behaviors, as well as mortality. Obesity, widely considered a health-related condition and precursor of disease, also deserves consideration given its negative association with SRH [7–9]. Consistent with Link and Phelan's [10] classic conceptualization of socio-economic status (SES) as a fundamental cause of health, individuals with higher educational attainment and income report better SRH [2]. Body mass index is found to mediate negative associations between socio-economic origin and health-related adult indicators [11].

SHR may be considered a reflection of actual disease states and health-related behaviors, as an individual may be well aware of medical diagnoses, symptoms and physical limitations. It is reasonable to suppose that the onset of chronic health conditions as adults move toward mid-life would promote significant deterioration in SRH. In fact, maintaining high SRH may become quite challenging beyond the early stages of adulthood. However, looking beyond chronic illnesses and related phenomena, SRH may be subject to a wide range of additional influences, including changing societal norms about the meaning of health, social comparison processes, and intrapersonal dynamics. The latter, particularly surrounding the self-concept, are of central interest here. We contend that SRH is worthy of study not only because it is associated with disease and the timing of mortality, but also because of its meaning and importance as a cognitive state.

1.2 Agency and self-rated health

Since health is of central importance in individual lives and universally highly valued, SRH is arguably a highly salient and enduring component of the self-concept, linked to other dimensions of the self-image. Not surprisingly, SRH is positively related to self-esteem, a general estimation of one's personal value and worth [2]. The self-concept is a strong motivational force, as individuals attempt to enhance and protect key dimensions of the self [12]. Given the many valued outcomes that poor health may threaten, including an array of valued activities, social relationships, goals and plans, one would think that people with high SRH would be motivated to protect their health. Those with low SRH would be motivated to improve it.

Such motivation, and resultant behavior, underlie the dynamics of what Emirbayer and Mische [13] call "projective agency," "the imaginative generation by actors of possible future trajectories of action, in which received structures of thought and action may be creatively reconfigured in relation to actors' hopes, fears, and desires for the future" (pg. 971). Projective agency includes cognitions and actions that promote positive goals and diminish negative ones, including expectations or beliefs surrounding one's agentic capacity. While such a general agentic orientation and related behaviors may be viewed as universal human capacities, a vast corpus of literature in social psychology conceptualizes agency as a significant individual difference, indicated by variable psychological resources or traits that promote agentic action. Although these resources may be conceptually and empirically indistinct [14, 15], they have generally been studied in isolation. Separate literatures address self-efficacy [16], internal (vs. external) control orientation [17], self-concept of ability [18], aspirations and plans [19], optimism [14, 20], grit [21], and others.

In this study, we focus on an agentic psychological dimension that Pearlin and colleagues call mastery: "Mastery refers to the extent to which people see themselves as being in control of the forces that importantly affect their lives," ([22] pg. 340 see also Ref. [23]). The Pearlin Mastery Scale is found to be responsive to life experience [24, 25] and associated with multiple positive life outcomes, including socioeconomic attainments, well-being, and health [14]. The sense of mastery, or control, may be considered an essential motivational resource in coping with age-related and other life challenges [26]. It is plausible to assume that those who see themselves as "in control" would be more confident about being able to maintain SRH than those who believe they are subject to the whims of fate or external forces. Those with a stronger sense of control would presumably be more likely to spring into action when valued goals or self-concepts, such as SRH, are seriously compromised, and would be more likely to successfully preserve this valued attribute of self.

In their now-classic research, Pearlin et al. [22] found evidence that a sense of mastery lessened the capacity of a major stressor (job loss) to diminish mental health (as indicated by depressed mood). In other research by Pearlin and his team [24] mastery was found to partially mediate the effects of prior economic hardship on depression among older

adults; it also moderated the effect of late life economic hardship on depression, anxiety, and physical symptoms. The authors comment, "High mastery may lead to anticipatory coping (i.e., taking preventive steps to avoid a stressor or curb its development in the very beginning" [24] (pg.639). Similarly, Pearlin and Bierman [27] (pg. 327) refer to "anticipatory stressors, those that are anticipated or apprehended rather than operant." In the face of anticipatory health-relevant stressors (such as signs of vulnerability to disease), "anticipatory coping" may be especially important to preserving good health, and hence, SRH.

Not surprisingly, given the prominence of Pearlin's early research (e.g., 12,218 citations to date to [23]), mastery has been given central attention in the ensuing literature on stress, health and coping [27, 28]. Mastery is found to predict objective indicators of physical and mental health when socioeconomic status, race, and other relevant variables are controlled [29, 30]. Whereas Taylor and Carr [31] report that resilience had stronger effects on later life health outcomes than mastery (and other psychological resources), their measurement of the resilience construct included two indicators of mastery.

Confirming Pearlin's early findings, mounting evidence supports the conclusion that mastery is a significant coping resource, mediating and moderating the effects of stressors on mental health. For example, mastery was found to fully mediate the effect of skin tone on depression among Black adolescents [32]. It also partially mediated the effect of unemployment on depression in a cohort of young Australians, ages 20–24, studied for 8 years [33]. In a study of employed Canadian adults (18 and older), mastery moderated the association between financial strain and distress in a fixed-effects analysis of three waves of survey data drawn over four years [34].

While there is plentiful evidence that mastery supports both physical and mental health, we are not aware of research that interrogates the effect of mastery on SRH. We hypothesize that a high level of mastery supports the self-perception of being in good health. While the mechanisms through which mastery exerts its influence are beyond the scope of the present research, mastery could support SRH by increasing educational attainment, by dampening the deleterious effects of life stressors (such as unemployment), or by stimulating health-relevant behaviors, such as physical exercise [35], healthy eating, weight loss, and other actions. When illness strikes, those who have a stronger sense of mastery may be moved to restore this valued self-concept dimension through more consistent adherence to medical regimens. Mastery might also foster SRH indirectly through the objective indicators of good health that result from such behaviors.

1.3 Life course perspective on mastery and self-rated health

The life course perspective [36] fosters a holistic view of human lives. The key life course principles of life-span development (human development is "life long"), agency (people may be considered architects of their lives), and timing (developmental processes vary across stages of life) direct attention to the dynamics of personal change and development that potentially vary across stages of life. These principles raise the possibility that the effects of internal or external forces are not constant as individuals age. Guided by the principles of life-span development, agency, and timing, we examine whether mastery has stable or varying impacts on SRH as individuals move from early adulthood to middle age. It would be consistent with the growing body of research on health, stress, and coping, including samples of different age (some of which is cited above), to predict that mastery would protect health (and SRH) irrespective of life stage. However, it is also reasonable to suppose that dimensions of agency would have greater impact on SRH when health itself is threatened. While young people are generally healthy, chronic diseases (back problems, obesity, diabetes, etc.) begin to emerge as individuals approach their middle years.

Investigators have examined change in both SRH and mastery over the life course, but have not, to our knowledge, investigated the relationship between them over the long term. SRH is found to be significantly stable during adolescence [37], young adulthood [7], and adulthood [1], but SRH tends to decline at older ages with the advent of serious health challenges in later life [2, 38]. Mastery is found to be responsive to life events during adolescence and the transition to adulthood [25]. Among older adults in the Health Retirement Study, mastery declined with increasing functional limitations and depressive symptoms [39]. However, Idler and Carwright [40] find that disease conditions have weaker effects on mastery among the elderly, particularly those 65 and older, than among younger individuals. They suggest that such difference may relate to social comparison processes that are protective of SRH, as elderly people assess their own health in relation to those of the same age who are sicker than they are (or even deceased). The malleability of both agency and SRH prompts analysis of how change in mastery may affect SRH as individuals move through the life course.

Sargent-Cox and colleagues [35] have addressed the stability of the effect of mastery on physical health indicators. They report that within-person change in mastery over an eight-year period was associated with change in grip strength, pain, and functional status as well as mental health (distress). Because there were no differences in the effects of mastery

across cohorts who were in their early 20's, 40's, and 60's at baseline, this research indicates stability in health dynamics across life stages. While this study provides evidence that fluctuations in mastery are reflected in both physical functioning and distress, it does not speak to the persistent or altered effects of mastery on subjective health as individuals move through the life course.

1.4 The current study

The present research directly examines the influence of mastery on SRH by following a sample of young people for more than two decades, from early adulthood to mid-life. In doing so, we contribute to an understanding of the intrapersonal dynamics through which agency influences SRH. Although mastery has been linked to objective indicators of health in numerous studies, its relationship to SRH has been overlooked. Moreover, we are aware of no previous prospective longitudinal studies that have examined whether the impacts of mastery (or other agentic psychological resources) on SRH vary across these stages of the life course. Our contribution is therefore twofold: first, we examine whether mastery affects SRH across a broad span of the life course; second, we assess whether the impacts of mastery vary from early adulthood to mid-life.

Unlike most investigations of the determinants of self-rated health, we control several plausible time-varying confounders as well those that are time-invariant. We control time-varying education and age, significant predictors of SRH [38], and unemployment experience, a major life stressor and threat to SRH [41, 42]. A supplementary analysis includes time-varying income, another SES indicator that is significantly related to SRH [38]. We also include time-varying indicators of obesity and serious diagnosed health problems. Our fixed effects analysis of mastery and self-reported health, which also controls unobserved invariant characteristics, provides clear evidence that agency promotes SRH from early adulthood to mid-life. Given the validity of SRH as an indicator of objective health and the timing of mortality, significant impacts of mastery on SRH could have important ramifications well beyond this subjective dimension.

2 Method

2.1 Data source

We use longitudinal data from the Youth Development Study (YDS). Beginning in 1988, a sample of 1000 9th grade students in St. Paul, Minnesota, were surveyed in schools. The adolescents were administered yearly in-school surveys, and approximately 93% of respondents were retained by the fourth year of the study. Each study participant was then followed longitudinally through surveys (via paper or online) from 1992 to 2019, encompassing 16 waves of data collection following high school. Data from the YDS is available at: https://www.icpsr.umich.edu/web/ICPSR/studies/24881

For these analyses, we focused on 10 survey waves from 1995 to 2019 that included relevant study variables and covered the period from early adulthood to mid-life: wave 8 (age 21–22), wave 10 (age 24–25), wave 12 (age 26–27), wave 13 (age 28–29), wave 14 (age 29–30), wave 15 (age 30–31), wave 16 (age 31–32), wave 18 (age 35–36), wave 19 (age 37–38), and wave 20 (age 45–46). The analyses are limited to respondents who had not attritted from the study by wave 8 (about 78% of respondents were retained by age 21–22), the first wave of data utilized in our analysis. Prior research [43] has shown that the retained panel by wave 8 is similar to the wave 1 panel in socioeconomic background, family composition, and nativity, though the wave 8 panel includes a larger proportion of white youth and females. Importantly, the retained panel does not differ from the original sample in wave 1 indicators of mastery and precursors of attainment, such as school achievement and academic engagement, as well as work experiences during high school.

2.2 Time-varying measures

2.2.1 Self-reported health

Self-reported health is based on one item asking "in general, how would you say your health is?" Responses at each wave ranged on a 5-point scale from 1 (poor) to 5 (excellent).

2.2.2 Mastery (lagged by one wave)

Mastery was assessed with the Pearlin Mastery Scale [22]. Respondents were asked to rate their agreement on a four-point scale (strongly agree to strongly disagree) with 7 items (e.g., "I can do just about anything I really set my mind to do", "what happens to me in the future mostly depends on me", "I have little control over things that happen to me."). We averaged these items at each wave (alphas ranged from 0.78 to 0.85), with higher scores indicating stronger mastery. This predictor was lagged by one wave to correspond with the hypothesized causal order.

2.2.3 Educational attainment and unemployment (lagged by one wave)

Educational attainment was based on the respondent's highest degree attainment, coded as 1 (high school or less), 2 (some college), 3 (vocational or associates degree), 4 (Bachelor's degree), and 5 (graduate or professional degree). Unemployment was based on a life history calendar, indicating total months in the past year that respondents were not employed and were searching for work (ranging from 0 to 12 months). These predictors were also lagged to correspond with the hypothesized causal order (i.e., socioeconomic indicators as predictive of later SRH).

2.2.4 Obesity and diagnosed serious health problems

Obesity indicates whether the respondent had a BMI of 30 or higher in each wave [44], based on the following formula: weight in pounds/(height in inches)$^2 \times 703$. Health diagnoses were based on whether the respondents had *ever* been told by a doctor that they had the following: (1) high blood pressure; (2) ischemic heart disease or a heart attack; (3) stroke; (4) hepatitis/jaundice; (5) diabetes; (6) prolonged anxiety, depression or other mental health problems; (7) cancer; (8) chronic lung disease (emphysema, asthma, chronic bronchitis); (9) fractures or broken bones; (10) chronic digestive disease (ulcer, colitis, liver problems); (11) epilepsy or a seizure disorder; (12) chronic back problem; or (13) any other major disease, disability or handicap. For each diagnosis, respondents were coded 1 if they indicated "yes" in the current wave and in all subsequent waves. Obesity and diagnoses were based on wave 10 responses for the 3 waves in which these items were not assessed (i.e., waves [12–14]).

Inclusion of obesity and the health conditions enable us to capture the impacts of mastery on that part of SRH that is not a product of these objective health indicators. It should be noted that while obesity is measured contemporaneously, at the same time as SRH, the measures of health conditions refer to a broad span of time prior to each survey wave. Thus, they enable us to examine the respondents' understanding of their physical and mental health considered as a function of both current and past diagnoses.

2.3 Analytic strategy

We used fixed effects models [45] to assess whether changes in mastery influence changes in SRH with the panel data covering a 24-year period (i.e., from ages 21–22 to 45–46). Fixed effects models control for time-stable person effects by first subtracting each respondent's over-time mean values on both the outcome (i.e., SRH) and predictor variables (e.g., mastery) from the observed values at each wave [45]. These within-person deviations in SRH are then regressed on mastery, with age and other time-varying predictors included, such as educational attainment, unemployment, obesity, and diagnoses. Because all time-stable person effects on SRH are controlled in these models, there is no need to include observed time-invariant predictors.

We used the command "xtreg, fe" in STATA Version 17 [46] to estimate the models, and our results show robust standard errors that adjust for within-individual correlation. Our analyses are based on 741 respondents followed over 4,850 occasions. Due to sample attrition, SRH was observed among fewer respondents at ages 45–46 (434 respondents) compared to ages 24–25 (614 respondents). However, it is important to note that given our modeling strategy, YDS respondents do not need to be observed at all waves to contribute to the estimation; on average, respondents contributed more than 6 observation waves over the 24-year period.

3 Results

3.1 Descriptive statistics

Table 1 shows descriptive statistics based upon the pooled data. On average, over the 9 waves, SRH is reported to be between "very good" and "good." Fig. 1a shows mean changes in SRH by year (age), and, not surprisingly, reveals a steady downtick in the prevalence of those indicating better SRH as they grew older over the 24-year period. Yet, the sample means shown in Fig. 1a may conceal within-person variation in SRH over time. Decomposing the between- and within-person variation in SRH in this pooled dataset (between SD = 0.685; within SD = 0.556) indicates variation in SRH within individuals from ages 24–25 to 45–46.

On average, levels of mastery in this panel remained relatively high (mean = 3.18; SD = 0.462 in Table 1) and stable from ages 21–22 to age 37–38 (as shown in Fig. 1b). However, the stability in mean levels of mastery in Fig. 1b may hide within-person variation over time. When we decomposed the between- and within-person variation in mastery in the pooled sample (between SD = 0.374; within SD = 0.286), we again observed within-person variation in mastery over the period.

As shown in Table 1, on average, educational attainment over the period is between some college and a vocational/associates degree, and respondents averaged less than 1 month over the waves during which they were not employed and searching for work. During the observation period, obesity was recorded in approximately 24% of the waves, and in 18% of waves respondents were previously or currently diagnosed with high blood pressure, 21% of waves with anxiety and depression, 31% of occasions with broken bones, and 18% of waves with chronic back problems. The YDS panel, on average, experienced 10% of the period ever having received chronic lung disease diagnoses, and in 8% of waves were ever diagnosed with chronic digestive diseases. Diagnosed heart disease, diabetes, and cancers were measured in 5%, 4%, and 3% of waves, respectively.

In Table 2, we provide these descriptive statistics by age, which suggest relative stability in unemployment and significant increases in education and in the prevalence of obesity and serious health problems from young adulthood to midlife. For instance, obesity in the panel increased from 15% at ages 24–25 to 42% at ages 45–46, consistent with national prevalence statistics [44]. Also, over this same period of life, currently or previously diagnosed high blood pressure increased from 11 to 38%, diabetes from 1 to 11%, cancer from 1 to 7%, and chronic back problems from 10 to 29%.

Table 1 Descriptive statistics

Outcome	Mean	SD	Min	Max
Self-reported good health	3.688	0.850	1	5
Time-varying predictors				
Mastery (lagged by one wave)	3.181	0.462	1	4
Educational attainment (lagged by one wave)	2.666	1.262	1	5
Months unemployed (lagged by one wave)	0.639	2.185	0	12
Obesity	24%		0	1
Ever diagnosed health problem				
High blood pressure	18%		0	1
Ischemic heart disease	5%		0	1
Diabetes	4%		0	1
Prolonged anxiety, depression	21%		0	1
Cancer	3%		0	1
Chronic lung disease	10%		0	1
Broken bones	31%		0	1
Chronic digestive disease	8%		0	1
Epilepsy	1%		0	1
Chronic back problem	18%		0	1
Other serious problem	9%		0	1

N 4850 person-waves (741 individuals)

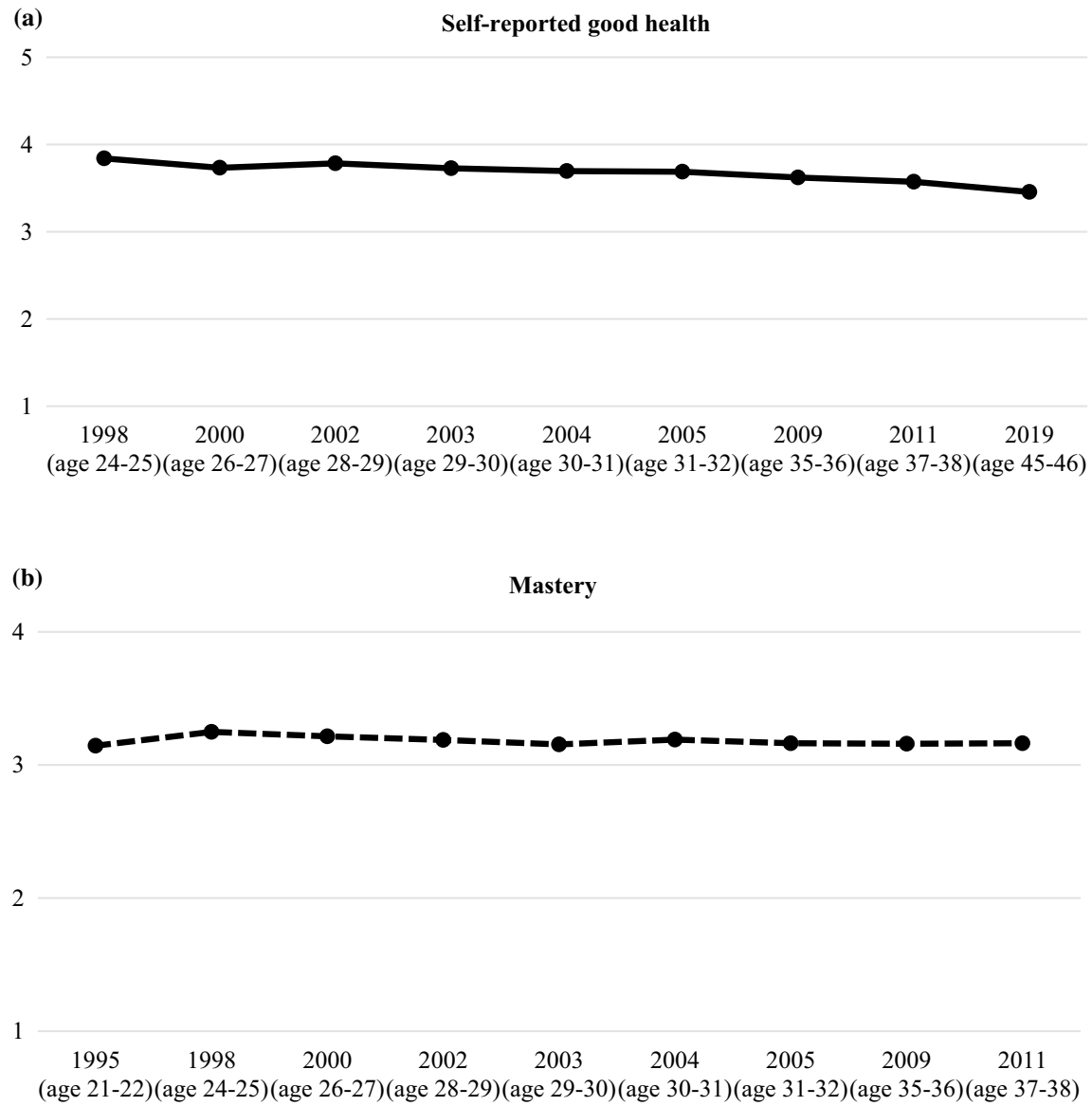

Fig. 1 **a** Mean self-reported good health by year (age). **b** Mean self-reported mastery by year (age)

3.2 Fixed effects results

In Table 3, we present estimates from three fixed effects models predicting changes in self-reported health. Mastery, educational attainment, and unemployment are lagged by one wave to ensure appropriate temporal ordering. Recall that we do not lag obesity and the diagnosed health variables in these models because we are trying to capture the impact of mastery on the sense of health that goes beyond being obese (or not) or having been diagnosed with specific health problems. Moreover, including these health conditions as contemporaneous predictors of SRH provides an especially stringent control for documenting lagged effects of mastery, because contemporaneous effects are generally more potent than lagged effects.

In Model 1, when respondents increased in their sense of mastery, they experienced an increase in subjective good health in the following wave, controlling age and all unobserved time-stable person effects. The mastery estimate (0.096) for the fixed effects model is statistically significant and corresponds to approximately an 11% standard deviation change in later subjective health. It is noteworthy that all age groups had significantly worse SRH than the

Table 2 Descriptive statistics (mean, proportion) by age

Age	SRH	MA	ED	UN	OB (%)	HBP (%)	IHD (%)	D (%)	AD (%)	C (%)	CLD (%)	BB (%)	CDD (%)	E (%)	CBP (%)	O (%)
21–22		3.14	1.84	0.50												
24–25	3.84	3.25	2.54	0.34	15	11	3	1	10	1	7	23	4	1	10	4
26–27	3.73	3.22	2.68	0.46												
28–29	3.78	3.19	2.76	0.30												
29–30	3.73	3.15	2.74	0.93												
30–31	3.70	3.19	2.77	0.89	26	18	5	5	21	2	9	29	7	1	18	8
31–32	3.69	3.16	2.83	0.75	27	20	6	6	27	4	11	34	9	2	22	11
35–36	3.62	3.16	2.96	0.74	32	22	7	6	33	3	12	41	13	2	24	13
37–38	3.57	3.16	3.07	0.87	31	26	7	7	38	4	14	42	13	2	26	17
45–46	3.46				42	38	7	11	40	7	15	43	14	2	29	23

SRH self-reported health, *MA* mastery, *ED* educational attainment, *UN* months unemployed, *OB* obesity, *HBP* high blood pressure, *IHD* ischemic heart disease, *D* diabetes, *AD* prolonged anxiety, depression, *C* cancer, *CLD* chronic lung disease, *BB* broken bones, *CDD* chronic digestive disease, *E* epilepsy, *CBP* chronic back problems, *O* other serious problems

Actual mean values at each age are presented for the three time-varying predictors in our fixed-effects models that are lagged by 1 wave (i.e., MA, ED, UN)

Table 3 Fixed effects models predicting self-reported health (N = 4850 person-waves; 741 individuals)

Time-varying predictors	Model 1		Model 2		Model 3	
	Est	SE	Est	SE	Est	SE
Mastery (lagged by 1 wave)	0.096**	(0.030)	0.094**	(0.030)	0.084**	(0.030)
Educational attainment (lagged by 1 wave)			0.060**	(0.020)	0.054**	(0.020)
Months unemployed (lagged by 1 wave)			− 0.001	(0.006)	0.0001	(0.006)
Obesity					− 0.214***	(0.041)
High blood pressure					− 0.115*	(0.053)
Ischemic heart disease					0.059	(0.158)
Diabetes					− 0.211**	(0.082)
Prolonged anxiety, depression					− 0.030	(0.049)
Cancer					− 0.295**	(0.109)
Chronic Lung Disease					− 0.048	(0.078)
Broken bones					0.041	(0.053)
Chronic digestive disease					− 0.030	(0.080)
Epilepsy					− 0.151	(0.234)
Chronic back problem					− 0.145*	(0.060)
Other serious problem					− 0.191**	(0.065)
Wave (reference = 1998, age 24–25)						
2000 (age 26–27)	− 0.124***	(0.033)	− 0.165***	(0.036)	− 0.161***	(0.036)
2002 (age 28–29)	− 0.065	(0.035)	− 0.115**	(0.039)	− 0.109**	(0.039)
2003 (age 29–30)	− 0.114***	(0.035)	− 0.168***	(0.039)	− 0.162***	(0.039)
2004 (age 30–31)	− 0.130***	(0.037)	− 0.186***	(0.043)	− 0.121**	(0.044)
2005 (age 31–32)	− 0.148***	(0.038)	− 0.204***	(0.043)	− 0.116**	(0.045)
2009 (age 35–36)	− 0.202***	(0.039)	− 0.260***	(0.045)	− 0.150**	(0.047)
2011 (age 37–38)	− 0.253***	(0.041)	− 0.318***	(0.047)	− 0.182***	(0.050)
2019 (age 45–46)	− 0.380***	(0.042)	− 0.448***	(0.049)	− 0.245***	(0.056)
Constant	3.532***	(0.097)	3.427***	(0.105)	3.543***	(0.104)
R2 (within)	0.033		0.036		0.060	

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

youngest group, age 24–25. The age coefficients were rather stable to age 29–30, decreased rather monotonically to age 37–38, and then dropped precipitously at age 45–46.

When we included lagged measures of educational attainment and months unemployed in Model 2, the lagged effect of changes in mastery on changes in self-reported health declined slightly (estimate = 0.094) but remained statistically significant, even after accounting for the positive effects of increasing educational attainment on health one wave later, the positive effects of age, and time-stable person effects. Months unemployed had no significant subjective health impact one wave later. It is interesting to note that the age estimates become appreciably more negative when educational attainment is added to the equation. Educational attainment, which promotes health [47], tends to rise with age (see Table 2), and may suppress the negative effects of aging on good self-rated health.

Finally, in Model 3, changes in mastery still had a statistically significant lagged effect on changes in self-reported good health (estimate = 0.084), after accounting for changes in educational attainment, unemployment, obesity, and diagnosed serious health problems, as well as age and unobserved time-stable person effects. Respondents reported significantly worse overall health on occasions when they were obese, and, not surprisingly, worse health when they had been diagnosed with high blood pressure, diabetes, cancer, chronic back problems, and other serious problems. Again, comparing Models 2 and 3, we see notable change in the coefficients representing age. All decline in magnitude; decreases in the predictive power of age are especially large by the mid-thirties when the significant disease-related predictors of SRH increase. Age may be considered a marker of serious health issues, which largely account for diminishing SRH as individuals grow older.

The analyses presented thus far establish the relevance of mastery for SRH across a broad span of life stages from early adulthood to mid-life. We now turn to our second research focus: does the effect of mastery change across life stages? That is, is the effect of mastery on self-reported health stronger in later life phases, such as when serious health diagnoses increase in prevalence? Despite the plausibility of this conjecture, a series of unlisted fixed effects model specifications predicting self-reported health yielded no evidence of an interaction between mastery and life stage. We also examined whether mastery dampened the effect of obesity or diagnoses on self-reported health but found no evidence of interactions between mastery and obesity or between mastery and the health diagnoses.

3.3 Alternative model specifications

In supplementary models, we addressed three additional research questions. First, would the link between mastery and self-reported health shown in Table 2 be stronger if unobserved time-stable factors were not controlled? To address this question, we re-estimated Model 3 shown in Table 2 using a random-effects model. Random effects models are similar to the previously reported fixed effects model specifications in that they assess time-varying changes in mastery and self-reported health. However, random effects models do not control for unobserved time-stable factors [45]. As shown in Table 4, the statistically significant effect of lagged mastery on SRH was approximately double in magnitude in this random-effects model specification (est = 0.164) versus the prior fixed effects model shown in Table 2, Model 3 (est = 0.084). The difference in the magnitude of the estimates is likely due to the fixed effects model specification's control for time-stable unobserved factors. We also performed a Hausman test [48] to evaluate the hypothesis that there is no correlation between person effects and the outcome variable, thus rendering a random effects model appropriate. Because this test was rejected, we relied on the fixed effects model specification shown in Table 2.

Second, was the link between mastery and self-reported health shown in Table 2 sensitive to the measurement of the time-varying confounders we included? In a series of supplemental fixed effect model specifications, we found that the substantive results shown in Table 2 did not change when we: (1) specified educational attainment as a series of lagged time-varying dummy variables; (2) included a time-varying measure that summed all the diagnosed serious health problems; and (3) given the links between income and SRH [38], replaced unemployment with a lagged time-varying measure of lower (i.e., < $20,000 per year) vs higher family income. Because the binary measure indicating lower family income had a relatively large amount of missing data (approximately 11% more missing data compared to the measure of unemployment), it was only included as a covariate in these supplementary models.

Third, do changes in self-reported health lead to changes in mastery? Given the plausibility of reverse causation (that is, feeling healthy would foster a greater sense of control over one's life), in a final fixed effects model, we predicted changes in mastery based on a lagged measure of self-reported health. Note that this alternative model was based on 8 waves of data instead of 9, as the item wording indicating self-rated health at age 21–22 was not consistent with the later waves, giving us 739 respondents followed over 4,498 observations. The estimate for the effect of lagged self-reported health on mastery was close to zero and not statistically significant.

Table 4 Random effects model predicting self–reported health

Time-varying predictors	Est	Robust SE
Mastery (lagged by 1 wave)	0.164***	(0.027)
Educational attainment (lagged by 1 wave)	0.069***	(0.014)
Months unemployed (lagged by 1 wave)	– 0.003	(0.005)
Obesity	– 0.266***	(0.035)
High blood pressure	– 0.148***	(0.040)
Ischemic heart disease	– 0.076	(0.109)
Diabetes	– 0.261***	(0.076)
Prolonged anxiety, depression	– 0.090*	(0.040)
Cancer	– 0.207	(0.109)
Chronic Lung Disease	– 0.097	(0.057)
Broken bones	0.015	(0.039)
Chronic digestive disease	– 0.057	(0.063)
Epilepsy	– 0.116	(0.194)
Chronic back problem	– 0.172***	(0.045)
Other serious problem	– 0.219***	(0.053)
Wave (reference = 1998, age 24–25)		
2000 (age 26–27)	– 0.176***	(0.035)
2002 (age 28–29)	– 0.124***	(0.037)
2003 (age 29–30)	– 0.178***	(0.037)
2004 (age 30–31)	– 0.109**	(0.040)
2005 (age 31–32)	– 0.099*	(0.041)
2009 (age 35–36)	– 0.124**	(0.044)
2011 (age 37–38)	– 0.149***	(0.045)
2019 (age 45–46)	– 0.201***	(0.051)
Constant	3.295***	(0.094)
R2 (within)	0.057	

N 4850 person-waves (741 individuals)

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

4 Discussion

Drawing on 10 waves of prospective data following 741 adults over a 24-year period (from ages 21–22 to 45–46), this research provides convincing evidence that mastery is an agentic psychological resource that bolsters subjective health from young adulthood to midlife. During this lengthy period of the life course, mastery was found to have a significant lagged effect on SRH, even when prominent predictors of SRH, including time-varying educational attainment, months of unemployment, income (in supplementary analyses), obesity, and diagnoses of serious health conditions, were controlled. Moreover, the fixed effects specification of the statistical models controlled all time-invariant person-specific differences that may be related to both mastery and SRH. Whereas other time-varying factors, not included in our models, could possibly account for the positive effect of mastery on SRH, the comprehensive time-varying and time-invariant controls in these models considerably strengthens causal inference. And though it is plausible to assume that SRH also supports a sense of mastery, a supplementary analysis that reversed the causal ordering of these key variables (with SRH predicting mastery) provided no evidence that this is the case.

A central impetus for this research was to address important principles of life course analysis—agency, life span development, and timing—in relation to self-reported health. We find consistent evidence for the forces of agency and life-span development. A key agentic dimension, mastery, fostered self-reported health; and this dynamic was found to extend across a broad span of life. However, we do not find evidence here for the principle of timing, which holds that developmental processes vary across stages. Instead, the findings indicate that the positive effect of mastery on SRH is remarkably stable from young adulthood to mid-life. We find evidence that SRH declines with age largely in response to the onset of obesity and chronic disease. However, instead of mastery "kicking in" only

in mid-life to support SRH when obesity and chronic health conditions increase in prevalence, the non-significant interactions of year and mastery show that mastery fosters self-rated health similarly across the quarter-century encompassed by the present study. Nor did mastery dampen the effects of obesity or disease diagnoses on SRH.

This research is not without limitations. The findings are based on a community study in St. Paul, Minnesota, with the initial sample selected from students entering public high schools in 1988. As such, it does not represent the entire U.S. population. There could be regional variation in the determinants of SRH (as well as objective health) linked to community resources, especially access to health providers, healthy foods, parks and other recreation facilities, crime rates, etc. The YDS sample does not include the more affluent segment of the St. Paul population, who are more likely to attend private or parochial schools. It is a predominantly white sample, reflecting the composition of St. Paul when the initial sample was drawn. The absence of significant representation of people of color threatens the generalizability of the findings, given cultural differences in understandings of the meanings of health and in the impacts of particular disease or bodily conditions on such definitions. Furthermore, like all long-term longitudinal studies, the YDS has suffered sample attrition. As might be expected, participation dropped during the long interval between the 19th and 20th survey waves (between the ages of 37–38 [2011] and 45–46 [2019]), potentially weakening the evidentiary basis for our findings about SRH at mid-life.

Finally, although the fixed effects specification has major advantages, a noteworthy drawback is that it does not enable assessment of the unique impacts of certain fixed characteristics. Further research is needed to examine individual time-invariant attributes that could influence both mastery and self-rated health. Foremost among these are variables reflecting family background. For example, parental educational attainment predicts adolescent mastery [49]. Other key agentic orientations, i.e., the self-concept of ability [50] and optimism [49, 51] are found to be similar among parents and children, both measured during adolescence. Agentic psychological resources may "run in families," due to genetic proclivities [52], styles of family problem-solving [53], role modelling and other socialization processes [49, 54].

In general, individuals of higher social position have a stronger sense of individual agency, largely attributable to their greater opportunities for efficacious action [55] to promote health or other objectives. Superordinate statuses in adulthood, linked to gender, race/ethnicity, or socio-economic origin, provide resources that enable those with higher levels of mastery to engage in actions that protect both their subjective and objective health. Clearly, the multiple dynamics through which invariant status characteristics, in conjunction with time-varying attributes (including mastery and other agentic psychological resources), influence self-rated health await future research.

5 Conclusion

Notwithstanding these limitations, the findings of this study provide a glimpse into the intrapersonal agentic dynamics that may promote the maintenance of a sense of subjective health, as well, perhaps, as actual health, both physical and mental. Here we find evidence of "projective agency" [13]. Even before illness strikes, the person with a strong sense of mastery may attempt to ward off disease by engaging in actions that protect health, and by limiting behaviors that threaten health; for example, by adjusting lifestyles involving nutrition, exercise, adequate rest, and avoidance of excessive stress and substance use. The exercise of agency may thus support SRH and mitigate the causes of disease onset. And, in the interest of preserving this seemingly critical dimension of the self-concept, when SRH is threatened by signs of actual ill health, mastery (and other psychological resources indicative of agency) could affect the interpretation of symptoms, slow disease progression, and thereby contribute to a return to a healthier state. That is, the predictive power of SRH with respect to disease conditions, noted in several studies reviewed in the introduction, may result, at least in part, from the agentic orientations and behaviors that foster self-rated health and actual health.

Importantly, we find that the positive effect of mastery on SRH does not change in magnitude as individuals move from early adulthood, a generally healthy state, to mid-life, when various chronic disease conditions begin to emerge. The persistent effect of mastery on SRH is testimony to the power of agency to protect what is arguably a key dimension of the self-image. The findings of this research, along with the well-established associations of SRH with disease diagnoses and the timing of mortality, are consistent with the long-noted observation that cognitive states affect susceptibility to illness and the actual course of disease progression (see, for example, Antonovsky's [56] sense of coherence and, in a

more popular vein, Cousins' [57] biology of hope). The mechanisms through which mastery influences self-rated health as well, perhaps, as actual health, deserve consideration in future longitudinal studies.

Acknowledgements The authors would like to thank Monica Kirkpatrick Johnson for her excellent comments, which helped us to improve the manuscript. The Youth Development Study was supported by grants "Work Experience and Mental Health: A Panel Study of Youth," from the National Institute of Child Health and Human Development (HD44138) and the National Institute of Mental Health (MH42843).

Authors' contributions JTM and JS Both authors made substantial contributions to the conceptualization of the work and to data acquisition and interpretation. Jeremy Staff conducted the data analyses. They shared the drafting of the manuscript, approved the present version, and agreed to be accountable for all aspects of the work, ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

Funding The Youth Development Study was supported by grants "Work Experience and Mental Health: A Panel Study of Youth," from the National Institute of Child Health and Human Development (HD44138) and the National Institute of Mental Health (MH42843).

Data availability Youth Development Study data are available through the Inter-University Consortium for Political and Social Research, University of Michigan: https://www.icpsr.umich.edu/web/ICPSR/studies/24881.

Code availability STATA Version 17 was used for all analyses.

Declarations

Ethical approval and consent to participate This research was approved by the Human Research Protection Program (IRB ID: 9103S03585), University of Minnesota. It adheres to the ethical principles set forth in the Declaration of Helsinki. Informed consent was obtained from all research participants.

Competing interests The authors declare no competing interests.

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