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A Coordinated Analysis of Physical Reactivity to Daily Stressors: Age and Proactive Coping Matter

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Abstract: Proactive coping involves efforts to prepare for future stressors and may have implications for physical responses to stress. We examined age differences in physical reactivity to daily stressors moderated by proactive coping in a coordinated analysis across two separate daily diary studies. Study 1 included data from 116 older (age range 60–90) and 107 younger (age range 18–36) adults on daily stressors and physical health symptoms for 8 consecutive days. Study 2 included data from 140 adults (age range 19–86) on daily stressors and self-rated physical health for 29 consecutive days. Participants in both studies reported on their proactive coping on the first day of the study. Physical reactivity was indexed via lagged multilevel models as increases in daily physical symptoms in Study 1 and decreases in daily physical health in Study 2 with corresponding increases in daily stressors. Results indicated that in both studies, younger adults with low proactive coping were more physically reactive to daily stressors compared to younger adults with high proactive coping. Proactive coping was associated with reduced physical reactivity to daily stressors among younger adults, consistent with the characterization of a high degree of control and ample opportunities at earlier phases of adulthood which are critical for accumulating resources to proactively cope.

Keywords: proactive coping; physical reactivity; daily stressors

1. Introduction

Daily stressors, the seemingly minor negative events of day-to-day living such as arguments, play a critical role in the physical well-being of adults [1,2]. Older adults tend to encounter more diseases, mortality, and complications than younger adults and thus may be more vulnerable to the physical effects of stressors [3]. Within-person increases in self-reported physical symptoms in response to stressors, termed physical reactivity, depend on situational as well as individual characteristics [4,5]. However, it is unclear how potential age differences in self-reported physical health indicators may fluctuate on a day-to-day basis in response to daily stressors and may be modified by individual differences in coping processes *before* stressor exposure.

The Proactivity Model of Successful Aging [6–9] emphasizes the value of planful engagement in anticipation of age-related stressors [10]. It proposes that older adults utilize resources with both preventive and corrective intent [6]. Whereas preventive adaptations typically occur prior to the onset of stressors, corrective adaptations are activated by stressors and can be facilitated by existing resources [11]. The Proactivity Model of Successful Aging was developed to emphasize the potential of older adults to meet challenges through the use of resources that are hypothesized to be important for subsequent proactive adaptations [9], which are viewed as the engine that drives successful aging [12]. A key feature is the focus on future orientation, which is considered a motivational antecedent of late-life proactivity [11].

In line with the Proactivity Model of Successful Aging, proactive coping is future-focused and can consist of efforts to prevent or alter the form of future stressors [10]. Although not directed toward a specific stressor, proactive coping has been conceptualized

as efforts to prepare for uncertainty in the long term as well as to build up resources that facilitate promotion toward challenging goals [13]. The former conceptualization suggests that building up general resources can result in prevention of a stressor altogether or that the severity and consequences could be minimized when the stressor does occur [10].

Distinctions have emerged with respect to different kinds of proactive coping, where some focus on prevention efforts [10,14,15], others focus on efforts to create future opportunities and goal attainment or pursuit [14–16], and others emphasize corrective forms [11]. When the focus is on building up general resources that may help avoid stressors, proactive coping serves a preventive function. Proactive coping can also direct efforts toward meeting challenging goals, which does not need to be preceded by negative appraisals like harm or loss [13]. Rather than perceiving demanding situations in the future as threatening, they are perceived as personal challenges. In this case, coping functions as goal pursuit/attainment instead of prevention [13,17]. Further evidence of the distinctions of these two kinds of proactive coping is methodological. Specifically, the Proactive Coping Inventory (PCI) [16] contains seven subscales (e.g., proactive coping scale focused on autonomous goal setting with self-regulatory goal attainment cognitions and behavior). Items were taken from the Preventive Coping subscale of the PCI, focused on coping efforts to a potential threat in the future, to generate Aspinwall and colleagues' [18] measure of proactivity. Although distinct in their measurement, each conceptualization shares a common focus on the future oriented management of stressors and challenges early in their course [18].

Freund and Riediger [19] emphasized the importance of future-oriented goals and described them as desired states that one wants to attain or avoid, in line with the goal attainment and prevention components of proactive coping [14]. Future-oriented goals connect people to their physical, cultural, and social contexts and are central to development in adulthood [19]. Although the behaviors may be similar, the motivations underlying the prevention and goal pursuit/attainment forms of proactive coping differ. In the prevention-focused framework, motivation is tied to threat appraisal and worry. In goal pursuit and attainment, motivation is tied to challenge appraisal and the desire to meet those challenges. These motivational differences have important implications for possible age differences in the use and effectiveness of proactive coping. The motivational theory of lifespan development [20] asserts that the lifespan is an age-graded, sequentially organized action field of opportunities and constraints in which individuals have to prioritize the pursuit of urgent, age-appropriate goals over others. In younger adulthood, which is characterized by a high degree of control and ample opportunities, goals are oriented toward gains (e.g., career). In contrast, older age may be characterized by a loss in primary control capacity and decreasing opportunities, so goals that offer emotional support should gain relevance [20]. This further builds on the association between the goal pursuit and prevention aspects of proactive coping [13]. Goal orientation toward gains in younger adulthood [20] suggests that it is possible that high levels of proactive coping focused on goal pursuit/attainment in younger adults may be especially useful to meet challenging goals. However, it is possible that prevention-focused aspects of proactive coping could be important for older adults to minimize losses.

The experiences of stress and coping can change across the lifespan. Age differences in proactive coping strategies and stressful experiences have been the focus of empirical and theoretical work. Older adults tend to engage in more active coping strategies than younger adults to prevent stressor occurrence [21], consistent with the prevention perspective. Older adults may use more frequent and effective attentional strategies, reappraisals, and behaviors that enable them to avoid negative events or de-escalate events when they do occur [22–24]. Avoiding stressors may be tied to older adults' motivation to maintain well-being through the structure of their daily lives [25,26]. Avoiding an interpersonal stressor was associated with a larger decrease in negative affect reactivity in older compared to relatively younger adults [27]. This suggests that experiencing an unavoidable stressor could potentially have more negative implications for older as compared to younger adults [28], but this has not yet been tested with physical reactivity.

Although conceptualized as a relatively stable between-person trait, proactive coping can permeate daily experiences and is associated with reduced daily negative affect [29] and lower levels of stress [30]. We know from past work that increases in daily stressors correspond with increases in physical health symptoms (physical reactivity) [5], and that proactive coping is associated with reduced emotional reactivity to daily stressors [29]. In addition, people high in proactive coping reported better health during the COVID-19 pandemic than those low in proactive coping [31]. However, proactive coping is not always beneficial. In order for coping to be effective, it must meet the demands of the situation [10]. Due to the unpredictable nature of stressor occurrence, one may work to accumulate and dedicate resources [32] to prepare for a nebulous stressor that may not occur (i.e., Y2K) [18]. Additionally, the ambiguity around future stressors may contribute to an individual taking steps to proactively cope in a manner that does not ultimately result in the prevention of the stressor or attainment of their goals [10]. Finally, one's approach to applying coping strategies is influenced by life experience [21,22]. The link between proactive coping and age differences in physical reactivity to daily stressors remains unexplored.

The Present Study

We examine the role of the goal attainment and prevention conceptualizations of proactive coping in age differences in physical reactivity to daily stressors. In a coordinated analysis across two studies, we examine two forms of physical reactivity. Consistent with past work [4,5], the first study operationalizes physical reactivity as within-person increases in self-reported physical symptoms associated with increases in daily stressor exposure. The second study operationalizes physical reactivity as within-person decreases in perceptions of physical health associated with increases in stressor exposure. Each of these indexes of physical reactivity align with the emphasis of dynamic processes [13]. Because physical reactivity to daily stressors is a within-person process, daily diaries, which collect repeated measurements from individuals throughout their daily lives are well-suited to capture these processes. Daily diaries reduce memory distortion and allow researchers to evaluate life as it is lived by evaluating day-to-day experiences, resulting in more ecologically valid data [33]. The current study evaluates these processes within the context of individual differences in age and proactive coping strategies. We expected that proactive coping would act as a buffer against daily physical reactivity to daily stressors, particularly among younger adults using a goal pursuit/attainment form of proactive coping and among older adults using a prevention-focused form of proactive coping.

2. Materials and Methods

Participants from Study 1 included 116 older adults ranging in age from 60 to 90 (*M* = 64.71, *SD* = 4.98), and 107 younger adults ranging from age 18 to 36 (*M* = 19.44, *SD* = 2.25). Participants were part of the Mindfulness and Anticipatory Coping Everyday (MACE) study [28,34] conducted during the spring and fall of 2016. Sample size was determined based on prior studies [35] and recommendations for daily diary studies [36], with the goal to maximize the number of participants and days for the available grant funds. Older adults were recruited from Amazon's Mechanical Turk (mTurk) with a link to the survey. Filters restricted participants to those residing in the United States. Older adults were directed to the Qualtrics page from the link to provide informed consent and to complete the Day 1 survey, a demographic information survey. Responses were then reviewed to ensure responses aligned with stated age and date of birth. Participants who were confirmed 60 years or older, lived in the United States, and had no diagnosis of dementia or mild cognitive impairment were invited to continue the daily portion of the study [28]. A total of 171 participants completed Day 1 with 32 not qualifying based on inclusion criteria stated above and 23 were qualified but chose not to continue. Out of the 171, 116 (68%) participants continued the study. Eight-eight (76%) of these participants completed at least 2 of the daily diary days and 71 (61%) completed all 9 days, for a completion rate of 71.2%. Of the older adult participants, 90% identified as white,

55% were married, 30% had a Bachelor's degree, and 45% were retired [28]. Participants were emailed daily a unique survey link for Days 2–9, which were password protected. Compensation of $1 per survey was awarded to each older adult participant. Younger adults were recruited from introductory psychology courses and received graduated course credit for participation. Participants were redirected to Qualtrics, where they provided informed consent before proceeding to the Day 1 survey, which collected demographic information (e.g., age and education), personality, and proactive coping. Days 2–9 assessed daily stressors, daily physical symptoms, and other measures not examined in the current study. All procedures were approved by the North Carolina State University IRB (#6517). Nearly all (99%) participants completed at least 2 daily diary days and 83% completed all 9 days. Given the education differences between the older and younger adults, we tested to see whether education may be related attrition in the older adults. The number of study days completed by the older adults was not related to education, r (113) = .16, $p = 0.09$. Of the younger adults, 80% were White, 49% were women, and 64% lived on campus. Participants were given unique, password protected survey links that directed them to each daily survey. A total of 223 participants (107 younger adults, 116 older adults) completed the online daily diaries over nine consecutive days, reporting on 1627 days.

Participants from Study 2 were 140 adults from the ESCAPED (Election Stress Coping and Prevention Every Day) [37,38] study and were recruited via Amazon's Mechanical Turk (mTurk) (*M* Age = 35.37, *SD* = 9.14, range = 19–86). Sample size was determined based on prior studies [35] and recommendations for daily diary studies [36], with the goal to maximize the number of participants and days for the available grant funds. Of the participants, 50% were men (*M* Age = 34.73, *SD* = 10.69), 50% were women (*M* Age = 35.20, *SD* = 11.78), 74% were white (*M* Age = 35.98, *SD* = 11.79), 12% were African American (*M* Age = 32.84, *SD* = 8.26), and 4% identified their race/ethnicity as other (*M* Age = 32.51, *SD* = 9.86). Participants were located in the U.S. across 35 states. All procedures were approved by the North Carolina State University IRB (#14231). Using the Qualtrics survey platform, participants were asked to complete daily questionnaires from 15 October 2018 to 13 November 2018. Informed consent was collected on Day 1 of the study. Participants generated a unique participant ID following a specific formula which they recorded in each day's survey. This allowed for an additional quality check across all study days. To ensure data quality, time checks were utilized, date of birth and age matching at baseline was reviewed, and date of birth and unique IDs at the daily level was checked. We eliminated cases where data quality and validity were questionable based on the above criteria. Initially, 151 participants completed the Day 1 survey and 140 provided additional daily reports to be included in analyses. Given the anonymity of the responses, contributing factors to the attrition of the 11 participants was unclear. These participants were not significantly different across any demographic factors than those who progressed to Day 2. In total there were 140 participants who provided both Day 1 and daily reports, resulting in 1119 daily reports.

2.1. Measures

Most measures were consistent across both studies, however the daily physical health and proactive coping measures differed. In Study 1 a checklist of physical symptoms was used daily and a 14-item proactive coping scale was implemented. In Study 2, physical health was measured with a single item each day and a 6-item proactive coping scale was used.

2.1.1. Baseline Measure

Proactive Coping in Study 1 was operationalized as goal pursuit proactive coping and was measured using the Proactive Coping Scale from the Proactive Coping Inventory (PCI) [16]. The scale combines autonomous goal setting with self-regulatory goal attainment cognitions and behavior [16] and includes 14 items (i.e., I visualize my dreams and try to achieve them; I try to pinpoint what I need to succeed). Questions were answered

on a scale of 1 (*not at all true*) to 4 (*completely true*). Higher scores reflected higher levels of proactive coping (current study α = .88). The scale has high internal consistency as seen in reliability measures ranging from (α) .80 to .85 [16] and acceptable test–retest reliability over a six month time period [14]. The scale shows good item-total correlations and acceptable skewness as an indicator of symmetry around the mean [16]. A principal component analysis confirmed its factorial validity and homogeneity [16] and a validation study indicated that a single-factor model fit the data well [39].

Proactive Coping in Study 2 was operationalized as prevention-focused proactive coping and was measured with 6 items (i.e., I prepare for adverse events) [18]. Two items were drawn from the Preventive Coping Scale of the PCI [16]. The goal of the scale is to assess preferences for planning for adverse events and expending resources to prevent them or reduce their impact [18]. A maximum likelihood factor analysis with oblique rotation revealed that the six items loaded onto one factor with loadings of 0.4 or higher and accounted for 38% of the variance [18]. Questions were answered on a scale of 1 (*strongly disagree*) to 5 (*strongly agree*). Higher scores indicated a greater preference for planning ahead, preparing for adverse events, and trying to take care of little problems before they become big problems (α = .74 from [18]; current study α = .89), in line with prevention of stressors. Aspinwall et al. [18] provided preliminary evidence of construct and predictive validity through significant associations of proactive coping with greater active coping and preparations for a potential stressor, independent of its concurrent association with demographic factors, worry, and optimism.

2.1.2. Daily Measures

Daily stressor exposure was measured using a written version [40] of the Daily Inventory of Stressful Events (DISE) [4]. Participants recorded if they had experienced seven different types of stressors within the past 24 h (e.g., arguments, potential disagreements, work stressors, etc.). Participants received a total stressor score for each day, with higher scores indicating more daily stressors.

Daily physical symptoms were measured in Study 1 using a version of Larsen and Kasimatis's [41] physical symptom checklist which consisted of 28 symptoms (e.g., fatigue, cough, and allergies). These self-reports reflect the perception of somatic disturbances [41] and correlate significantly with external indicators of illness such as medical records, documented visits to physicians, and physicians' ratings [42,43]. Each day, participants checked the boxes next to the physical symptoms that applied to them. A daily sum was created for experienced symptoms, with high scores representing more reported daily physical symptoms (i.e., worse health).

Daily physical health was measured in Study 2 using a single item. Participants rated their physical health overall that day ranging from 1 (*poor*) to 5 (*excellent*), with high scores representing better health. This single self-rated health item is frequently used to capture participants' self-reported general health [44] and has evidence of strong reliability [44,45] and validity [46,47]. Single item self-reported health also predicts mortality [45,48], use of health services [49], and health expenditures [49,50].

2.1.3. Covariates

Education was included as a covariate because of the theoretically important influence of resources on proactive coping [10]. Conscientiousness, the personality trait that is associated with thoroughness and diligence [51] is related to active, problem-focused response strategies [52] and is associated with proactive coping [53]. Given that physical reactivity was based on self-reported data, we further controlled for potential influences to subjective health reports. Neuroticism is the relatively stable tendency to respond with negative emotions to threat, frustration, or loss, and corresponds with higher rates of physical and mental health symptoms [54]. We included conscientiousness and neuroticism, measured using The Revised Midlife Development Inventory Personality Scales [55] (Conscientiousness α = .74 [Study 1], α = .76 [Study 2]; Neuroticism α = .82 [Study 1], α = .83 [Study 2]),

as covariates. Additionally, chronic health conditions [56], daily memory failures [40], and daily negative affect (PANAS) [57], were included as covariates to adjust for differences in stable health contexts and daily resources.

3. Results

Following best practices for conducting coordinated analysis [58,59], we applied the same statistical procedures to both studies. Coordinated analysis allows for the comparability and replication of findings from multiple studies of varying populations which used different instruments to assess the same constructs [59]. Descriptive statistics (see Table 1) and between-person correlations (see Table 2) were conducted for all study variables for both studies.

Table 1. Descriptive Statistics for Study Variables.

Variable	Study 1			Study 2		
	M	*SD*	Range	*M*	*SD*	Range
Daily Physical Symptoms/Health	1.80	1.86	0–10	3.97	0.80	1.55–5
Physical Symptoms/Health PD	1.77	1.71	0–8.63	3.94	0.80	1–5
Previous Day Stressors	0.45	0.51	0–3.13	3.32	2.61	0–7
Daily Negative Affect	1.60	0.61	1–3.61	2.31	1.14	1–4.90
Daily Memory Failures	0.85	0.77	0–3.13	2.62	2.28	0–6
Chronic Conditions	2.10	2.81	0–22	3.77	5.03	0–29
Education	6.96	2.09	4–12	8.47	1.44	4–12
Age	43.03	23.07	18–90	35.37	9.14	19–86
Neuroticism	2.17	0.72	1–4	2.81	0.60	1–4
Conscientiousness	3.35	0.50	2–4	3.11	0.56	1–4
Daily Stressors	0.47	0.58	0–4	4.09	2.68	0–7
Proactive Coping	2.99	0.48	1.07–4	2.68	0.84	1–5

Note: Daily Physical Symptoms refer to the measure used in Study 1 and Daily Physical Health refers to the measure used in Study 2. Ranges indicate between-person averages for daily variables and higher scores reflect more of the target construct. The observed ranges of education in both studies corresponds with GED (4) and Professional Degree such as Ph.D. (12). The average in Study 1 corresponds to 3 or more years of college but no degree. The average in Study 2 corresponds to a 2 year college degree. PD = previous day. Proactive Coping in Study 1 refers to goal pursuit, whereas Proactive Coping in Study 2 refers to prevention-focused efforts.

Table 2. Between-Person Correlations.

Variables	1	2	3	4	5	6	7	8	9	10	11	12
1. Daily Physical Symptoms/Health	-	.69 ***	.25 **	.29 ***	.32 ***	.04	.07	−.19 *	.04	.16	.19 *	−.07
2. Physical Symptoms/Health PD	.80 ***	-	.19 *	.20 *	.28 **	.03	−.05	−.15	.04	.06	.11	−.07
3. Stressors PD	.25 ***	.28 ***	-	.61 ***	.72 ***	.18 *	.08	−.00	.01	−.04	.55 ***	.03
4. Negative Affect	.08	.11	.13 *	-	.77 ***	.34 ***	.21 *	−.10	−.18 *	−.19 *	.78 ***	.20 *
5. Daily Memory Failures	.34 ***	.26 ***	.08	.41 ***	-	.30 ***	.16	−.04	−.10	−.13	.88 ***	.13
6. Chronic Conditions	.43 ***	.38 ***	.1	.1	.19 *	-	.39 ***	−.15 *	−.27 ***	−.41 ***	.31 ***	.21 **
7. Education	.00	.04	.04	−.24 ***	−.17 *	.21 ***	-	−.01	.08	.22 **	.19 **	.03
8. Age	.08	.06	−.07	−.38 ***	−.16 *	.37 ***	.59 ***	-	.14 *	.19 **	−.02	−.13
9. Neuroticism	.20 **	.13 *	.10	.51 ***	.25 **	.14 *	−.31 ***	−.39 ***	-	.31 ***	−.03	−.14 *
10. Conscientiousness	−.04	−.01	.00	−.34 ***	−.17 *	−.06	.19 **	.27 ***	−.30 ***	-	−.18 *	−.34 ***
11. Daily Stressors	.26 ***	.29 ***	.70 ***	.20 **	.17 **	.07	.01	−.08	.17 **	.00	-	.19 **
12. Proactive Coping	−.12	−.09	.00	−.15 *	−.15 *	−.16 *	.04	−.02	−.37 ***	.43 ***	.06	-

Note: * *p* < 0.05, ** *p* < 0.01, *** *p* < 0.001. Study 1 on the lower triangle and Study 2 on the upper triangle. PD = previous day. Proactive Coping in Study 1 refers to goal pursuit, whereas Proactive Coping in Study 2 refers to prevention-focused efforts.

Age and proactive coping differences in physical reactivity to daily stressors was addressed via multilevel modeling [60], taking advantage of the nested structure of the daily diary data. Days (Level 1) are nested within participants (Level 2). We generated a lagged model where previous day physical symptoms (Study 1) or previous day physical health (Study 2) and previous day stressors were included as predictors of current day physical symptoms (Study 1) or current day physical health (Study 2). Thus, results are interpreted as predicting the change (i.e., residual of stability from one day to the next) in

daily physical symptoms/health from one day to the next, controlling for previous day daily stressors. Day-level covariates included negative affect and memory failures. Person-level covariates included chronic conditions, education, neuroticism, and conscientiousness. We used daily stressors (Level 1), proactive coping (Level 2), and continuous age (Level 2) and their interactions as predictors of daily physical symptoms/health (Level 1) to address our main research questions. The within-person slope between current daily stressors and physical outcomes was operationalized as physical reactivity in both studies.

3.1. Study 1

Between-person correlations (see Table 2 lower triangle) indicated that daily physical symptoms (higher scores reflecting worse health) were positively associated with previous day physical symptoms, previous day stressors, memory failures, chronic conditions, neuroticism, and current stressors. There were also significant correlations among person-level predictors: goal pursuit proactive coping was negatively correlated with chronic conditions and neuroticism, but was positively associated with conscientiousness. Older adults also reported more chronic conditions, higher levels of education, lower neuroticism, and higher conscientiousness than younger adults.

Results from a fully unconditional multilevel model revealed that 65% (τ_{00} = 3.09, z = 9.48, *p* < 0.0001) of the variance was between-person and 35% (σ^2 = 1.66, z = 24.87, *p* < 0.0001) was within-person in daily physical symptoms. Full model results are presented in Table 3. There were no main effects of proactive coping or daily stressors, but daily stressors interacted with both proactive coping and age. Higher proactive coping and older age were each associated with reduced physical reactivity. These two-way interactions were qualified by a significant three-way interaction between daily stressors, proactive coping, and age (see Figure 1). We tested the simple slopes using http://www.quantpsy.org/interact/hlm3.htm (accessed on 8 November 2022). The slopes of daily stressors for younger adults with low (*M* − 1*SD*; simple slope = 0.94, *t* = 7.24, *p* < 0.0001) and high (*M* + 1*SD*; simple slope = 0.45, *t* = 3.21, *p* = 0.0014) proactive coping were significant. However, the slopes of daily stressors for older adults with low (*M* − 1*SD*; simple slope = 0.14, *t* = 0.41, *p* = 0.684) and high (*M* + 1*SD*; simple slope = 0.23, *t* = 0.60, *p* = 0.547) proactive coping were not significant. Younger adults low in proactive coping were the most physically reactive to daily stressors (i.e., exhibited the steepest slope of an increase in physical health symptoms). The significant Stressor × Age interaction (Table 3) suggests that older adults were less physically reactive compared to younger adults. The model explained 11% of the within-person and 42% of the between-person variance in daily physical symptoms. Separate models conducted for younger (see Table 4) and older (see Table 5) participants with all covariates were used to obtain predicted points for Figure 1.
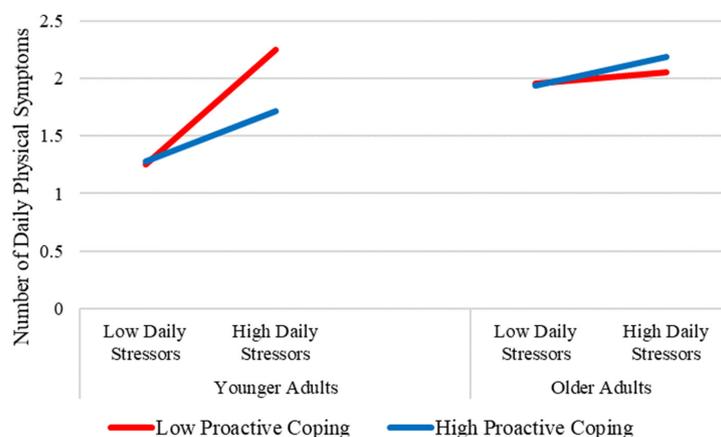

Figure 1. Significant 3-way interaction of daily stressors, age, and proactive coping predicting the number of daily physical symptoms (higher scores reflect more physical symptoms, worse health).

Predicted points were plotted based on separate models for younger and older adults with low ($M −$ 1SD) and high ($M + 1SD$) proactive coping and low ($M − 1SD$) and high ($M + 1SD$) daily stressors, adjusted for all covariates. Younger adults low in proactive coping were the most physically reactive to daily stressors (i.e., exhibited the steepest slope). Older adults were less physically reactive to daily stressors compared to younger adults (see significant Stressor × Age effect in Table 3).

Table 3. Full Sample Models.

Variables	Study 1			Study 2		
	Estimate	SE	*p*	Estimate	SE	*p*
Intercept	0.07	1.59	0.9673	4.36	0.85	**<0.0001**
Daily Physical Symptoms/Health (PD)	0.14	0.02	**<0.0001**	0.25	0.03	**<0.0001**
Daily Stressors (PD)	0.06	0.05	0.2769	0.02	0.01	0.0616
Daily Negative Affect	0.01	0.08	0.8839	0.003	0.04	0.9221
Daily Memory Failures	0.17	0.05	**0.0002**	0.02	0.02	0.3239
Chronic Conditions	0.27	0.04	**<0.0001**	0.004	0.02	0.8541
Education	−0.04	0.06	0.4671	0.06	0.04	0.1058
Neuroticism	0.16	0.17	0.3495	0.12	0.10	0.2019
Conscientiousness	0.18	0.22	0.4199	0.26	0.12	**0.0337**
Daily Stressors	3.24	0.64	**<0.0001**	−0.28	0.25	0.2560
Proactive Coping	−0.09	0.46	0.8393	−0.10	0.24	**0.0003**
Age	0.003	0.03	0.9258	−0.09	0.02	**<0.0001**
Proactive Coping × Age	0.001	0.01	0.9434	0.02	0.01	**0.0004**
Daily Stressors × Age	−0.05	0.02	**0.0014**	0.01	0.01	0.4767
Daily Stressors × Proactive Coping	−0.78	0.21	**0.0002**	0.13	0.08	0.1069
Daily Stressors × Proactive Coping × Age	0.01	0.01	**0.0109**	−0.003	0.002	0.2245

Note: PD = previous day. Bold indicates significant effects. Both models were run without covariates included; the pattern of results with and without covariates are the same in both studies. We additionally tested for the possibility of a Previous Day Stressor × Proactive Coping × Age interaction and did not find evidence of it in Study 1 (*p* = 0.0897) or in Study 2 (*p* = 0.9939).

Table 4. Younger Adult Model.

Variables	Study 1			Study 2		
	Estimate	SE	*p*	Estimate	SE	*p*
Intercept	0.24	1.50	0.8726	1.96	0.66	**0.0047**
Daily Physical Symptoms/Health (PD)	0.17	0.03	**<0.0001**	0.30	0.04	**<0.0001**
Daily Stressors (PD)	0.02	0.07	0.8302	0.01	0.02	0.5785
Daily Negative Affect	−0.02	0.10	0.8407	−0.04	0.05	0.4246
Daily Memory Failures	0.15	0.01	**0.0128**	−0.01	0.03	0.7029
Chronic Conditions	0.46	0.07	**<0.0001**	0.01	0.02	0.5326
Education	−0.05	0.17	0.7796	0.07	0.05	0.1490
Neuroticism	0.17	0.20	0.3975	0.22	0.11	0.0505
Conscientiousness	−0.02	0.28	0.9577	0.03	0.13	0.7875
Daily Stressors	2.39	0.46	**<0.0001**	−0.13	0.06	**0.0291**
Proactive Coping	0.03	0.30	0.9097	−0.18	0.07	**0.0110**
Daily Stressors × Proactive Coping	−0.57	0.15	**0.0001**	0.05	0.02	**0.0140**

Note: PD = previous day. Bold indicates significant effects.

3.2. Study 2

Between-person correlations indicated that daily physical health (higher scores reflecting better health) was positively associated with previous day physical health, previous day stressors, negative affect, memory failures, and current stressors, and was negatively associated with age. Prevention-focused proactive coping was positively associated with negative affect, current stressors, chronic conditions, and neuroticism, but was negatively correlated with conscientiousness.

Table 5. Older Adult Model.

	Study 1			Study 2		
Variables	**Estimate**	**SE**	*p*	**Estimate**	**SE**	*p*
Intercept	1.01	1.85	0.5869	2.22	2.10	0.2907
Daily Physical Symptoms/Health (PD)	0.09	0.03	**0.0036**	0.17	0.04	**<0.0001**
Daily Stressors (PD)	0.09	0.07	0.1903	0.04	0.02	**0.0316**
Daily Negative Affect	0.11	0.14	0.4091	0.03	0.05	0.5466
Daily Memory Failures	0.21	0.07	**0.0017**	0.05	0.04	0.1641
Chronic Conditions	0.18	0.05	**0.0013**	0.02	0.08	0.7739
Education	−0.07	0.07	0.2832	−0.07	0.08	0.3998
Neuroticism	0.18	0.29	0.5406	−0.15	0.24	0.5474
Conscientiousness	0.05	0.38	0.8951	0.40	0.03	0.1926
Daily Stressors	−0.28	0.55	0.6165	−0.09	0.11	0.4207
Proactive Coping	−0.02	0.38	0.9636	0.21	0.19	0.2662
Daily Stressors × Proactive Coping	0.15	0.18	0.4214	0.01	0.04	0.7686

Note: PD = previous day. Bold indicates significant effects.

Results from a fully unconditional multilevel model revealed that 68% (τ_{00} = 0.57, z = 7.41, p < 0.0001) of the variance was between-person and 32% (σ^2 = 0.27, z = 23.02, p < 0.0001) was within-person in daily physical health. Full model results are presented in Table 3. There was a main effect of proactive coping such that people high in proactive coping reported worse physical health, on average, compared to people low in proactive coping. There was also a main effect of age where older adults reported worse physical health compared to younger adults. The Age × Proactive Coping interaction was the only significant interaction in the full model. Consistent with best practices for coordinated analysis [58,59], we tested simple slopes using the same procedure as in Study 1 and conducted separate models for younger (age 19–36, see Table 4) and older (age 37–86, see Table 5) participants with all covariates. The simple slope procedure did not indicate evidence of a 3-way interaction, but did show evidence of differing stressor slopes for low and high proactive coping for younger adults. This result also appears in the significant Daily Stressor × Proactive Coping interaction in Table 4 and is depicted in Figure 2. The negative slope for low proactive coping in Figure 2 represents more physical reactivity; that is, a decrease in physical health. Thus, younger adults low in proactive coping were more physically reactive (i.e., experienced a decrease in physical health from one day to the next with increased stressor exposure) than younger adults high in proactive coping. For older adults (see Table 5), the only significant effects were the stability of daily physical health from one day to the next and yesterday's daily stressors. The full model explained 4% of the within-person and 54% of the between-person variance in daily physical health.
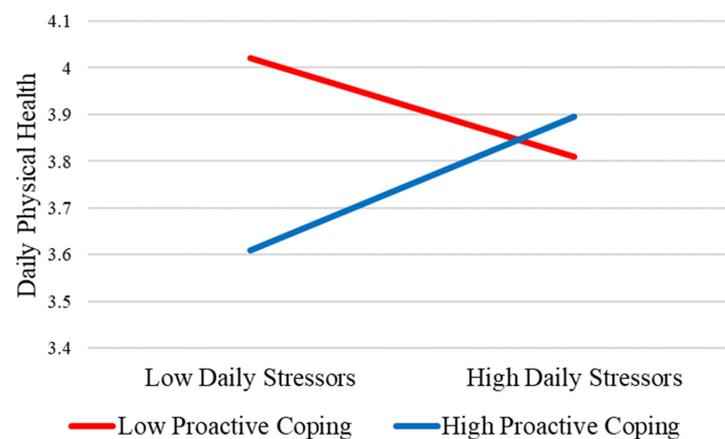

Figure 2. Significant 2-way interaction between daily stressors and proactive coping predicting daily physical health for younger adults (higher scores reflect better health). Predicted points were plotted

with low ($M − 1SD$) and high ($M + 1SD$) proactive coping and low ($M − 1SD$) and high ($M + 1SD$) daily stressors, adjusted for all covariates. Younger adults low in proactive coping were more physically reactive (i.e., experienced a decrease in physical health from one day to the next with increased stressor exposure) than younger adults high in proactive coping.

4. Discussion

The current study examined age and proactive coping differences in physical reactivity to daily stressors. Results from any single study can reflect the peculiarities of that study's design, sample, and instruments [59], so our coordinated analysis allowed us to directly study the comparability and replication of findings. Across two daily diary studies that differed in duration, age ranges, recruitment methods, as well as in measures of physical health and proactive coping, our coordinated analysis findings were consistent. Physical reactivity to daily stressors depended on both age and proactive coping. Specifically, younger adults low in proactive coping were more physically reactive to daily stressors than younger adults high in proactive coping, and older adults in general were less physically reactive to daily stressors than younger adults. Contrary to our expectations, older adults' physical reactivity was unrelated to proactive coping in both studies, suggesting instead that proactive coping is especially beneficial for younger adults.

Consistent with the focus on gains in younger adulthood from the motivational theory of lifespan development [20] as well as the importance of context for goals [19], our results in Study 1 showed that younger adults high in proactive coping (i.e., high in goal pursuit) experienced reduced physical reactivity to daily stressors. Younger adults low in proactive coping (i.e., low in goal pursuit) were the most physically reactive. There was no evidence of a significant increase in physical symptoms with increases in daily stressors for older adults, suggesting that older adults were able to minimize their physical reactivity to stressors. Although there were no age differences in proactive coping in either study, older adults may be more efficacious in their utilization of proactive coping strategies due to their life experience. In other words, older adults may be engaging in proactive coping strategies at a similar frequency as younger adults, however, their targeted strategies may be more effective in regulating their physical reactivity regardless of level of stressor exposure. As experience accumulates over the lifespan, older adults may become experts in navigating their daily experiences [3]. In line with the Proactivity Model of Successful Aging [6–9] which emphasizes the value of planful engagement in anticipation of age-related stressors [10], the potential of older adults to meet challenges through the use of resources is important for subsequent proactive adaptations [9] and is viewed as the engine that drives successful aging [12]. Future work examining the use and deployment of specific resources may help elucidate potential age-related differences in proactive coping efficacy.

Contrary to our expectations that older adults would benefit from the prevention aspect of proactive coping in terms of their physical reactivity, our results from Study 2 suggest that this form of proactive coping is also beneficial for younger adults. Although the motivational theory of lifespan development [20] emphasizes the need to adjust, cope, and take advantage of changing opportunities and constraints that emerge at different stages of life, our findings suggest that these considerations can operate on a daily basis and have implications for within-person changes in health in younger adulthood. A key feature of the model, which emphasizes the importance of context [19], is that adaptation hinges on control over one's environment (i.e., primary control) across different domains of life [20]. One way to directly implement the importance of control over different domains would be to examine each stressor domain separately. With the focus of the current study on stressor exposure in general, we found that prevention-focused efforts were helpful for younger adults' physical reactivity. It is possible that a domain-specific stressor investigation that focused on areas of particular salience to older adults, such as interpersonal relationships based on the tenets of Socioemotional Selectivity Theory [61], could reveal the importance of stressor prevention strategies for older adults. For example, older adults high in perceptions of control were less physically reactive to daily interpersonal stressors than younger adults in previous work [5]. In addition, past work has shown that older adults high in perceptions

of control were less physically reactive to work stressors than younger adults [5]. Using the same measure of proactive coping that emphasizes prevention-based strategies [18], Pearman et al. [31] showed that higher levels of proactive coping were associated with less COVID-19 stress for older adults relative to younger adults. Extending the current findings to a domain-specific stressor as well as capturing stressor severity could further elucidate age differences in physical reactivity that may depend on goal pursuit/attainment or preventive aspects of proactive coping.

It may seem counterintuitive that daily stressors would not be related to within-person increases in daily physical health symptoms for older adults (Study 1). However, we suggest that this could be evidence of heterogeneity in aging [62], where health is multi-determined [63] and not necessarily so strongly tied to self-reported stressors. For example, within Study 1, older adults' daily physical symptoms were predicted by daily memory failures and chronic conditions. It is possible that the more enduring, chronic health conditions that can be age-graded are more important for daily manifestations of physical symptoms than daily stressors [64]. It is also possible that daily increases in memory failures are associated with daily increases in physical symptoms for older adults because of the well-established connection between cognitive and physical health [65]. We also note that one of the daily memory failure items involved forgetting to take medication as scheduled, which could have physical consequences. In addition, it is important to note that the age range for the older adults in Study 1 spanned 30 years, likely serving as an additional source of heterogeneity. In Study 2, increases in daily stressors were actually associated with an increase in next-day physical health for older adults, which also highlights heterogeneity in aging. Although daily stressors are typically associated with negative outcomes, recent work suggests that they are also associated with positive outcomes. For example, Diachina and Neupert [66] found that older adults experienced an increase in positive affect when using anticipatory coping before an upcoming daily stressors related to home demands. Positive outcomes may result from daily stressors because daily stressors could reflect engagement with life; those who report no daily stressors are likely to have fewer positive events [67]. In Study 2, older adults' daily health also seems to be tied to the previous day's health rating, again pointing to the possibility of the importance of enduring health ratings that carry over from one day to the next.

Although proactive coping is associated with lower levels of stress [30] and increases in daily stressors are associated with increases in physical health symptoms [5], these processes may be especially important at younger ages. Results of the Age × Proactive Coping interaction in Study 2 suggest that younger adults high in preventive strategies experience lower self-rated health, on average, compared to younger adults low in preventive strategies. It is possible that poorer perceptions of health could prompt the use of a prevention-focused perspective to try to avoid further losses [20]. Methods that can test the temporal ordering and potential bidirectionality of proactive coping and physical health could be an important avenue for future work.

Whereas younger adults were more likely in prior work to have higher reactivity (i.e., physical consequences of daily stressors) when daily stressor exposure was high [5], our findings suggested that physical reactivity was amplified for younger adults who reported low proactive coping. Neupert and Bellingtier [28] found that younger adults were the ones who benefited the most from forecasting an upcoming stressor, suggesting that future-oriented thinking such as proactive coping may be especially relevant for younger adults. Because proactive coping relies on the accumulation of resources that contribute to the reduction or prevention of future stressors [10], it is possible that younger adults are closer to the beginning of the resource accumulation process compared to older adults. This finding may be consistent with the idea that a strength of aging may be in avoiding a stressor (i.e., prevention), but that when a stressor cannot be avoided, those efforts may not be as beneficial [3].

Limitations and Future Directions

Results from the current study should be considered in light of some limitations. The data are exclusively self-report and correlational in nature. Future studies with objective indicators of daily health would be important to determine replicability of the current results. Although we cannot make causal claims, our lagged models and inclusion of negative affect and neuroticism as covariates provide evidence for the association between stressors and changes in daily physical health and account for factors that unduly influence self-reported physical health ratings. The current study focuses on proactive coping, which is a set of thoughts and behaviors that is not directed at a particular stressor and is considered trait-like [10]. Evaluation of state-like anticipatory coping efforts directed to specific stressors [2,28,35] would be beneficial in deconstructing the dynamics of domain-specific coping strategies that may evolve over time. This approach could shed additional light on psychological mechanisms and developmental differences in coping with implications for physical reactivity. In addition, longitudinal studies are necessary to move beyond the cross-sectional effects with proactive coping in the current study. Although our Study 2 results suggested that people who engaged in more proactive coping reported more stressors (Table 2), longitudinal designs are necessary to help establish temporal sequencing and test the possibility that exposure to stressors might prompt engagement in proactive coping strategies to attempt to reduce future stressors.

Recruitment processes differed in Study 1 between younger and older adults which could introduce a confounding effect when observing age differences. Specifically, the older adults recruited through MTurk in Study 1 may be positively selected with respect to resources, motivation, and technological savvy. However, higher quality data can be acquired through a more diverse group of participants with MTurk when compared to standard community samples [68], and the results across Study 1 and Study 2 are consistent. We also note that our rates of stressor exposure reports are in line with previous national studies (i.e., National Study of Daily Experiences), where no daily stressors were reported on 61% of the eight study days [4]. In Study 1, no daily stressors were reported on 68% of the eight study days, and in Study 2, no daily stressors were reported on 45% of the 29 study days. The younger adults in Study 1 were all college students in one state, making them less diverse in terms of education and geography than the older adults. Study 2 was more diverse in terms of education and geography, so we have increased confidence that the results are not due to recruitment processes.

We encourage future studies with more racial and ethnic backgrounds and countries to examine additional contexts as potential moderators. Within the U.S., we know that African Americans may be differentially affected by stressor exposure, especially in regard to physical symptoms [69]. Beyond chronological age differences, subjective perceptions of aging experiences may also be important to consider in future work, as those who view their aging with a more positive attitude tend to have better self-reported health [70]. Finally, the subjective intensity or severity of the stressors may be important to consider [71], so future research should incorporate participants' subjective appraisals of stressors in addition to stressor exposure, especially given the stressor prevention and goal pursuit/attainment orientations associated with proactive coping [13].

5. Conclusions

Proactive coping is more strongly related to physical reactivity to daily stressors in young adulthood than in older adulthood. Proactive coping strategies consist of key skills that can be taught and may be iterative in their evolution [10], and our findings suggest that younger adults may be at a key developmental period to engage in structured efforts to boost their development and usage of proactive coping strategies. We encourage future work that could determine the causal implications of interventions to boost proactive coping and whether domain-specific preventive strategies would be especially helpful for older adults.

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