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Grip strength and quality of life in the second half of life: hope as a moderator

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ABSTRACT

Objectives: The purpose of the current study was to investigate grip strength, hope, and their interaction as predictors of quality of life four years later in a nationally representative sample of older adults.

Method: Data were derived from the first (2005–2006) and second wave (2009) of the Israeli component of the Survey of Health Ageing and Retirement in Europe (SHARE; $N = 344$). Hope was measured by three items from the Hope Scale, and quality of life was measured by the CASP-12 (Control, Autonomy, Self-Realization, and Pleasure). Multiple regression analyses were conducted.

Results: Grip strength at T1 predicted QoL in T2, but hope was not a significant predictor. Furthermore, hope moderated the effect of handgrip on QoL, such that the effect was weaker for higher levels of hope.

Conclusion: As hypothesized, hope acted as a moderator, such that poor grip strength was associated with worse QoL for less hopeful older adults, but grip strength was not associated with QoL for more hopeful older adults. Findings are consistent with a theoretical conceptualization of hope as a buffer between physical challenges and negative outcomes like QoL. Encouraging a hopeful perspective could enhance QoL for older adults with decreased muscle strength.

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Quality of life; grip strength; hope; longitudinal

Introduction

Older adults with a stronger grip (a simple measure of muscle strength) tend to live longer and enjoy a better quality of life than those with a weaker grip (Leong et al., 2015; Sayer et al., 2006). Hope – defined as a person's beliefs in his or her abilities to achieve meaningful goals – has been found to relate to several indicators of well-being, including in older adults with physical illnesses (Gum, *in press*). Specifically, hopeful individuals with poor physical health or disability tend to maintain good quality of life or well-being (Hirsch, Sirois, & Lyness, 2011; Madan & Pakenham, 2014; Ong, Edwards, & Bergeman, 2006). Thus, the purpose of the current study was to investigate the hypothesis that hope moderates the relationship between grip strength and quality of life for older adults.

Grip strength predicts quality of life

Muscle weakness is an important risk factor for incident disease and death (Mitchell et al., 2015). Grip strength is a simple way to measure muscle strength, which involves muscle mass, connective tissue, innervation, and additional factors such as balance and motivation (Mitchell et al., 2015). Loss of muscle mass and strength (i.e. sarcopenia) occurs with age, and it involves changes to basic structures and processes, including muscle fibers and their innervation. In the same vein, it has been suggested that grip strength may be an indicator of frailty (Syddall, Cooper, Martin, Briggs, & Sayer, 2003).

Muscle strength, as measured by grip strength, predicts morbidity and mortality. In a large-scale study of 142,861 participants across 17 diverse countries (Leong et al., 2015), after controlling for numerous covariates of mortality, adults aged 35–70 with weaker grip strength were more likely to develop cardiovascular disease and to die within four years (all-cause, cardiovascular, and non-cardiovascular mortality), compared to individuals with a stronger grip. In fact, grip strength was a stronger predictor of all-cause mortality than systolic blood pressure and physical exercise. This pattern of findings was remarkably consistent across the 17 countries.

In addition to predicting disease onset and death, a stronger grip also relates to better quality of life – a person's perceptions of his or her life across several important domains, including physical health and functioning, social functioning, and mental functioning. In the largest study of the connection between grip strength and various quality of life domains, which involved a cross-sectional examination of 2,987 community-dwelling older adults (Sayer et al., 2006), grip strength was correlated with all domains of quality of life as measured by the Short Form-36. After controlling for age, height, weight, smoking, and comorbid medical conditions, grip strength still predicted general health and physical function for males. Similarly, it predicted general health, physical function, bodily pain, physical role function, vitality, and mental health for women. Other studies also found relationships between grip strength and quality of life (Jakobsen, Rask, & Kondrup, 2010), and between other measures of muscle strength and quality of life (Lin et al., 2011; Olivares, Gusi,

Prieto, & Hernandez-Mocholi, 2011; Samuel, Rowe, Hood, & Nicol, 2012).

Hope as a moderator of stressors and physical challenges

Hope is a positive psychological construct that has been found across many studies to relate to better adjustment and quality of life for people coping with chronic illness and disability. According to hope theory, hope is a relatively stable personality characteristic that is 'primarily a way of thinking' (Snyder, 2002, p. 249), encompassing a person's beliefs about his or her capacity to pursue and achieve meaningful goals. Hope includes two components: pathways – a person's beliefs about being able to identify routes to achieve goals; and agency – a person's beliefs about being able to muster sufficient energy, motivation, and determination to implement pathways, overcome obstacles, and achieve goals. Hope is measured using the Hope Scale, which includes scores for the two subscales (pathways, agency) and a total score (Snyder et al., 1991), although large epidemiological studies have used a brief three-item version (Keinan, Shrira, & Shmotkin, 2012).

Across the lifespan, hope (total score and subscales) is associated with many positive outcomes, including academic performance, performance in sports, mental health, good social relationships, physical health, and adjustment to chronic illness (Rand & Cheavens, 2009). As such, hope may have relevance for understanding the relationships between grip strength and quality of life, and may have implications for intervening to improve quality of life, even for those with poor muscle strength.

The body of research on hope with older adults is growing, confirming research with younger age groups regarding hope's associations with positive physical, social, and mental functioning (Gum, *in press*). One set of studies involved a large population-based epidemiological study of older adults in Germany, finding that hopeful older adults have better self-perceived physical health and functioning (Steverink, Westerhof, Bode, & Dittmann-Kohli, 2001; Wurm, Tesch-Römer, & Tomasik, 2007). They may even live longer than less hopeful older adults (hazard ratio = .80 at 8-year follow-up; Wiest, Schüz, & Wurm, 2013). Hope's relationship with mortality disappeared after controlling for smoking and functional health, suggesting that these health factors may mediate these relationships. This would be consistent with studies of younger ages indicating that high hope predicts engaging in more health-promoting behaviors (Feldman & Sills, 2013).

Hope theory posits that hope acts as a buffer of negative outcomes when people experience stressors. Specifically, the theory predicts that hopeful people are better able than less hopeful people to overcome barriers imposed by life stressors, including physical illness or disability, and find other ways to achieve goals – or find alternate goals (Snyder, 2002). In the case of weaker grip strength, hope theory would predict that hopeful older adults are likely to overcome challenges created by poor muscle strength, as measured by grip strength, and still maintain high quality of life. If they are unable to accomplish certain goals due to muscle weakness, hope theory predicts that they would find other, achievable goals to help them maintain quality of life. For example, an older adult with difficulty walking due to poor muscle strength or endurance might call a friend or write a card,

instead of visiting as often. Or, even if it was painful or tiring to walk down the block to visit the friend, a high-hope older adult might do it anyway, and thereby maintain better physical functioning, social relationships, and overall quality of life.

The empirical evidence thus far is consistent with these predictions of hope theory, with evidence that hope serves a buffering (i.e. moderating) role against the negative effects of stressors on constructs related to quality of life, including moods and well-being. For example, for 105 primary care patients, the relationship between functional impairments and depressive symptoms was strongest for less hopeful older adults, and weaker for more hopeful older adults (Hirsch et al., 2011). A similar pattern was found in a study of 296 patients with multiple sclerosis, in which high hope buffered the relationship of perceived stress with several adjustment outcomes, including depressive and anxiety symptoms (Madan & Pakenham, 2014). A daily diary study indicated that, for hopeful older adults, their daily negative affect was not strongly related to stressors the day before, whereas less hopeful older adults experienced more negative affect following stressors (Ong et al., 2006). Hopeful people also tolerate more pain, keeping their hand in painfully cold water longer than less hopeful people (Snyder et al., 2005); a brief hope-based intervention helped individuals tolerate the cold water task longer compared to individuals randomized to an attention control condition (Berg, Snyder, & Hamilton, 2008).

Research on optimism also supports the general idea that positive expectations for one's future protect individuals from negative outcomes of stressors and physical challenges. Optimism and hope are moderately to highly correlated, but not redundant, according to a recent meta-analysis (Alarcon, Bowling, & Khazon, 2013). A primary conceptual distinction is the individual's role: optimism involves general expectations that the future will hold positive outcomes (Carver & Scheier, 2014), which may or may not involve one's own actions to create positive outcomes, whereas hope focuses on the person's beliefs in his or her abilities to create positive outcomes. As with hope, optimistic adults and children enjoy a number of positive psychological and physical outcomes (Carver & Scheier, 2014). Most relevant for the current study, more optimistic people tend to cope better and maintain well-being during stressful situations, including during illness and disability (Carver & Scheier, 2014; Chang, 1998a). Optimism moderates the relationships between stressors and well-being for younger age groups (Chang, 1998b) and between stress and psychological symptoms for younger and older adults (Chang, 2002). In summary, research findings suggest that both general expectations for the future (i.e. optimism) and more specific beliefs about one's ability to create positive outcomes (i.e. hope) relate to multiple indicators of quality of life and protect individuals from negative outcomes of stressors and physical challenges.

Study hypotheses

Thus, we formulated two hypotheses for the current study involving a large national Israeli sample with a four-year follow-up. First, we hypothesized that grip strength (Hypothesis 1a) and hope (Hypothesis 1b) would independently predict quality of life four years later. Second, we hypothesized that these relationships would be qualified by an interaction. Specifically, our second hypothesis was that hope would moderate the relationship between grip strength and quality of life four years later,

such that there would be a stronger relationship between grip strength and quality of life for less hopeful older adults, and a weaker relationship between grip strength and quality of life for more hopeful older adults (Hypothesis 2).

Methods

Participants and procedure

Data were derived from the first and second waves of the Israeli component of the Survey of Health Ageing and Retirement in Europe (SHARE). SHARE is a survey that samples adults aged 50 years and older and their spouses regardless of age in European countries and Israel. Respondents were interviewed by means of computer-assisted personal interview, and supplementary data (concerning mostly sensitive issues) were collected by a paper-and-pencil questionnaire (drop-off questionnaire) left by the interviewer at the end of the interview. This procedure is aimed to allow privacy and elicit responses to more sensitive questions. SHARE-Israel was approved by the ethics review board of the Hebrew University of Jerusalem, and all participants provided written informed consent.

The first wave of data was collected in Israel in 2005–2006, and the second wave was collected in 2009. The sample in the first wave included 2,589 respondents from the non-institutionalized population in Israel. A total of 1,828 respondents participated in the second wave for a response rate of 70.4%. For this study, we included those who were 65 and older in the first wave of data collection ($N = 1117$), participated in both waves of data collection ($n = 748$), and provided information on all study variables, including the drop-off questionnaire ($n = 347$). Attrition analysis revealed that those who participated in both waves were younger ($M = 62.91$ vs. $M = 64.5$, $t(2601) = 3.66$, $p < .001$), had higher incomes ($M = 24,192$ vs. $M = 20,461$, $t(2601) = 3.285$, $p < .001$), and reported better quality of life ($M = 22.91$ vs. $M = 21.60$, $t(1684) = 3.62$, $p < .001$).

Measures

Quality of life (QoL)

Participants were asked to rate the frequency with which they experienced 12 statements as reflective of their lives, using a scale ranging from 1 (never) to 12 (often). The CASP-12 is based on the original CASP-19. CASP stands for the four domains measured by the scale: Control (the ability to actively intervene in one's environment), Autonomy (the freedom from unwanted interference of others), Self-realization, and Pleasure (these two concepts reflect the active and reflexive processes of self-fulfillment; Hyde, Wiggins, Higgs, & Blane, 2003). The CASP-19 was initially validated (Hyde et al., 2003), following which the CASP-12 was validated (Wiggins, Netuveli, Hyde, Higgs, & Blane, 2008), and is being used in international epidemiological studies with older adults, including SHARE (in Europe and Israel).

An overall score was computed as a sum, only when responses were provided for at least 10 items. Following Palgi, Shrir, and Zaslavsky (2015), scores of 10–11 items were interpolated by dividing the sum score by the number of completed items, and multiplying it by 12. Scores ranged from 4 to 36 ($\alpha = .81$).

Grip strength

To measure grip strength, participants were given a dynamometer (Smedley, S Dynamometer, TTM, Tokyo, 100 kg) and asked to squeeze it as hard as they could while standing or sitting with their elbow at a 90-degree angle pressed against their body. The grip strength was recorded twice for each hand, and the final value used for the analysis was the maximal grip strength obtained from either one of the four trials. Values were recorded as missing if the measurement differed by more than 20 kg for one hand, or if only one measurement in one hand was obtained. Valid values were defined as greater than zero and smaller than 100 kg. Values outside this range were also defined as missing (SHARE release guide 2.6.0).

Hope

The hope measurement consisted of three items derived from the trait Hope Scale (Snyder et al., 1991), ranging from 1 (strongly disagree) to 5 (strongly agree). The full Hope Scale contains eight items, which load onto two factors: Agency (goal-directed determination) and Pathways (finding ways to reach goals; Babyak, Snyder, & Yoshinobu, 1993; Snyder et al., 1991). The three items were: 'I pursue my goals with lots of energy' (Agency factor); 'I still find ways to solve a problem if others have given up' (Pathways factor); and 'Given my previous experiences I feel well prepared for my future' (Agency factor). All three items have significant loadings onto their respective factors, although they are not the highest loadings for each factor across samples (Babyak et al., 1993; Snyder et al., 1991). Hope was measured at Wave 1 only. Items were averaged to generate the scale when a response was provided for at least one of the items. When a response was obtained for one item only, the score was set to missing ($\alpha = .712$).

Covariates

We included several covariates in the analysis, controlling for respondents' age, gender, marital status (coded as 1 for married and 0 for not married) and education. Education was measured using the International Standard Classification of Education (ISCED-97) classification, ranging from 0–6. In this classification, aimed at enabling international comparisons, Zero indicates preprimary education (i.e. bridge between home and school); One: primary education (basic literacy skills); Two: lower secondary education (complementing the skills acquired in level 1); Three: upper secondary education, that typically begins after the completion of mandatory education; Four: postsecondary nontertiary education (bridge between level 3 programs and postsecondary education); Five: tertiary education – programs that usually require the successful completion of level 3 or 4 programs; Six: second stage of tertiary education – programs lead to the award of advanced research qualification (UNESCO, 2006).

We also controlled for gross household total income (in Euros), a variable generated by the SHARE team, and consists of income derived from different sources (employment, regular transfers and assets). The sum is adjusted for the purchasing power parity. As hope could be affected by religiosity (Ai, Peterson, Tice, Bolling, & Koenig, 2004), we controlled for the reported frequency of praying. Scored ranged from 1 'never' to 6 'more than once a day.' For this study, we created a binary variable coded as 0 'pray once a week or less' or 1 'pray more than once a week.'

Grip strength could be affected by general health status, and hence we controlled for body mass index (BMI), Activities

Table 1. Descriptive statistics and correlations between study variables.

	M/%	SD	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1. Age	71.67	5.47														
2. Gender ^a	43.9%	–	–.08													
3. Marital status ^b	77.6%	–	–.19***	–.25***												
4. Education	2.89	1.73	–.04	–.12*	–.03											
5. Income	22	19	–.06	–.07	.17**	.25***										
	888.49	941.74														
6. Nationality ^c	81.7%	–	.19***	.14**	–.18**	.33***	.26***									
7. Praying ^d	37.5%	–	.02	–.07	.16**	–.33***	–.20***	–.38***								
8. Alcohol	2.06	1.81	.06	–.17**	–.03	.12*	.09	.23***	–.03							
9. Smoking ^e	12.5%	–	–.06	–.06	–.07	.009	.001	–.03	–.02	.04						
10. ADL	.59	1.31	.13	–.03	.16**	–.27***	–.17**	–.20***	.20***	–.05	–.04					
11. BMI	26.75	3.98	–.08	–.05	–.02	–.06	–.04	–.11*	.04	–.04	–.05	.10				
12. Grip strength	30.10	10.42	–.16***	–.64***	.22***	.23***	.18**	–.05	–.06	.15*	.08	–.26***	.09			
13. Hope	2.80	.74	.02	–.04	–.02	.16**	.15**	.26***	–.08	.05	–.07	–.24***	–.09	.13*		
14. QoL W1 ^f	23.45	6.36	.01	.10	–.04	.32***	.27***	.52***	–.23***	.13*	–.03	–.34***	–.20***	.08	.55***	
15. QoL W2 ^f	24.21	6.50	–.12*	.04	.05	.32***	.18**	.19***	–.19***	.05	–.02	–.39***	–.16**	.22***	.28***	.46***

Note: Total $N = 344$.

^a Coded 1 = female, 0 = male. ^b Coded 1 = married, 0 = not married. ^c Coded 0 = Arab, 1 = Jewish. ^d Coded 0 = I pray once a week or less, 1 = pray more than once a week. ^e Coded 0 = not smoking, 1 = smoking. ^f QoL = quality of life.

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

of Daily Living (ADL), smoking, and drinking habits. ADL consists of six activities (eating, bathing, dressing, toileting, walking across the room, and getting in and out of bed). For each activity respondents reported whether they experienced difficulty performing it or not (coded as 1 for 'yes' and 0 for 'no'). The ADL score was computed as the sum of yes answers. Alcohol consumption was measured as the frequency of alcohol consumption in the last three months, ranging from 1 (not at all in the last 6 months) to 7 (almost every day). Smoking habits were coded as 1 if respondents reported to be currently smoking and 0 if not.

Data analysis

First, descriptive statistics and Pearson correlations were calculated for all variables. Second, to test the study hypotheses, we performed stepwise regression analysis, with QoL at Wave 2 as the outcome variable. In the first step, we entered the covariates and QoL from Wave 1. In the second step, the main effects were entered (grip strength and hope from Wave 1), testing Hypothesis 1a and 1b. In the third step, we entered the interaction term between hope and grip strength, to test Hypothesis 2. The independent variable and the moderator were mean-centered before entering them into the analyses. Simple slopes were calculated using Process, estimating the slope between the independent and dependent variable when the moderator is low (1 SD below the mean, mean, or high (1 SD above the mean) (Hayes, 2013).

To make sure the assumptions of the regression were met, a preliminary multicollinearity test was performed. The results of this test showed that the tolerance of all independent variables (age, gender, marital status, income, praying, alcohol, smoking, physical disability, BMI, and QoL on Wave 1) ranged from 0.586 to 0.954 and the VIF ranged from 1.707 to 1.049. Thus, the analysis demonstrated no multicollinearity (Field, 2009).

Results

Descriptive statistics and correlations between study variables are presented in Table 1. The sample was 71.67 years old on average (SD = 5.47), 43.9% female, and 77.6% married.

Regarding the primary study variables, grip strength and hope were moderately correlated with each other ($r = .13$, $p = .02$). Also, grip strength and hope were moderately correlated with QoL at Time 2 ($r = .22$ and $.28$, $p < .001$, respectively). They were more likely to have better QoL at Time 2 if they were younger ($r = -.12$, $p = .02$), more highly educated ($r = .32$, $p < .001$), had higher income ($r = .18$, $p = .001$), were Jewish ($r = .19$, $p < .001$), prayed less ($r = -.19$, $p < .001$), had lower ADLs ($r = -.39$, $p < .001$), and lower BMI ($r = -.16$, $p = .003$).

As seen in Table 2, regarding the first hypothesis (main effects of Wave 1 grip strength and hope on Wave 2 QoL), after controlling for the covariates in the first step, grip strength in Wave 1 predicted QoL in Wave 2 ($b = .13$, $p = .002$), but Wave 1 hope did not predict Wave 2 QoL ($b = .30$, $p = .52$). Thus, the findings support Hypothesis 1a (grip strength) but not Hypothesis 1b (hope).

In line with Hypothesis 2, adding the interaction term between grip strength and hope in the third step significantly predicted QoL ($b = -.08$, $p = .039$). We complemented the

Table 2. Predicting wave 2 QoL by grip strength, hope, and their interaction.

Variable	Step 1		Step 2		Step 3	
	B	SE	B	SE	B	SE
Intercept	23.93***	5.43	21.89***	5.16	22.30***	5.14
Age	–.08	.06	–.04	.06	–.05	.06
Gender ^a	.52	.66	2.25**	.67	2.11	.67
Marital status ^b	.18	.79	.18	.79	.20	.79
Education	.64***	.19	.61**	.19	.60**	.19
Income	.001	.001	.001	.001	.001	.001
Nationality ^c	–1.72	1.03	–1.56	1.03	–1.65	1.03
Praying ^d	–.20	.69	–.02	.69	–.12	.68
Alcohol	–.004	.17	–.01	.17	–.01	.17
Smoking ^e	–.47	.90	–.53	.90	–.66	.90
ADL	–1.12***	.25	.94***	.25	–.86***	.25
BMI	–.11	.08	–.13	.07	–.13	.08
QoL W1 ^f	.36***	.06	.33***	.06	.35***	.06
Grip strength			.13**	.03	.12***	.03
Hope			.30	.48	.26	.48
Grip*hope					–.08*	.04
R ²	.323		.345		.355	
Δ R ²			.012**		.010*	

Note: $N = 344$.

^a Coded 1 = female, 0 = male. ^b Coded 0 = not married, 1 = married. ^c Coded 0 = Arab, 1 = Jewish. ^d Coded 0 = I pray once a week or less, 1 = pray more than once a week. ^e Coded 0 = not smoking, 1 = smoking. ^f QoL = quality of life.

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

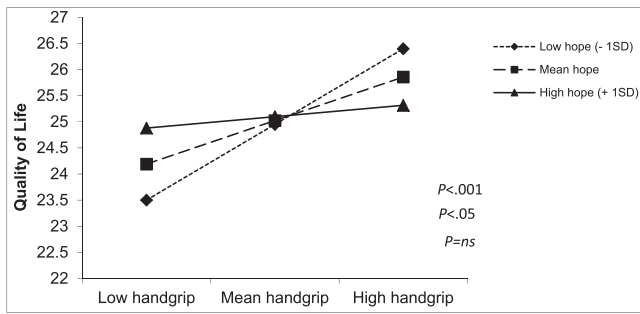


Figure 1. Two-way interaction between grip strength and hope on QoL.

analysis by testing the simple slopes between grip strengths and QoL for low (1 SD below mean), mean, and high (1 SD above the mean) levels of hope. Consistent with the hypothesis, hope weakened the effect of handgrip strength on QoL ($b = .18, p = 0.0002$ when hope was 1 SD below mean; $b = .13, p = .0026$ when hope was at the mean; $b = .06, p = .20$ when hope was 1 SD above the mean). The predicted QoL values for low levels of hope are: 22.26 for low grip strength and 26.06 for high grip strength; for mean levels of hope: 23.06 for low grip strength, and 25.63 for high grip strength; for high levels of hope: 23.86 for low levels of grip strength, and 25.19 for high levels of grip strength. Figure 1 presents the two-way interaction between handgrip strength and hope on QoL.

Discussion

This study explored the moderating role of hope on the relationship between grip strength and QoL, resulting in two main findings. First, participants with weaker grip strength experienced worse QoL four years later, compared to those with a stronger grip, above and beyond demographic variables, health behaviors, and other indicators of disability. This result is consistent with other large epidemiological studies of grip strength (Sayer et al., 2006) and other measures of muscle weakness (Lin et al., 2011; Olivares et al., 2011; Samuel et al., 2012). The current study extends previous findings by replicating the findings in another country (Israel), with a different measure of global QoL (CASP-12), and in longitudinal analysis, predicting outcomes four years later. Contrary to the first hypothesis, hope did not independently predict quality of life four years later.

The second main finding was that the relationship between grip strength and QoL was qualified by an interaction, which has not been explored in prior research. Hope moderated the relationship of grip strength with quality of life four years later, consistent with the second hypothesis. The relationship between grip strength and QoL was stronger among those who were less hopeful, whereas grip strength and QoL were not significantly related for more hopeful participants. This result supports prior research and a hypothesis derived from hope theory – that hope serves a buffering function in stressful, challenging situations (Hirsch et al., 2011; Madan & Pakenham, 2014; Ong et al., 2006; Snyder, 2002). To our knowledge, this is the first study to examine hope, or any personality characteristic, related to grip strength and quality of life.

This study possesses several limitations that need to be acknowledged. One clear weakness was that the full Hope

Scale was not used, with two items representing the Agency subscale and one item representing the Pathways subscale. The use of the full scale would have been desirable, although this is a common compromise made in large epidemiological studies, and the internal consistency and patterns of correlations are comparable to prior research. It is unknown whether the findings would have been different had other items been selected; perhaps having more items reflecting agency assessed the energy or determination component to goal pursuits, more than finding specific strategies to achieve goals. Another important weakness is that hope was measured only at baseline, so changes in hope over time could not be considered. Participants who were older, had lower income, and lower quality of life at baseline were more likely to drop out, so findings may not generalize to those participants. Another weakness includes the correlational nature of the data, which precludes firm conclusions about causality. Nevertheless, the longitudinal design provides some support for the hypothesis that hope may act in a way that attenuates the relationship between grip strength and quality of life four years later. We also do not have detailed information to examine the hypothesized mechanisms by which hope might interact with grip strength, such as the hypothetical hopeful older adult who finds alternative pathways to achieve goals or alternative goals despite muscle weakness.

We recommend future research that examines hope, other personality characteristics, and mental health in relation to grip strength and related factors. A variety of methodologies would likely be useful for this research, including longitudinal studies like this one, qualitative research, or daily diary studies that closely examine challenges created by muscle weakness, and how people go about overcoming challenges and pursuing goals. In addition to a moderating role as found here, hope earlier in life may even help older adults maintain muscle strength, given that hopeful adults seem to value health behaviors and may engage in more physical activity (Feldman & Sills, 2013), a known protective factor against loss of muscle strength (Mitchell et al., 2015). Hope also may facilitate rehabilitation for people with muscle weakness, if they believe in their abilities to pursue rehabilitation-related goals and engage in more rehabilitation exercises. Interventions have been tested that improve hopeful thinking and goal pursuits (for recent review, please see Cheavens & Guter, in press); these interventions might be valuable as an adjunct to rehabilitation or exercise interventions with healthy older adults as well as those with compromised muscle strength. Even for older adults with very weak muscle strength, a hope intervention might help them maintain quality of life and perhaps prevent further decline in muscle strength or other aspects of physical functioning. The goal of such interventions would be to help adults maintain muscle strength over their life course, and when muscle weakness occurs, to rebuild or maintain muscle strength if possible, and if not, to find alternative ways to achieve meaningful goals and maintain a good quality of life.

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Disclosure statement

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