Journal of Psychosomatic Research 162 (2022) 111035

Contents lists available at ScienceDirect

Journal of Psychosomatic Research

journal homepage: www.elsevier.com/locate/jpsychores

# Are coping strategies and variability in their use associated with lifespan?

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ARTICLE INFO

*Keywords:*
Coping
Coping variability
Emotion regulation
Flexibility
Longevity
Mortality

ABSTRACT

*Objectives:* Some stress-related coping strategies contribute to survival among medical populations, but it is unclear if they relate to longevity in the general population. While coping strategies are characterized as being adaptive or maladaptive, whether capacity to tailor their implementation to different contexts (i.e., flexibility of use) may influence lifespan is unknown.

*Method:* In 2004–2006, participants from the Midlife Development in the United States study completed a validated coping inventory including 6 strategies and provided information on sociodemographics, health status, and biobehavioral factors ($N = 4398$). Deaths were ascertained from death registries with follow-up until 2018. Accelerated failure time models estimated percent changes and 95% confidence intervals (CI) in predicted lifespan associated with use of individual coping strategies. As a proxy for flexibility, participants were also classified as having lower, moderate, or greater variability in strategies used, using a standard deviation-based algorithm.

*Results:* After controlling for sociodemographics and health status, maladaptive strategies (e.g., per 1-SD increase in Denial = −5.50, 95%CI = −10.50, −0.21) but not adaptive strategies (e.g., Planning) were related to shorter lifespan. Greater versus moderate variability levels were related to a 15% shorter lifespan. Estimates were somewhat attenuated when further controlling for lifestyle factors.

*Conclusion:* Although most associations were of modest magnitude, use of some maladaptive coping strategies appeared related to shorter lifespan. Compared to moderate levels, greater coping variability levels were also clearly detrimental for lifespan. Although adaptive strategies were unrelated to longevity, future work should examine other favorable strategies (e.g., acceptance) and more direct measures of flexibility (e.g., experience sampling methods).

## 1. Introduction

Stressful experiences (e.g., childhood abuse) and psychological responses (e.g., anxiety symptoms) are related to greater disease risk and shorter lifespan (1–4). Yet, findings sometimes appeared weaker than expected, possibly because studies often fail to consider how individuals handle these stressors and related responses. Prior theoretical research posits that psychological regulatory processes such as the capacity to regulate emotions and cope with stressors can help understand why diverse stressors and psychological responses impact physical health (2,4–6). Coping strategies, defined as ways to mitigate stressful experiences and their potentially toxic sequelae, may thus have important implications for long-term health.

Numerous studies have investigated whether specific stress-related coping strategies are associated with subsequent health outcomes (5,7–13). For example, scholars have examined associations of various coping strategies with survival and recurrence in cancer patients (8). Individual strategies include Active Coping (taking actions to remove

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https://doi.org/10.1016/j.jpsychores.2022.111035
Received 5 May 2022; Received in revised form 6 September 2022; Accepted 6 September 2022
Available online 13 September 2022

the stressor or improve its consequences), Positive Reinterpretation & Growth (construing a stressful transaction in positive terms), Focusing on & Venting of Emotions (focusing on and verbalizing distress), and Denial (refusing to believe the stressor exists) (8–10,12,14). Coping strategies are often conceptualized as being adaptive or maladaptive, depending on how they typically influence mental and physical health (9,10,12–14). For instance, Active Coping, Planning, and Social Support are characterized as adaptive strategies because they usually promote greater psychological well-being, lower psychological distress, and more favorable health outcomes, whereas Denial, Behavioral Disengagement, and Avoidance are characterized as maladaptive strategies because they frequently relate to poorer mental and physical health outcomes (9,10,12–14).

Yet, scholars increasingly argue that, rather than being intrinsically adaptive versus maladaptive, the impact of such strategies depends on the flexibility with which they are used across contexts (15–17). This perspective suggests optimal psychological functioning will be evident among more *flexible* individuals, characterized as those who show some *variability* in their selection of strategies, possibly as a way to maximize the appropriate use of specific strategies in particular contexts (17,18). This flexibility framework provides a broader approach for characterizing how individuals may cope with varied stressors (15), and how the use of particular coping strategies may affect health. If flexibility is a key parameter determining the coping-health relationship, this could also help to explain why prior findings linking coping strategies in a more fixed way to health have sometimes been inconsistent. Because flexibility has been mainly examined over short durations (e.g., over hours/days in laboratory protocols and experience-sampling studies) (19), its role in long-term health-related outcomes is unknown. Moreover, while being flexible in the use of coping strategies might be health beneficial, it is unclear if there are limits to how much flexibility is beneficial. Indeed, the operationalization of coping variability and its linear association with outcomes, where more variability is inherently better, are debated (17,18).

Most health research assessing coping in relation to longevity has focused on medical populations (8–10,13). However, associations may differ depending on whether individuals are already ill or generally healthy. Evidence for such associations among the general population is limited (20) and most studies have examined individual coping strategies in relation to mortality risk. For example, one study evaluated five coping strategies among 79,580 initially-healthy Japanese adults with all-cause mortality risk and adjusted for sociodemographic, health status, and behavioral covariates (21). Results indicated sex differences, whereby mortality risk was lower among women who reported using emotional expression, social support, and disengagement, and among men who reported using emotional expression, problem-solving, and positive reappraisal. Two other studies evaluated six coping strategies among 55,130–57,017 initially-healthy Japanese adults and found that only positive reappraisal was related to reduced risk of cancer and cardiovascular disease mortality, respectively (22,23). Interestingly, these two studies also examined whether coping variability, defined by engaging in 4–6 strategies regularly versus none of them, was related to each endpoint. No differences were found; however, these studies may have been underpowered to detect effects as few deaths ($n < 10$) were reported among individuals using 4–6 strategies ($n < 5000$) (22,23).

Studies conducted among non-medical populations have mainly considered distinct stress-related coping strategies in relation to mortality. However, studying positive health outcomes like longer lifespan would acknowledge the construct of health in its fullest sense, rather than solely focusing on disease or mortality (24,25). Studies of regulatory processes may also provide pivotal information since such processes might be a more efficient intervention target to promote better health than separately targeting individual stressors and related psychological responses. This study examined whether strategies used to cope with stressful events and the variability in their use are related to changes in predicted lifespan. Data are from the Midlife Development in the United States (MIDUS), an ongoing national study in which a validated coping scale was administered and mortality follow-up was conducted. Based on previous research and theory, we broadly hypothesized that strategies usually deemed adaptive would be related to a longer lifespan, whereas strategies usually deemed maladaptive would be associated with a shorter lifespan. Analyses adjusted for potential confounders like sociodemographic characteristics and initial health status. We further explored the association of coping variability –operationalized as the extent to which strategies chosen within a repertory are (un)equally used (19)– with changes in predicted lifespan without a priori hypothesis, given limited studies of this relationship.

## 2. Method

### 2.1. Participants

Participants are from MIDUS, a longitudinal cohort study examining how biopsychosocial factors influence physical and mental health across adulthood. Briefly, 7108 MIDUS participants aged 25–74 were recruited in 1995–1996 (Wave I) through random-digit dialing procedures. They completed a comprehensive telephone interview and self-administered questionnaire, which queried information about sociodemographic, psychosocial, behavioral, and health variables. Of these, 5554 participants completed similar questionnaires at MIDUSII (Wave II) in 2004–2006. This subset includes a sample of African Americans from Milwaukee ($n = 592$) that was added to the larger sample to enable examination of health in minority populations. All measures in the Milwaukee sample paralleled those used in MIDUSII. The study was approved by the Institutional Review Board at all participating centers, and written informed consent was obtained from all participants.

The present study was restricted to the MIDUSII sample, when coping was first assessed. We excluded participants who did not complete the self-administered questionnaire at MIDUSII ($n = 1097$) and who had missing data on all coping items ($n = 59$), leading to an analytic sample of 4398 participants. Following MIDUS guidelines (26), for the remaining coping items with missing values, the mean value of completed items from the same subscale was substituted as the missing item value. Since few participants had missing data on analytic baseline covariates (ranging from 0.02% to 4.16% across covariates), multiple imputation was used, as described below. Individuals who were excluded versus included in the analytic sample were slightly younger, less educated and had lower income; they were also more likely to be from underrepresented racial/ethnic groups and not married, and to have poorer health (Supplemental Table S1).

### 2.2. Measures

Details about how each variable was measured, the rationale for using coping strategies individually rather than under "coping styles" (e.g., problem- versus emotion-focused), and the conceptual validation of our dispositional coping variability construct are provided in Text S1.

#### 2.2.1. Coping

At MIDUSII, how individuals cope with stressful events in general, as a dispositional style, was measured using a modified version of the validated 60-item Coping Orientation to Problems Experienced (COPE) inventory (14). This 24-item version encompassed three subscales generally considered adaptive (Active Coping, Planning, and Positive Reinterpretation & Growth), and three subscales generally considered maladaptive (Focus on & Venting of Emotions, Denial, and Behavioral Disengagement) (14). Each subscale includes 4 items rated on a scale from 1 = *a lot* to 4 = *not at all*. In our analytic sample, all coping subscales had acceptable-to-good internal consistency reliability ($\alpha = 0.65$ to 0.79). For each subscale, individual item scores were reverse-coded and summed to calculate a total score (range = 4–16) where higher scores reflect greater use of the strategy. Continuous scores from

individual coping strategies were z-standardized to facilitate comparisons.

To derive a proxy measure of coping flexibility, we adapted an algorithm from prior research to obtain a dispositional Between-Strategy Index (19). Although our index is derived from a one-time assessment of how individuals *typically* cope with stressors rather than repeated assessments across *specific* situations, prior COPE research found moderate-to-high concordance between dispositional and situational versions of the inventory (14,27). Thus, our variability score indicates to what extent strategies chosen within a repertory are (un)equally used in general, as a dispositional tendency. Such variability potentially indicates attempts to find the best strategy or favor certain strategies across distinct situations (19). Table 1 shows the calculation of the Dispositional Between-Strategy Index with fictitious data. In statistical analyses, we tertiled this index (lower, moderate, greater) to examine potential non-linear effects in the coping-lifespan association (17,18). Characterizing coping variability with a standard deviation (*SD*) score can be confounded by the average level of strategies favored (individuals who have consistently low or high mean levels of usage across strategies cannot display high levels of variability due to floor or ceiling effects) (19). Therefore, following prior research (19), we further controlled for mean strategies endorsement in all models to assess whether coping variability, beyond the average level of strategies used, would relate to changes in lifespan.

#### 2.2.2. Lifespan

Lifespan was operationalized as changes in predicted lifespan, following previous studies investigating the association of psychosocial factors with longevity (28–30). Information on vital status was obtained from the National Death Index (31) and MIDUSIII survey fielding (26) through June 2018, the most recently available data.

#### 2.2.3. Covariates

Following prior research (28–30), we considered sociodemographic characteristics, health status, and biobehavioral factors as covariates, all self-reported at MIDUSII, our analytic baseline. Sociodemographics may confound the coping-lifespan relationship and included age, sex, race, education, income, and marital status. Health status, another possible confounder, was represented by prevalent or history of major chronic conditions including cancer, diabetes, and stroke. We considered as biobehavioral factors body mass index (BMI), physical activity, alcohol consumption, and smoking status. To optimize statistical power, these 4 health-related biobehavioral factors were aggregated into a lifestyle index, as done in previous studies (i.e., with 1 point attributed to healthy levels of each factor, with a total ranging from 0 [unhealthiest] to 4 [healthiest]) (32–34). Such biobehavioral factors are typically considered either as potential confounders or mediators linking emotion-related factors with physical health outcomes (2,6). However, their role in this coping study is more complex because many of these factors may be coping strategies themselves, used either consciously or unconsciously to adjust to stressors (35–37). As these health behaviors were evaluated as general lifestyle habits rather than stress-related coping strategies in MIDUSII, we included them as potential confounders in exploratory models.

### 2.3. Statistical analysis

#### 2.3.1. Descriptive statistics

Statistical analyses were conducted using SAS 9.4. Multiple imputation with 10 imputed datasets was used to account for missing data on covariates in all models. We first calculated the descriptive statistics for covariates and then computed Pearson correlations to evaluate the relationships among COPE subscale scores.

#### 2.3.2. Primary models

We ran three accelerated failure time models (see details Text S1). Models progressively accounted for potential confounders to estimate the proportion by which participants' predicted lifespan differed in association with level of use for each individual coping subscale. The first model adjusted for age. The second model further controlled for sex, race, education, income, and marital status. The third (core) model additionally included health status. To explore the potential confounding role of biobehavioral factors, in Model 4 we further added the lifestyle score. The six coping subscales (continuous, per 1-SD increase) and the coping variability tertiles (lower, moderate, greater; looking at all possible contrasts) were considered as independent variables in separate models. Coping variability models further adjusted for mean strategies endorsement.

#### 2.3.3. Secondary models

To evaluate potential sex differences, an interaction term of sex*-individual coping strategy score was introduced to the core Model 3. If the interaction test was statistically significant ($p < 0.05$), stratified analyses by sex were conducted. To reduce potential concerns about reverse causation, whereby underlying declining physical health could impact the use/report of coping strategies, primary models were re-evaluated while excluding participants who died ≤1 year of baseline ($n_{deaths} = 49$; analytic subsample: $N = 4349$).

## 3. Results

### 3.1. Baseline characteristics

Table 2 shows participants' baseline characteristics. Participants were on average 56 years old (SD = 12; range = 30–85). Approximately half of the sample was female and most participants were White,

**Table 1**
Example of the Dispositional Between-Strategy Index to capture an individual's general level of coping variability with fictitious data.

| Participant number | Strategy 1 | Strategy 2 | Strategy 3 | Strategy 4 | Strategy 5 | Strategy 6 | Dispositional Between-Strategy Index | Mean strategies endorsement |
|---|---|---|---|---|---|---|---|---|
| 1 | 4 | 4 | 4 | 3 | 3 | 3 | 0.55 | 3.50 |
| 2 | 1 | 1 | 1 | 2 | 2 | 2 | 0.55 | 1.50 |
| 3 | 6 | 1 | 3 | 1 | 1 | 1 | 2.04 | 2.17 |
| 4 | 0 | 0 | 3 | 3 | 3 | 0 | 1.64 | 1.50 |
| 5 | 6 | 6 | 6 | 0 | 0 | 0 | 3.29 | 3.00 |
| 6 | 0 | 0 | 6 | 6 | 0 | 0 | 3.10 | 2.00 |

*Notes.* The Dispositional Between-Strategy Index and this example table are adapted from Blanke and colleagues' study on the Between-Strategy Index. (19) Data are from six fictitious participants and their rating of the frequency with which they used six coping strategies on a scale from 0 (not at all) to 6 (all the time). Calculation details are available in Text S1. Individuals displaying lower variability scores (e.g., participants 1 and 2) would generally use all strategies simultaneously to a similar extent (displaying high evenness in their coping scores across strategies) across circumstances, whereas those with greater variability scores (e.g., participants 5 and 6) would be more likely to select only a few strategies from their repertory and rely heavily on them without using other strategies (displaying high unevenness in their coping scores). By contrast, individuals exhibiting moderate variability scores (e.g., participants 3 and 4) might use several strategies but each to a different extent or use a few strategies to a modest extent, possibly reflecting an attempt to find the best strategy in a given context (displaying moderate unevenness in their coping scores) (19).

**Table 2**
Sociodemographic, health, and biobehavioral characteristics of the analytic sample at baseline ($N = 4398$).

| | N or mean | % or SD |
|---|---|---|
| *Age, mean (SD)* | *55.8* | *12.3* |
| Sex, N (%) | | |
| Female | 2470 | 56.2 |
| Male | 1928 | 43.8 |
| Race/ethnicity status, N (%) | | |
| White individuals | 3669 | 83.4 |
| Underrepresented individuals | 728 | 16.6 |
| Missing | 1 | 0.02 |
| Education, N (%) | | |
| Lower than high school | 324 | 7.4 |
| GED or high school | 1210 | 27.5 |
| Some college | 945 | 21.5 |
| College or more | 1914 | 43.5 |
| Missing | 5 | 0.1 |
| Income, N (%) | | |
| Lower than $25,000 | 981 | 22.3 |
| $25,000 to $44,999 | 767 | 17.4 |
| $45,000 to $69,999 | 835 | 19.0 |
| $70,000 or more | 1632 | 37.1 |
| Missing | 183 | 4.2 |
| Marital status, N (%) | | |
| Married | 2953 | 67.1 |
| Separated/divorced/widowed | 1016 | 23.1 |
| Never married | 423 | 9.6 |
| Missing | 6 | 0.1 |
| Prevalent or history of major chronic condition(*s*)[a], N (%) | | |
| No | 3189 | 72.5 |
| Yes | 1209 | 27.5 |
| Body mass index, N (%) | | |
| $<25$ kg/m$^2$ | 1306 | 29.7 |
| $\geq 25$ kg/m$^2$ | 2864 | 65.1 |
| Missing | 228 | 5.2 |
| Physical activity, N (%) | | |
| Moderate levels >1/week or vigorous levels ≥1/week | 1989 | 45.2 |
| Moderate levels ≤1/week or vigorous levels <1/week | 2219 | 50.5 |
| Missing | 190 | 4.3 |
| Alcohol consumption, N (%) | | |
| Between 1 and 8 (female) or between 1 and 14 (male) beverages/week | 859 | 19.5 |
| <1 or >8 (female) or 14 (male) beverages/week | 3528 | 80.2 |
| Missing | 11 | 0.3 |
| Smoking status, N (%) | | |
| Never or former smokers | 3694 | 84.0 |
| Current smokers | 704 | 16.0 |
| *Lifestyle index (ranging from 0 [unhealthiest] to 4 [healthiest]), mean (SD)* | *1.8* | *0.9* |

*Notes.* GED = general educational development, N = sample size, SD = standard deviation. [a]At least one of the following: diabetes, stroke, heart failure, heart disease, myocardial infarction, and cancer.

married, and had some college education. At least three-quarter of the analytic sample were not current smokers and about half engaged in regular moderate-to-vigorous physical activity. Approximately a quarter of participants reported at least one chronic condition (27%) and two-thirds had a BMI $\geq 25$ kg/m$^2$. Three-quarters reported either drinking $<1$ or $>8$ (female) or $>14$ (male) alcoholic beverages/week on average. Table S2 presents descriptive statistics and a correlation matrix of the coping variables. Subscales were inter-correlated but coefficients were of varying magnitude ($|r| = 0.03$ to 0.81). Coping strategies generally conceptualized as adaptive were inversely and modestly correlated with maladaptive ones, supporting their orthogonality (14).

### 3.2. Primary models: Individual coping strategies and lifespan

Over the follow-up period (mean = 12.81 years, SD = 2.85, range = 0–14 years), 655 participants died (14.89%). Table 3 reports estimates for associations of each coping variable with percent changes in predicted lifespan. Adaptive coping strategies were not clearly associated with lifespan in any model. When considering maladaptive coping strategies in age-adjusted models, each 1-SD increase in Denial and in Behavioral Disengagement were related to 8.90% and 6.41% shorter lifespans, respectively. These associations were somewhat diminished after adding sociodemographic and health status covariates (e.g., for Denial: Model 2 = −6.02, 95%CI = −11.09, −0.67; Model 3 = −5.50, 95%CI = −10.50, −0.21). An association of Focus on & Venting of Emotions with lifespan was not as clearly evident across models, although the estimates were in the expected direction and marginally significant (Model 3: −5.04, 95%CI = −10.21, 0.43). When considering coping variability, compared to lower variability levels, greater levels were unrelated to lifespan, whereas moderate levels were marginally associated with longer lifespan in the age-adjusted model (13.75, 95% CI = −1.19, 30.94) but these associations were attenuated in the core model (10.85, 95%CI = −3.45, 27.27). However, when using moderate variability levels as the reference group, greater levels were clearly associated with shorter lifespan (Model 3: −15.37, 95%CI = −26.17, −3.00).

Further including biobehavioral factors to the core model slightly attenuated estimates in some instances (Model 4). All associations of lifespan with adaptive coping strategies remained null. The maladaptive strategies coefficients remained elevated, even if their respective 95% CIs became wider (e.g., Denial = −4.45, 95%CI = −9.54, 0.92). In the variability models, the association of greater versus moderate levels became slightly stronger (−16.30, 95%CI = −26.97, −4.07).

### 3.3. Secondary models

We found no evidence that the coping-lifespan association was moderate by sex (all sex*coping strategy interaction terms had $p > 0.05$). When excluding participants who died within one year of baseline (Table S3), the magnitude of estimates was slightly attenuated but associations remained evident. For instance, in core Model 3, shorter lifespan remained associated with maladaptive strategies (e.g., Focus on & Venting of Emotions = −4.95, 95%CI = −9.49, −0.19). Further, greater versus moderate levels of coping variability were associated with shorter lifespan (e.g., Model 3 = −11.60, 95%CI = −21.56, −0.39).

## 4. Conclusion

This prospective study investigated whether the ways in which individuals cope with stressful events are related to predicted lifespan over a 14-year follow-up. In primary models, strategies typically considered as maladaptive were associated with shorter lifespans, beyond sociodemographics and initial health status. Notably, every 1-SD higher in frequency of using Denial and Behavioral Disengagement each was related to a 6% shorter lifespan. However, associations were not evident with strategies generally deemed adaptive (e.g., Planning). Although a 6% shorter lifespan may appear small, based on life expectancy statistics it represents 5 years lost among US 65-year old adults in 2018 (38). For coping variability, analyses indicated a non-linear relationship, whereby greater versus moderate levels were related to a clear 15% loss in lifespan (i.e., 13 years for 65-year old adults), whereas moderate versus lower levels appeared marginally beneficial. These primary associations did not differ by sex and were slightly attenuated when introducing a 1-year lag to address potential concerns about reverse causation. Such attenuation might suggest coping's role in lifespan is more potent with or influenced by imminent death. However, caution in interpretation is warranted since only 49 participants were excluded from these analyses.

Although these associations were either null or of modest magnitude, they partly confirmed our hypotheses, by indicating some maladaptive coping strategies may relate to a shorter lifespan. The absolute magnitude of these findings is consistent with those from recent studies that showed an association between other psychological factors with longevity (3,28). For example, among U.S. middle-aged adults, every 1-SD higher in optimism was related to 4–6% longer lifespan (28).

**Table 3**
Percent changes in predicted lifespan associated with individual coping strategies and coping variability levels.

| | Model 1 Age only % (95% CI) | Model 2 Sociodemographics % (95% CI) | Model 3 M2 + health status (core model) % (95% CI) | Model 4 M3 + lifestyle (exploratory model) % (95%CI) |
|---|---|---|---|---|
| Individual coping strategies (per 1-SD increase) | | | | |
| Positive Reinterpretation & Growth | 4.72 (−1.03, 10.79) | 3.49 (−2.19, 9.49) | 2.13 (−3.42, 8.00) | 2.21 (−3.36, 8.09) |
| Active Coping | 3.47 (−2.16, 9.43) | 0.68 (−4.77, 6.44) | 0.29 (−5.08, 5.97) | −0.57 (−5.88, 5.05) |
| Planning | 5.14 (−0.62, 11.22)† | 2.58 (−3.03, 8.51) | 1.91 (−3.60, 7.74) | 1.32 (−4.15, 7.10) |
| Focus on & Venting of Emotions | −4.28 (−9.54, 1.29) | −5.30 (−10.55, 0.25)† | −5.04 (−10.21, 0.43)† | −4.55 (−9.76, 0.96)† |
| Denial | −8.90 (−13.66, −3.87)*** | −6.02 (−11.09, −0.67)* | −5.50 (−10.50, −0.21)* | −4.45 (−9.54, 0.92)† |
| Behavioral Disengagement | −6.41 (−11.53, −1.01)* | −5.69 (−10.85, −0.22)* | −5.60 (−10.69, −0.22)* | −4.97 (−10.08, 0.44)† |
| Variability in coping strategy use | | | | |
| Moderate versus lower variability | 13.75 (−1.19, 30.94)† | 13.39 (−1.38, 30.37)† | 10.85 (−3.45, 27.27) | 10.49 (−3.75, 26.84) |
| Greater versus lower variability | −6.62 (−18.36, 6.81) | −6.37 (−18.11, 7.05) | −6.19 (−17.84, 7.12) | −7.52 (−19.00, 5.59) |
| Greater versus moderate variability | −17.91 (−28.55, −5.67)** | −17.43 (−28.06, −5.22)** | −15.37 (−26.17, −3.00)* | −16.30 (−26.97, −4.07)** |

*Notes.* $N = 4398$, $n_{deaths} = 655$. Although all coping variables are presented in the same table, they represent distinct analyses.
†$p \leq 0.10$; *$p \leq 0.05$; **$p \leq 0.01$; ***$p \leq 0.001$. CI = confidence interval, SD = standard deviation.
Standardized scores of coping variability levels: Low = 0.12 to 0.59; Moderate = 0.59 to 0.87; High = 0.87 to 3.03.
Model 1 adjusted for age (and mean strategies endorsement in coping variability models). Model 2 adjusted for age, sex, race, education, income, and marital status (and mean strategies endorsement in coping variability models). Model 3 adjusted for age, sex, race, education, income, marital status, and health status (and mean strategies endorsement in coping variability models). Model 4 adjusted for age, sex, race, education, income, marital status, health status, and the lifestyle index (and mean strategies endorsement in coping variability models).

However, our findings are somewhat at odds with those from other studies, given we did not observe the expected association between some strategies previously identified as adaptive and lifespan changes. For example, in the three Japanese studies described earlier, adaptive strategies (e.g., positive reappraisal, emotional expression) and, in some instances, maladaptive strategies (e.g., disengagement) were associated with a lower all-cause and cause-specific mortality risk (21–23). Yet, the different outcomes of mortality risk versus changes in predicted lifespan, greater statistical power, as well as cultural differences (11,17) might explain such discrepancies. For instance, behavioral disengagement is typically considered a maladaptive strategy because individuals using it give up any attempt to deal with the stressor (14). Yet, in Japanese individuals, disengaging from a stressor may be adaptive if it reflects the acceptance of a situation, especially when it cannot be changed (21).

We also considered coping variability, to operationalize the premise that flexible implementation of a diverse set of strategies across contexts may allow better adjustment than relying on the same few strategies at all times. To date, diverse conceptualizations of coping variability have been used. In the Japanese studies described earlier, the authors created a repertory by summing the number of individual dispositional coping strategies frequently used and found no difference in mortality risk for greater versus lower variability levels (22,23). In our study, when considering variability levels using a dispositional version of the Between-Strategy Index (19) that relies on standard deviation of coping strategy scores, we likewise noted no difference in predicted lifespan for greater versus lower variability. However, longevity benefits appeared with moderate levels: in fact, marginal gains in lifespan where evident when compared to lower levels, whereas greater levels clearly showed a detrimental association with lifespan. This finding echoes results from previous mental health research in which moderate but not greater variability across various strategies, regardless of their inherent (mal) adaptive nature, was associated with fewer symptoms of psychopathology (19,39).

As noted earlier, individuals categorized as having greater variability on our dispositional Between-Strategy Index show high unneveness in the frequency of various strategies used. For instance, they may rely heavily on the same 1–2 strategies (e.g., Denial, Positive Reinterpretation) to handle every stressor at the expense of other strategies that might be more useful in certain situations (e.g., Planning, for controllable stressors). In this case, greater variability would translate into *less* flexibility in coping strategies used and, consequently, lead to failed attempts to regulate effectively (40). Conversely, individuals who show moderate variability exhibit what might be deemed a "beneficial unneveness" in the usage frequency of distinct strategies. For instance, a few strategies may be used regularly while others are used sporadically, selected as a function of the stressor encountered. It could also reflect the tendency to try out a large number of strategies and then rely on a smaller number found to be useful. Such individuals may be more skilled at managing stressors and their related psychological responses via a more targeted and efficient execution of various strategies, ultimately leading to more favorable mental and physical health outcomes (17).

Exploratory analyses further controlling for lifestyle attenuated most associations, which raises some important questions regarding the relationships between coping, behaviors, and longevity. Such findings could suggest that biobehavioral factors either confound or mediate the coping-lifespan relationship. In fact, detrimental lifestyle factors (e.g., smoking, physical inactivity) contribute to shorter lives (34), and a limited number of studies, mostly cross-sectional or experimental in design, have also indicated that regulatory processes like coping are associated with such biobehavioral factors (41–43). However, untangling lifestyle factors' role in the coping-lifespan association is complex because they can be regulatory processes themselves (35–37). Future studies that evaluate explicitly whether individuals have used smoking, alcohol consumption, or exercise to cope with stressful situations will help determine to what extent these behavioral coping strategies relate to other coping strategies and lifespan.

The current results should be interpreted in light of several limitations. First, we did not have information about the nature of stressful events that serve as the context for coping, which can vary in intensity and chronicity, and across participants. However, prior findings on the coping-health association indicated similar results when stressors were imposed by researchers (e.g., all participants reported how they cope with the death of a spouse) versus self-selected by participants (12), suggesting that even if our participants reflected on different stressors when answering the coping items, it is unlikely to have led to consequential variations. Relatedly, the COPE inventory focuses on conscious strategies used to cope with stressful events (14); yet, regulatory processes also occur unconsciously (e.g., repressing unwanted thoughts/feelings) and when experiencing positive events and emotions (44,45). Furthermore, this modified COPE version captured only six coping strategies, which were dispositional by nature. Additional strategies may matter for lifespan too, either individually or by enriching the operationalization of the coping variability construct. For instance, future studies should determine whether individual behaviors like

eating palatable food to cope with stressors predicts lifespan more strongly than denial. Moreover, although a single dispositional coping assessment can be informative when investigating long-term health outcomes (46), such one-time assessment did not permit examination of dynamic changes at a more granular level (e.g., within-strategy variability across days/stressors (19)). Lastly, although MIDUS is a national study, our analytic sample may not be generalizable to the U.S. population of midlife adults. Our participants were mainly Whites and the number of underrepresented individuals (e.g., Blacks) was too low to have sufficient statistical power to detect small, albeit meaningful, associations within racial subgroups. Given an increasing appreciation that individuals' sociocultural context shapes their capacity to cope with stressful situations and select certain strategies over others (2,36), future research on coping's role in lifespan should especially target varied populations and also consider characteristics of the specific stressors they encounter.

Nonetheless, this study has many strengths. We used a validated coping scale that captured various ways midlife adults may handle stressors, which permitted comparisons of how different coping strategies relate to predicted lifespan. Moreover, we acknowledged the complexity of regulatory processes and moved beyond the conventional categorization of adaptive versus maladaptive coping by exploring whether variability in the use of coping strategies relates to lifespan. Lastly, the availability of multiple sociodemographic, health, and biobehavioral factors allowed their examination as covariates.

In conclusion, associations found in this study were of modest magnitude but potentially have meaningful implications. Specifically, findings showed a 6% shorter lifespan with the use maladaptive coping strategies and a 15% shorter lifespan with greater (versus moderate) variability in the use of coping strategies, beyond adjustment for established risk factors. These estimates translate into 5–13 lost years of life. Although adaptive coping strategies were not clearly related with predicted lifespan, additional key coping processes (e.g., acceptance) may be important and should be evaluated. Additionally, a valuable related question is whether other regulatory processes, like emotion regulation, predict longevity. For instance, because emotion regulation typically focuses on emotional states and therefore occurs within shorter time periods than coping (35,44,45), more variability across a set of strategies may exist. Lastly, embbeding experience-sampling data collection about regulatory processes within large prospective studies will help determine if variability in the use of various strategies contributes to long-term health outcomes and, if so, what type and level of variability may be health beneficial. Building such empirical evidence may inform the development and evaluation of cost-effective, transdiagnostic strategies for managing various stress-related factors and regulating multiple behaviors that promote health over the lifecourse.

## Acknowledgments

The MIDUS study has been funded by the John D. and Catherine T. MacArthur Foundation Research Network and the National Institute on Aging (P01-AG020166; U19-AG051426).

Claudia Trudel-Fitzgerald is the Junior Research Chair on Social Disparities, Stress-Related Coping, and Health at Université du Québec à Trois-Rivières and was supported by salary funding from the Lee Kum Sheung Center for Health and Happiness. Lewina O. Lee (K08-AG048221, RF1-AG064006) and Ruijia Chen (4K00AG068431-02) were supported by grants from the National Institute on Aging. This study was also supported by the Michigan Integrative Well-Being and Inequality (MIWI) Training Program, which is funded by a grant from the National Institutes of Health (R25-AT0106641).

## Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.jpsychores.2022.111035.

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