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Leger, Kate

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The Association of Daily Physical Symptoms with Future Health

THESIS

submitted in partial satisfaction of the requirements
for the degree of

MASTER OF ARTS

in Social Ecology

by

Kate Ann Leger

Thesis Committee:
Professor Susan T. Charles, Chair
Assistant Professor Sarah D. Pressman
Professor Roxane Cohen Silver

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ABSTRACT OF THE THESIS

The Association of Daily Physical Symptoms with Future Health

By

Kate Ann Leger

Master of Arts in Social Ecology

University of California, Irvine, 2015

Professor Susan T. Charles, Chair

Background: Daily physical symptoms play a critical role in health and illness experiences.

Despite their daily prevalence, the ability of these symptoms to predict future health status is debated.

Purpose: The current study examined whether physical symptom reports predict future health outcomes independent of trait measures of emotion.

Method: Participants (N=1189) who completed both Midlife in the United States (MIDUS) Surveys I and II as well as the National Study of Daily Experiences (NSDE) reported their daily physical symptoms at baseline and number of reported chronic conditions and functional disability nearly 10 years later.

Results: Physical symptoms at baseline significantly predicted the occurrence of chronic conditions and functional impairment at long-term follow-up, even after adjusting for potential confounders such as self-reported affect, self-reported health, and previous health status.

Conclusions: Findings suggest that daily physical symptoms are important indicators of future health status

Introduction

Physical health symptoms such as headaches and indigestion can shape our health behaviors, interfere with our daily routines, and contribute greatly to our perceived sense of health and well-being (Charles & Almeida, 2006). Despite their importance for the quality of daily life, however, it is unclear how such symptoms predict future physical health status. Some researchers claim that symptom reports and health complaints are not reliable indicators of physical health because they are largely manifestations of affective states. According to this view, positive and negative emotions are related to future health processes (see reviews by Friedman & Booth-Kewley, 1987 and Pressman & Cohen, 2005), but physical symptom reports may simply reflect these relationships and have no predictive merit on their own. In contrast, other researchers believe that non-specific daily symptoms are predictive of objective and subjective health outcomes (Creed et al., 2012). The view that people's own health assessments reliably predict future outcomes is bolstered by findings showing self-reported health predicts survival better than medical record information (see review by Idler & Benyamini, 1997). The current study examines how well daily physical symptoms uniquely predict three different health-related outcomes among adults nearly 10 years later: self-reported chronic conditions, basic activities of daily living, and instrumental activities of daily living, after adjusting for affect and baseline self-reported health.

The importance of physical symptoms. Physical symptoms refer to sensations such as back pain, fatigue, headache, and other discomforts that an individual perceives as worrisome or a change from normal health (Kroenke, 2003; Zijlema, 2013). They are the leading reason people seek medical care (Kroenke, 2001) and contribute greatly to overall perceptions of health and well-being. Daily physical symptoms interfere with work and daily routines and can be

detrimental to an individual's ability to function (Matalon, Kotliroff, Blumberg, Yaphe, & Kitai, 2011). What remains unclear, however, is whether such symptoms are related to future physical health and illness.

The relationship between symptoms and affect. Despite the prevalence and importance of daily symptoms, researchers disagree as to whether they actually reflect physical health status. The Symptom Perception Hypothesis (Watson & Pennebaker, 1989) argues that rather than being signs of physical health problems, non-specific symptoms reflect high levels of negative affect. According to this view, people with high levels of negative affect are more likely to engage in somatosensory amplification, defined as being highly attuned to bodily sensations that are reported as physical symptoms. People with high levels of negative affect also have a tendency to interpret benign bodily sensations as physical symptoms demanding attention (Brown et al., 2012; Hansell & Mechanic, 1985; Salovey & Birnbaum, 1989). Consistent with this view, studies have found that trait negative affect, a disposition associated with higher levels of experiencing anger, contempt, and disgust, is associated with a greater degree of physical symptom reporting (Van Deist et al., 2005).

Across a large number of studies and a variety of measures, higher levels of negative affect are consistently associated with increased physical symptom reporting (Brown & Moskowitz, 1997; Feldmen, Cohen, Doyle, Skoner, & Gwalthney, 1998; Mora, Robitaille, Levanthal, Swigar & Levanthal, 2002; Williams & Wiebe, 2000). In addition, higher levels of neuroticism, a personality trait related to experiencing negative, distressing emotions, are associated with a greater number of medical complaints across a wide range of physical symptoms and conditions (Costa & McCrae, 1987; McNiel & Fleeson, 2006; Ramirez-Maestre, Martinez, & Zarazaga, 2004), even in situations where these symptoms are unrelated to objective

health status (Costa & McCrae, 1980). These associations are often bidirectional, with studies documenting that high negative affect leads to increases in symptom reporting, and that a greater number of symptoms lead to higher negative affect (e.g., Charles & Almeida, 2006).

Symptom reporting is not only associated with higher levels of negative affect and neuroticism, but also with lower levels of positive affect. Although early studies found little association between positive affect and symptom reporting in healthy populations (Watson & Pennebaker, 1989), more recent studies find that in patient samples, individuals with high levels of positive affect report fewer and less severe symptoms even after adjusting for objective measures of disease (Cohen, Doyle, Turner, Alper, & Skoner, 2003). Among relatively healthy individuals, measures of both state and trait positive affect have been associated with fewer symptom reports (Røysamb, Tambs, Reichborn-Kjennerud, Neale, & Harris, 2003; Benyamini, Idler, Leventhal & Levanthal, 2000).

Symptoms as predictors of future health. Self-reported physical symptoms rely on people's appraisals of their health status, and research suggests that self-reported appraisals of health can reliably predict physical health outcomes. For example, general health appraisals ascertained by asking adults to rate their overall health on a scale from 1 to 5 predicts objective health measures such as chronic conditions, functional status and longevity often better than self-reported lists of medical conditions (Borawski, Kinney, & Kahana, 1996, Linn & Linn, 1980; Kaplan & Kotler, 1985; Idler & Benyamini, 1997; Mossey & Shapiro, 1982). Few studies, however, have examined more proximal reports of health status, such as actual health symptoms and their association with later health-related outcomes.

Studies examining patient cohorts have found that self-reported symptoms predict various health-related outcomes (Kaplan & Kotler, 1985, Sha et al., 2005; Creed, 2011; Jackson et al.,

2006; Creed et al., 2013). For example, daily disease-specific symptoms (e.g. chest pain) predict mortality among people with ischemic heart disease (Kaplan & Kotler, 1985). In another study, non-specific daily symptoms (such as headache and backache) predict functional impairment in daily activities (Creed, 2011) and health-related quality of life in patients attending neurology, gastroenterology, and cardiology clinics 6 months later (Jackson et al., 2006). Finally, a recent study by Creed et al. (2013) found that the presence of multiple physical symptoms was associated with impaired health status one year later in patients with chronic pain, chronic fatigue, and irritable bowel syndrome. This research suggests that daily symptoms among patient populations predict later health-related outcomes, although questions remain regarding how these findings generalize to broader community-based populations. It is possible that symptom reporting in patient populations signals disease-specific change, but that symptoms among community-based populations are unrelated to health-related processes.

Present study. The current study examined whether daily symptoms predict future health among a non-patient, community-based sample of men and women. To our knowledge, only one study has addressed this question. In that study, participants reported the physical symptoms they had experienced across the prior six months, as well as their overall health status and symptoms of anxiety and depression (Creed et al, 2012). Higher levels of self-reported physical symptoms predicted overall health status one year later after adjusting for depression and anxiety symptoms. The current study expands upon prior research in several ways. First, we used a daily questionnaire to capture whether symptoms were reported each day as opposed to a retrospective report over a longer time frame. By using a more proximal measure, our goal was to capture daily symptoms the day they were experienced as opposed to general appraisals of health that rely on memory over a longer period of time. We further included self-reported health as a

covariate to ensure that any findings were not driven by overall self-reported health appraisals, but specifically to self-detected physical symptoms. We did so to allay any concerns that general self-report biases captured by appraisals about one's health were inflating associations between symptoms and the health-related outcomes. Finally, given concerns that symptoms may just be a proxy for trait characteristics related to affect, we included both trait positive and negative affect in our statistical models.

In the current study, we examined how well daily physical symptoms predicted three different health-related outcomes across almost 10 years among a community-based sample: self-reported chronic conditions, basic activities of daily living, and instrumental activities of daily living. By using data from the Midlife in the United States Surveys (MIDUS I and II), we examined this process among a group of men and women who ranged from 25 to 74 years old at the beginning of the study (Midlife in the United States, 2014). For these participants, we hypothesized that daily symptoms would be related to later health-related outcomes even after adjusting for initial health status, and adjusting for the influences of affect and self-reported health.

Methods

Sample and Design

The Midlife in the United States Study (MIDUS I) includes data from telephone interviews and mailed surveys from a national sample of 7,108 people, aged 24-74. Original data were collected in 1995-1996. A longitudinal follow-up of the original sample was conducted approximately 9 years later from 2004-2006 (MIDUS II), which included 3,990 participants who completed both the self-administered questionnaires and phone interviews at both time points.

The National Study of Daily Experiences (NSDE) consists of a subset ($N = 1500$) of randomly chosen individuals from the MIDUS I sample who completed semi-structured telephone interviews about their daily experiences each day for eight days. These interviews took place in 1996-1997. Each interview included questions regarding participants' affective state, physical health status, and stressors they encountered. Of the original 1500 NSDE participants, 79% ($N=1189$) completed MIDUS II. Additionally, 166 participants who had siblings participating were excluded to avoid issues of dependency in the data. Therefore, the current analyses included 1023 participants. At follow-up, participants (471 men, 552 women) ranged from 35-84 years old ($M=56$) and were predominantly white (90.9%). Almost all participants (93%) reported having at least a high school degree, and 37% had at least a bachelor's degree. Mean household income was \$70,000, and men reported higher levels of mean individual income ($M = \$55,000$) than women ($M = \$30,000$).

Measures

Daily physical symptoms. Daily symptoms were measured in NSDE I using a shortened version of Larsen and Kasimatis' (1991) physical symptom checklist (Charles & Almeida, 2006). Men and women were asked five questions about how much of the time today they had experienced: 1) headaches, backache, or muscle soreness (pain/aches); 2) a cough, sore throat, fever, chills, or other cold and flu symptoms (flu/cold); 3) nausea, diarrhea, poor appetite, or other stomach problems (gastrointestinal symptoms); 4) any chest pain or dizziness (heart-related symptoms), and 5) any other physical symptoms or discomforts. In addition, women were asked 6) whether they had any menstrual-related symptoms such as cramps, bloating, breast tenderness; and 7) hot flashes or flushes. Participants responded to each question using a scale from 1 (all of the time) to 5 (none of the time). A single physical symptom score for each day was calculated

for each participant by averaging the scores across each of the questions. Reverse-coding was used so that higher scores indicate longer durations of physical symptoms. The eight daily scores were averaged to create a single mean physical symptom score to reflect an average daily duration of physical symptoms over the 8-day interview period.

Trait negative affect. Trait negative affect was measured in MIDUS I using the Non-specific Psychological Distress Scale (Kessler et al., 2002). Participants indicated how much of the time over the past 30 days they experienced six emotional descriptors (nervous, restless, hopeless, worthless, everything was an effort, so sad nothing could cheer you up) on a 5-point scale from 1 (all of the time) to 5 (none of the time). Scores were averaged across each set of items for each participant (Cronbach $\alpha=0.87$). Items were reverse coded so that a higher score was indicative of more trait negative affect.

Trait positive affect. Trait positive affect was assessed in MIDUS I by asking participants how much of the time over the past 30 days they felt cheerful, in good spirits, extremely happy, calm, satisfied, and full of life. Participants rated each item on a 5-point scale from 1 (all of the time) to 5 (none of the time). Items were averaged together for each participant (Cronbach $\alpha =0.91$) and reverse coded so higher scores indicate more trait positive affect.

Body mass index (BMI). Participants' self-reported weight (converted into kilograms) was divided by height (converted into meters squared) to obtain a body mass index for each subject.

Self-rated health. MIDUS I participants rated their physical health on a scale from 1 (poor) to 5 (excellent).

Chronic illness. In both the MIDUS I and II surveys, participants were asked if they have had each of 29 chronic physical conditions in the prior 12 months (Marmot, Ryff, Bumpass,

Shiple, & Marks, 1997). Participants also reported whether they had ever experienced cancer or heart disease. Chronic conditions were placed into 16 chronic condition categories to prevent multiple reports of conditions. Categories included autoimmune disorders, cancer, cardiovascular conditions, diabetes, digestive conditions, foot trouble, hay fever, gall bladder trouble, lung conditions, neurological conditions, pain related conditions, skin trouble, thyroid disease, mouth/gum trouble, sleep problems, and urinary/bladder problems. Mental health conditions such as anxiety or depression were excluded from the current analyses because related symptoms were assessed via measures of trait negative affect.

Functional disability. MIDUS 1 and MIDUS II surveys asked about activities of daily living (ADLs) and instrumental activities of daily living (IADLs) to assess functional disability (Katz, Ford, & Moskowitz, 1963; Lawton & Brody, 1969). Items in the ADL category reflect an individual's ability to function at a basic level on her or her own. These items included bathing or dressing oneself, walking one block, and climbing one flight of stairs. Items in the IADL category reflect an individual's ability to engage in everyday activities, including lifting or carrying groceries, climbing several flights of stairs, bending, kneeling, or stooping, walking more than a mile, walking several blocks, vigorous activity, and moderate activity. Participants indicated the extent to which their health limited these activities on a 4-point scale ranging from 1 (a lot) to 4 (not at all). The mean was then calculated so that higher scores indicated greater functional disability.

Statistical analysis

To test whether symptom reporting predicts an individual's risk of reporting a chronic condition or functional limitations in ADLs and IADLs at follow-up, we categorized each of the health measures into dichotomous variables. For chronic conditions, participants were

categorized as either having [1] or not having [0] any chronic conditions. For both ADLs and IADLs, participants were categorized as either having [1] or not having [0] any functional limitations. Variables were categorized in this fashion at both time points.¹ Analyses calculated adjusted relative risk ratios (aRR) using a Poisson regression with robust error variance for each of the predictor variables. This procedure allowed us to correct for the overestimation of the standard error that can occur when using a Poisson regression to estimate relative risk (Zou, 2004). A relative risk of 1 signifies that the variable of interest is not significantly associated with a one unit change in symptom reporting. A relative risk greater than 1 indicates the adjusted increased likelihood of reporting a chronic condition or disability increases. All models included age, race/ethnicity (0 = white; 1 = non-white), gender (0 = female), education, BMI, trait negative affect, trait positive affect, self-rated health, and baseline health (that matched the outcome variable; e.g., baseline chronic health when predicting follow-up chronic health) as indicators. In secondary analyses, we also focused these models on those participants who reported no chronic conditions or limitations in ADLs or IADLs at baseline.

In addition to examining overall levels of physical symptoms, we were interested in whether the consistency of symptom reports predicts these health-related measures. We therefore analyzed the number of days that participant's experienced any physical symptom. A participant was coded as either having [1] or not having [0] a symptom each day if they reported the occurrence of any symptom at least some time during that day. We then calculated the percentage of days that each participant reported at least one symptom. Additionally, we

¹ Dependent variables were also analyzed as continuous measures. Results yielded the same pattern of significance in all analyses. We report the findings as adjusted risk ratios to provide a more accessible interpretation with percentages corresponding to relative risk rather than beta scores.

examined the number of continuous days that any symptom was reported. Because these two measures of physical symptom consistency did not predict any of our health-related outcomes at follow-up, the null effects are not reported in the results section. All analyses were conducted using SAS statistical software, version 9.3 (SAS, Cary, NC).

Results

Of the 1023 participants in the sample, five participants were missing scores for one of the affect variables, 10 were missing a score for symptom reports, and 39 were missing data for any of the remaining baseline covariates leaving 968 participants with complete data. Of these remaining participants (95% of the sample), none were missing scores for the chronic conditions variable at follow-up, but 141 were missing scores for the follow-up ADL variable and 142 were missing scores for the follow-up IADL variable and thus could not be included in analyses predicting these functional outcomes.

Participants reported low levels of overall daily symptoms with an average of .47 ($SD = .51$) on the physical symptom scale at baseline.² Pain was the most common symptom cluster, reported by 80.5% of the participants on at least one of eight days. The least common symptom for both men and women was heart-related symptoms, reported among 15% of the participants. At baseline, 26.4% of participants reported no chronic conditions. Across the entire sample including those with and without a chronic condition at baseline, 18.2% reported an increase in chronic conditions; 12.4% of the entire sample went from having no chronic conditions at baseline to having at least one chronic condition at follow-up. For ADLs, 11% reported an ADL

² In addition to the physical symptom summary score, we also assessed each question that corresponded with categories of symptoms. These analyses were not significant. Potential reasons for these null effects could be that a one-item assessment for each symptom cluster lacked sufficient variability and specificity. Another reason could be the low rates of symptom reports for some of the questions, e.g., less than 15% of the sample (N=178) reported heart related symptoms on any of the interview days.

impairment at baseline and 24% did so at follow-up. For IADLS, 64% reported an IADL impairment at baseline and 76% reported some impairment at follow-up.

Consistent with previous findings (Kroenke, 2003; Mallers, Almeida, & Neupert, 2005), people reporting a higher level of physical symptoms were more likely to be women, $t(938.85) = 4.96, p < .001$, younger, $r = -.13, p < .001$, and have higher levels of trait negative affect, $r = .28, p < .001$, and lower levels of trait positive affect, $r = -.21, p < .001$. Daily symptoms were significantly associated with all health-related outcomes at baseline. Participants with higher levels of physical symptoms reported more chronic conditions ($r = .15, p < .001$), fewer ADLs ($r = .13, p < .001$) and fewer IADLs ($r = .13, p < .001$). Appendix A displays bivariate correlations between all predictor and outcome measures.

Risk of a Health-Related Condition at Follow-up

Chronic conditions. Appendix B displays results of the Poisson regression examining the relative risk of reporting a chronic condition at follow-up. As hypothesized, baseline physical symptom reports predicted risk for future chronic conditions even after adjusting for all potential covariates and baseline chronic condition incidence. Every one unit increase in symptom reporting increased the relative risk of reporting a chronic health condition at follow-up by 11%. In addition, participants who were older, female, reported a chronic condition at baseline, had a higher BMI, and had poorer self-rated health at baseline were more likely to report a chronic condition at follow-up.

We also investigated whether physical symptom reports predicted the risk of each specific cluster of chronic conditions at follow-up. We conducted separate analyses for each cluster of chronic conditions previously outlined in the above methods section. Results revealed that physical symptom reports at baseline predicted an increased risk of reporting pain conditions

at follow-up by 31% ($p < .001$), and digestive conditions at follow-up by 28% ($p = .01$). There was a trend for physical symptoms at baseline to predict sleep problems at follow-up ($p = .06$).

We next examined whether these effects remained if we only included individuals who reported no chronic conditions at baseline ($N = 256$). Although greatly reducing the sample size, this is arguably the strictest test of the ability of physical symptoms to predict new chronic conditions. Results showed that higher levels of symptom reporting independently predicted greater risk of reporting a chronic condition at follow-up. Using this select sample, for every one unit increase on the physical symptom scale, there was a 46% increase in the risk of reporting a chronic condition at follow-up (see Appendix B, model 2).

Activities of daily living. Appendix C presents results of the model examining the relative risk of reporting an ADL impairment at follow-up. As hypothesized and similar to findings for chronic conditions, daily symptom reports at baseline were significantly associated with an increased risk of reporting an impairment in ADLs at follow-up even after including all covariates. Specifically, every one unit increase in symptom reporting conveyed a 48% increase in the risk of reporting an ADL impairment at follow-up. Participants who were older, reported an ADL impairment at baseline, scored lower on the positive affect scale, had a higher BMI, had a higher education and reported worse self-rated health at baseline were more likely to report an ADL impairment at follow-up.

As with chronic conditions, we next conducted the stricter test of whether these effects remained if we only included individuals who reported no ADLs at baseline ($N = 739$). Results showed that higher levels of symptom reporting independently predicted greater risk of reporting an ADL impairments at follow-up. With this reduced sample, for every one unit increase on the

physical symptom scale, there was a 47% increase in the risk of reporting an impairment in ADLs at follow-up (see Appendix C, model 3).

Instrumental activities of daily living. Results of the model predicting an IADL impairment at follow-up are presented in Appendix D. Daily symptom reports at baseline significantly increased the risk of reporting an IADL impairment at follow-up even after adjusting for potential covariates. Specifically, every one unit increase in symptom reporting increased the risk of reporting an impairment in ADLs at follow-up by 7%. Participants who were older, reported an IADL at baseline, scored lower on the positive affect scale at baseline, and had a higher BMI were more likely to report an IADL impairment at follow-up. When we repeated these analyses on individuals who reported no IADLs at Time 1 (N=292), physical symptoms did not significantly increase the risk of reporting an IADL impairment at follow-up (see Appendix D, model 4).

Discussion

This study examined the ability of daily physical symptom reports to predict future health measures in a relatively healthy, community-based population. Our findings suggest that physical symptom reports independently predict a variety of future health-related measures above and beyond the influences of affect and overall self-reported health at baseline.

Relationship between symptoms, affect, and health. We found that higher levels of symptoms are strongly associated with higher levels of trait negative affect and lower levels of trait positive affect, consistent with existing literature (e.g. Watson & Pennebaker, 1989; Cohen et al., 2003). Additionally, our results indicate that both symptom reports and affect are associated with concurrent health-related measures. These findings add to the already large body of literature showing that not only does a relationship exist between symptom reports and affect,

but also that these variables are closely tied to concurrent health status. In addition, we found that physical symptom reports at baseline were strongly correlated with all three health-related outcomes nearly a decade later. The fact that these daily physical symptoms are predictive of major health problems in the future illustrates that they provide meaningful information to both the person experiencing these symptoms as well as their health care providers.

What is the underlying mechanism that may explain why symptom reports predict health-related outcomes years later? Although not addressed in the current study, one possibility is that people are detecting physiological processes that are manifested by these daily physical symptoms and which lead to worse health later. These daily symptoms may not just be daily annoyances, but may in fact be warning signs of the development of more serious conditions. Another possibility is that people who report higher levels of physical symptoms have heightened physiological reactivity to external environmental influences and stressors. As a result, these people may just be more susceptible to health threats. Thus, this heightened physiological reactivity may lead to greater vulnerability to physical ailments in the future, therefore portending worse long-term health (McEwen, 2006).

Daily symptoms significantly predicted future health-related outcomes even after adjusting for initial measures of self-rated health. Given that physical symptoms are important factors in determining how we view and report our overall health, one might expect that both measures reflect an evaluation of health that would highly overlap and potentially eliminate any unique variance that each may offer. However, our findings demonstrate that daily physical symptoms offer information that is distinct from the perceptions of general health status, and that is not captured in a single assessment of overall health. Our findings also suggest that it is not the

consistency of symptom that confers an increased risk of worse health in the future, but the total amount of symptoms experienced across the initial eight-day period.

Strengths and limitations. The main limitation of this study was the reliance on self-reported measures as health outcomes. The number of chronic conditions and level of functional impairment were ascertained through paper and pencil questionnaires. Because all information was collected through self-report, it is possible that the observed associations are influenced by a shared reporting bias. One factor that decreases this concern, however, is that, we adjusted for overall self-reported health, and for both positive and negative affect, factors known to be associated with self-reports of symptoms and chronic conditions. Even after adjusting for these factors, symptom reports at baseline were still predictive of health-related outcomes at follow-up. Furthermore, a body of literature shows that self-reports of chronic conditions and levels of functional impairment correlate strongly with a diagnosis of illness by a physician (Henderson et al., 2009). Therefore, the use of self-reported measures for health outcomes may be an acceptable proxy for health status.

An additional limitation is the restricted scope of the physical symptom checklist used to assess participants' daily levels of physical symptoms. Symptoms were clustered into questions about subgroups, and each evening participants were asked about the duration of their symptoms for each subgroup. As such, analyses on the effects of individual symptoms could not be conducted, limiting variability and specificity in these reports. Additionally, the physical symptoms checklist assessed symptom duration but not severity. Thus, we were unable to examine how symptom severity may interact with symptom duration when predicting future health. However, in spite of the limited scope of the physical symptom checklist, self-reported symptoms still predicted future health-related outcomes. The fact that a relationship exists

between symptoms and future health despite this limitation makes these findings more noteworthy.

Finally, although participants were selected from a national cohort of Americans, the majority of the participants was white and had higher socioeconomic status than the national average. Future studies should target minority groups and individuals of lower income levels given the strong associations between health status, minority status and low socio-economic status (Adler & Ostrove, 1999).

Future directions and conclusion. The current findings suggest that daily physical symptoms predict future health independent of several possible confounding factors. Physical symptom reports are not solely reflections of emotional states or affective traits. Furthermore, our findings suggest that physical symptom reports may have utility in both clinical and research settings as important indicators of future health status.

Very few studies have examined the ability of daily physical symptoms to predict future health-related outcomes among relatively healthy adults. Our findings in a large national sample and a longitudinal design build upon results from studies that examine symptom reporting in clinical populations with cross-sectional designs. Future studies will be able to further build upon our findings by investigating the mechanisms responsible for these longitudinal associations. The progression from subclinical symptoms to diagnosed disease and disability is complex and likely due to the interplay of many factors. Therefore, future studies should examine the potential pathways through which daily physical symptoms can affect multiple aspects of future health including disease onset and progression, disability, and mortality.

Additionally, future studies would benefit from a multi-method approach, using quantitative and qualitative data for a variety of different scales and outcomes. Symptom

experience in the general population is a complex phenomenon. Differences in symptom onset, duration, and severity all contribute to variability in how those symptoms are perceived and handled. Aspects of symptomatology including pain, fatigue, and dizziness have been captured by multi-item scales to assess multiple dimensions of symptom severity, duration, and symptom-related impairment (Kroenke, 2001). In addition, behavioral reports and informant reports further build upon self-reported data from the individual. Future studies should utilize a variety of symptom scales and report sources to increase the robustness of and provide additional support for the relationship between symptom reporting and future health-related outcomes.

Daily physical symptoms are important contributors to perceived health and well-being. They guide health behaviors, influence daily functioning, and are the primary reason why people seek medical care. The findings of this study suggest that daily physical symptoms are valid indicators of long-term health, and that this association exists independently from a variety of psychological factors.

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Appendix A

Correltion Matrix for Variables of Interest

Variable (Mean,SD or %)	1	2	3	4	5	6	7	8	9	10	11	12
1 Age (55.65, 12.71)	1.00											
2 Gender (46% male)	0.01	1.00										
3 Body Mass Index (26.60, 4.85)	0.14**	0.15**	1.00									
4 Education (7.21, 2.50)	-0.07	0.09*	-0.09*	1.00								
5 Race (91% white)	0.05	0.04	-0.01	0.05	1.00							
6 Baseline Chronic Conditions (26% = 0)	0.19**	-0.06	0.09*	-0.05	0.01	1.00						
7 Baseline Activities of Daily Living (89= 0)	0.14**	-0.02	0.16**	-0.08*	-0.09*	0.13**	1.00					
8 Baseline Instrumental Activities of Daily Living (36% = 0)	0.28**	-0.10*	0.29**	-0.15**	-0.10*	0.24**	0.68**	1.00				
9 Baseline Self-rated health (3.63, 0.90)	-0.11**	0.07	-0.24**	0.24**	0.11**	-0.25**	-0.26**	-0.44**	1.00			
10 Baseline Trait Negative Affect (1.52, 0.60)	-0.15**	-0.15**	-0.02	-0.10*	-0.04	0.17**	0.15**	0.21**	-0.22**	1.00		
11 Baseline Trait Positive Affect (3.42, 0.70)	0.11*	0.11**	0.01	0.02	-0.04	-0.16**	-0.06	-0.14**	0.23**	-0.62**	1.00	
12 Baseline Physical Symptoms (0.47, 0.51)	-0.13**	-0.15**	0.02	-0.09*	-0.01	0.16**	0.13**	0.20**	-0.19**	0.28**	-0.21**	1.00

*p<.01; **p<.001

Appendix B

Relative Risk of Reporting a Chronic Condition at Follow-up

Risk Factors	Model 1 Risk Ratio (95% CI; n=968)	Model 2 Risk Ratio (95% CI; n=256)
Baseline Physical Symptoms	1.11 (1.04-1.18)**	1.46 (1.19-1.79)***
Age	1.01 (1.00-1.02)***	1.03 (1.02-1.04)***
Baseline Trait Negative Affect	0.97 (0.90-1.05)	0.73 (0.49-1.09)
Baseline Trait Positive Affect	0.98 (0.91-1.05)	0.89 (0.70-1.14)
Gender (ref=female)	0.91 (0.84-0.98)*	0.97 (0.76-1.25)
Baseline Chronic Condition (ref=no)	1.40 (1.23-1.60)***	
Body Mass Index	1.01 (1.00-1.02)**	1.00 (0.97-1.03)
Education	1.01 (0.99-1.03)	0.97 (0.86-2.43)
Race (ref=non-white)	1.08 (0.93-1.24)	1.44 (0.70- 2.20)
Baseline Self-rated health	0.95 (0.91-0.99)*	0.86 (0.73-1.02)

Model 1 includes the full study cohort. Model 2 includes participants with no chronic conditions at baseline.
*p<.05, **p<.01, ***p<.001.

Appendix C

Relative Risk of Reporting an Impairment in Activities of Daily Living (ADL) at Follow-up

Risk Factors	Model 1 Risk Ratio (95% CI; n=827)	Model 2 Risk Ratio (95% CI; n=739)
Baseline Physical Symptoms	1.48 (1.27-1.71)***	1.47 (1.22-1.78)***
Age	1.03 (1.02-1.04)***	1.04 (1.02-1.05)***
Baseline Trait Negative Affect	0.97 (0.80-1.17)	0.93 (0.70-1.24)
Baseline Trait Positive Affect	0.71 (0.60-0.85)**	0.69 (0.54-0.88)**
Gender (ref=female)	0.87 (0.68-1.10)	0.85 (0.63-1.17)
Baseline Activity of Daily Living (ref=no)	1.95 (1.49-2.54)***	
Body Mass Index	1.05 (1.03-1.07)***	1.06 (1.04-1.10)***
Education	0.93 (0.89-0.98)**	0.90 (0.84-0.96)**
Race (ref=non-white)	0.88 (0.61-1.27)	0.79 (0.47-1.33)
Baseline Self-rated Health	0.86 (0.75-0.98)*	0.80 (0.67-0.96)*

Model 1 includes the full study cohort. Model 2 includes participants with no ADL limitations at baseline.
*p<.05, **p<.01, ***p<.001.

Appendix D

Relative Risk of Reporting an Impairment in Instrumental Activities of Daily Living (IADL) at Follow-up

Risk Factors	Model 1 Risk Ratio (95% CI; n=826)	Model 2 Risk Ratio (95% CI; n=292)
Baseline Physical Symptoms	1.07 (1.02-1.13)*	1.15 (0.93-1.44)
Age	1.01 (1.01-1.01)***	1.02 (1.01-1.03)**
Baseline Trait Negative Affect	0.98 (0.92-1.06)	1.04 (0.82-1.32)
T1 Trait Positive Affect	0.92 (0.87-0.98)*	0.94 (0.79-1.13)
Gender (ref=female)	1.01 (0.94-1.08)	1.04 (0.82-1.31)
Body Mass Index	1.01 (1.00-1.01)**	1.02 (1.00-1.05)
Education	0.98 (0.97-1.00)*	0.97 (0.93-1.01)
Race (ref=non-white)	1.00 (0.90-1.12)	1.26 (0.68-2.32)
Baseline Instrumental Activity of Daily Living (ref=no)	1.56 (1.38-1.75)***	
Baseline Self-rated Health	0.97 (0.93-1.00)	0.90 (0.79-1.03)

Model 1 includes the full study cohort. Model 2 includes participants with no IADL limitations at baseline.
*p<.05, **p<.01, ***p<.001.