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Emotional Reactivity to Daily Physical Symptoms in Adulthood and Old Age: The Role of Different Facets of Social Support

Angelica V. Hosea[a] Johanna Drewelies[b, c] Emma K. Bridger[a] Sophie Potter[c]

[a]School of Psychology and Vision Science, University of Leicester, Leicester, UK; [b]Max Planck Institute for Human Development, Berlin, Germany; [c]Department of Psychology, Heriot-Watt University, Edinburgh, UK

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Keywords
Daily health · Emotional/affective reactivity · Social support · Experience sampling method

Abstract

Introduction: Routine physical symptoms can impact our everyday emotional experiences in adulthood and old age, with evidence of elevated emotional reactivity on days with more symptoms. Social support is known to profoundly influence emotional regulation in the face of challenge. Although different types and sources of support are known to differ in how helpful they are, this has not been tested for emotional reactivity to routine physical symptoms. We therefore examined (1) emotional support received in daily life, (2) perceptions of support from friends, and (3) from family, as moderators of emotional reactivity to routine physical symptoms. We also aimed to extend limited and inconsistent evidence on the moderating role of functional limitations and age. ***Methods:*** Multilevel models were applied to the MIDUS 3: Daily Diary Project (2017–2019), wherein 1,021 participants (M_{age} = 62.7; range = 43–90; 56% female) reported routine physical symptoms, emotional support received, positive and negative affect on eight consecutive days. ***Results:*** Evidence for the differential role of social support emerged: perceived support from family (but not friends) attenuated emotional reactivity, while emotional reactivity was exacerbated on days when emotional support was received (but only for negative affect). No "spillover" effect indicated that the potentially negative role of received support is short-lived and context-dependent. We found exacerbated emotional reactivity for those with more limitations, but age was unrelated. ***Conclusion:*** Findings add to the literature on the complex role of social support and functional health for handling the emotional ups and downs of everyday symptom as we age.

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Introduction

Physical health is widely recognized in research, practice, and policy as a key predictor of emotional well-being [1, 2]. Despite this, findings supporting this are more mixed than often assumed. The majority of studies in this area focus on trait-level associations, with some studies reporting strong associations [3], while others report no or only very weak effects [4]. However, physical health and emotions manifest and change in everyday life. To capture these short-term dynamics, researchers have increasingly adopted experiential approaches that capture emotions as they occur in daily life. In contrast to trait-level reports, these studies consistently show that routine physical symptoms in adulthood and old age correspond to heightened negative affect (NA) and lower positive affect (PA) [5–8]. This matters

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Correspondence to:
Sophie Potter, s.potter@hw.ac.uk

because such symptoms, including headaches, chest pain, and shortness of breath, are commonly experienced in the daily lives of healthy middle-aged and older adults [9], and repeated emotional reactivity to these symptoms may have lasting health consequences, including increased risks of falls, disability, and mortality [9, 10]. While the role of social support for physical health and emotional well-being has been studied extensively in psychological, medical, and sociological research, its role in the association between routine physical symptoms and well-being has only been examined for life satisfaction, but not for emotional reactivity to such symptoms [11, 12]. This is limiting because routine physical symptoms fluctuate within individuals from one day to the next. Moreover, while general perceptions of support are associated with positive outcomes, this may differ depending on the source of support. There is also growing evidence of the potentially negative effects of received support in daily life [13, 14]. However, these different types of support have not been explored for emotional reactivity to routine physical symptoms in everyday life. To address these gaps, we examined whether different facets of social support (receiving emotional support on a given day, general perceptions of support from friends or family) along with other key factors (functional limitations and age) moderated emotional reactivity in PA and NA to routine daily physical symptoms in adults and older adults.

Emotional Reactivity to Daily Physical Symptoms in Adulthood and Old Age

Emotional reactivity is defined as emotional responses to daily stressors and other types of negative events that have the potential to disrupt routines or cause irritation [15]. Because common physical symptoms often fluctuate with increasing frequency and volatility as we age [16], they constitute as an important source of daily stressors that contribute to day-to-day emotional reactivity in middle-aged and older adults. This can happen by restricting engagement in the external world and disrupting routine activities, leading to heightened psychological distress and social isolation (activity theory [17]; activity restriction model [18]). Correspondingly, there is increasing evidence of elevated emotional reactivity on days with more symptoms, as reflected in lower in PA and higher in NA relative to individual's typical experience [5–8]. Yet, it is important to note that a range of sociocontextual and individual factors shape how well adults and older adults regulate their emotions in the face of health challenges, including social support, functional limitations, and age [4–6, 11, 12].

Emotional Reactivity to Daily Physical Symptoms: The Role of Different Facets of Social Support

Lifespan developmental perspectives and prominent biopsychosocial models have long held that social support is important for sustaining well-being in the face of health-related challenges [19, 20]. However, different types and sources of support may be more or less beneficial. Social support, broadly defined, encompasses both the receipt of support and the perception that it is available. Perceived support reflects individuals' assessment of the availability and adequacy of assistance. It is often conceptualized as a belief system that facilitates coping with health-related stressors by framing stressful conditions less negatively, providing a stable psychological resource, and a sense of security and predictability [21]. Indeed, perceptions of social support in general are associated with positive outcomes (for a systematic review and meta-analysis, see [22]) and have been shown to mitigate the impact of health challenges on life satisfaction among older adults in cross-sectional studies [11, 12]. However, it is possible that these effects depend on the perceived source of support.

According to the convoy model of social relations [23], the composition and function of close and periphery support networks change with age, reflecting shifting social roles and needs (socioemotional selectivity theory [24]). Family members are typically core to one's support network at all ages, with evidence that adults and older adults are better able to cope with health challenges when they perceive more support from family [25]. Friends are typically more peripheral in the supportive network across midlife and old age but nonetheless play an important role in helping people cope with health issues [26]. There is evidence that perceived support from friends is more beneficial in supporting well-being [27] because these relationships are voluntary and provide companionship important for maintaining well-being [28]. This implies that perceptions of support from friends may be more consistently associated with emotional reactivity to routine daily symptoms than perceived support from family. The data used in this study do not permit a direct comparison of this kind. Nonetheless, they do permit contrasts between perceived and received support, which we examine in the next section.

Received support, on the other hand, is often reactive, occurring after challenges emerge [21], and can sometimes be less beneficial or even detrimental if it undermines autonomy, signals dependency, or fails to match the recipient's needs. For example, optimal matching theory [29] emphasizes that its effectiveness

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depends on timely, appropriate matching. Likewise, unsolicited support, offered before a need is expressed, may reduce self-efficacy and independence [30, 31]. Social constructivist perspectives further suggest that receiving help can signal need and reinforce dependency. Indeed, many studies report that support receipt is associated with increased daily NA [13, 14, 31]. The possibility that such findings simply reflect increased NA on higher need days (rather than as a consequence of received support), has been explored extensively, with prior work suggesting that the effects are unlikely to stem from reverse causality or shared stressors but rather arise when support signals deficits or overprotection, particularly when it exceeds needs [32, 33]. To our knowledge, no studies have examined the role of receiving support in daily life for emotional reactivity to routine physical symptoms.

Emotional Reactivity to Daily Physical Symptoms: The Role of Functional Limitations and Age

Functional limitations and age are also widely considered to influence our experience of physical health and emotional well-being, but evidence for their role for emotional reactivity to routine daily physical symptoms is limited and inconsistent [5–8]. Although functional limitations and physical symptoms are related, they represent distinct constructs: common physical symptoms (e.g., pain, fatigue) reflect momentary physiological or perceptual experiences that vary from day-to-day. In contrast, functional limitations reflect perceived difficulties in everyday activities and typically represent more enduring health restrictions, making them relatively stable (though they can also be assessed in daily life; see [5]). For this reason, routine physical symptoms are well suited to daily assessment, whereas functional limitations are captured as a between-person characteristic. Functional limitations may exacerbate emotional reactivity to routine daily symptoms via sensitization, so that even modest health issues are perceived as threatening because they signal further decline or loss of independence [3]. In contrast, functional limitations may dampen emotional reactivity through habituation, whereby routine physical symptoms are anticipated and appraised as less threatening over time (consistent with response-shift processes). Daily diary evidence for the moderating role of functionality is limited and has only focused on day-to-day fluctuations in impairment rather than a more enduring trait: Katana et al. [5] assessed *daily* impairment and found that higher impairment on a given day exacerbated associations with pain. However, much less is known about whether trait-level or more enduring functional limitations play a similar moderating role. The only related evidence comes from Potter et al. [6], who used baseline morbidity as a proxy for more stable functional constraints and found the opposite pattern – attenuated emotional reactivity to routine physical symptoms.

Conceptual models of adaptation [34] and leading theories of ageing and emotion, such as socioemotional selectivity theory [24], suggest that a lifetime of emotional experiences and an increasing focus on emotionally meaningful goals equip older adults with the ability to preserve emotional well-being despite health-related challenge. Self-regulation frameworks likewise emphasize adaptive goal management in the face of age-related losses, such as the shift from goal tenacity to flexible goal adjustment described in Brandtstädter's Assimilation-Accommodation Model [35] and the compensatory control strategies outlined in Heckhausen's Motivational Theory of Lifespan Development [36]. These perspectives suggest that older adults may be better able to regulate emotional responses to routine physical symptoms because they adjust their goal to align with their age-related changes, relying more on acceptance and adaptive coping strategies. However, evidence for age as a moderator of reactivity to physical ill-health is inconsistent: two studies reported that older adults were *less* emotionally reactive [6, 7], whereas another reported no effect [8], underscoring the need to substantiate this initial evidence.

Present Study

This study examined whether different facets of social support (receiving emotional support on a given day, perceptions of support from friends or from family), functional limitations, and age moderated emotional reactions in PA and NA to common everyday physical symptoms in daily life. Based on previous research [5–8], we expected higher levels of emotional reactivity on days with more routine physical symptoms (i.e., above-average increases in NA and/or decreases in PA). Based on theoretical perspectives and extant evidence of the benefits of perceived social support for coping with health challenges and other life stressors [11, 12, 20], we expected perceptions of support from friends and from family at baseline to attenuate emotional reactivity. Although theory and evidence indicate that perceptions of support from friends and family may differ [23, 27], we make no specific hypothesis regarding the direction or magnitude of these differences. Given evidence of the negative consequences of received support [13, 14, 30, 31], we expected exacerbated emotional reactivity on

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days when support was received. We also expected evidence for the moderating role of functional limitations but do not specify directionality due to conflicting theory and limited evidence. Finally, based on leading theories of adaptation, ageing, and emotion [24, 34], we expected increasing age to be associated with attenuated emotional reactivity.

Methods

Participants and Procedure

Data from the midlife in the US studies (MIDUS; http://midus.wisc.edu/) was used. Daily data (physical symptoms, PA, NA, emotional support received) were from the Daily Diary Project (2017–2019), and trait-level data (perceived social support from friends and family, functional limitations) were collected at baseline from MIDUS wave 3 (2013–2014)[1]. For the Daily Diary Project, participants completed telephone interviews about their daily experiences of affect, routine physical symptoms, and emotional support received across eight consecutive days. Respondents provided seven daily interviews on average (SD = 1.6) yielding an overall completion rate of 94%. Data collection was approved by the Institutional Review Board of the Pennsylvania State University (2015), and all participants provided written informed consent. Individuals were included in analyses if they participated in the daily diary study and had information for key study variables. Two hundred and fifteen participants were excluded because relevant MIDUS 3 measures were administered only to the national sample or were missing, leaving a total of 1,021 (M_{age} = 62.7; SD = 10.15; range = 43–90; 56% female). Most participants had completed high school (96%), were white (91%), and were married (69%).

Measures

Daily PA and NA

Participants reported how much of the time in the past 24 hours they had experienced 13 positive emotions (in good spirits, cheerful, extremely happy, calm and peaceful, satisfied, full of life, close to others, like you belong, enthusiastic, attentive, proud, active, confident, within-person Cronbach's alpha [37] = 0.85) and 14 negative emotions (restless or fidgety, nervous, worthless, so sad nothing cheer you up, everything was an effort, hopeless, lonely, afraid, jittery, irritable, ashamed, upset, angry, frustrated, within-person Cronbach's alpha [37] = 0.76) on a 5-point scale (0 = none of the time; 4 = all of the time). Items were summed and averaged to create a total within-person PA score (M = 2.69; SD = 0.75) and NA score (M = 0.16; SD = 0.26). Emotional reactivity was therefore defined as above or below one's own average levels of PA and NA on days when more physical symptoms than usual were reported.

Daily Physical Symptoms

Daily physical symptoms were measured by asking participants whether they had any of the following 23 routine physical symptoms: headache, backache, muscle soreness, fatigue, joint pain, muscle weakness, cough, sore throat, fever, chills, other cold or flu symptoms, nausea, allergies, diarrhoea, constipation, poor appetite, other stomach problems, chest pain, dizziness, shortness of breath, menstrual related symptoms, hot flashes or flushes, any other physical symptoms. These were summed and averaged within-persons (M = 1.92; SD = 2.07). Severity of symptoms – measured by asking how severe each symptom was (1 = very mild; 10 = very severe) – was tested in supplementary analyses[2].

Social Support

Three facets of social support were measured. Days with emotional support received was obtained by asking participants each day whether they had received emotional support (yes/no). Perceived support from family was measured at baseline in MIDUS 3 with the following four items: (1) "How much do they care about you?"; (2) "How much do they understand the way you feel about things?"; (3) "How much can you rely on them for help if you have a serious problem?"; (4) "How much can you open up to them if you need to talk about your worries?" (1 = a lot; 4 = not at all). Perceived support from friends was also measured at baseline in MIDUS 3 with the same 4 items. This yielded separate scores for family members (α = 0.82) and friends (α = 0.85). Items were reverse-coded and group-mean centred, so that higher scores reflect more perceived support.

Functional Limitations

Functional limitations were measured at baseline in MIDUS 3 using the Instrumental Activities of Daily Living [38]. Participants answered questions about how

[1]The time lag between the baseline assessment (2013–2014) and the daily diary study (2017–2019) ranged from approximately 3–6 years, with a median lag of about 5 years. Most participants were clustered around a lag of approximately 4–5 years, reflecting the concentration of baseline assessments in 2013 and diary assessments in 2018.

[2]Participants reported on average only two symptoms per day (M = 1.92; SD = 2.07), and there were some days in which participants reported no symptoms at all, resulting in a zero-inflated severity variable, which can violate model assumptions. We therefore report analyses with symptom count in the primary analyses, with symptom severity analogues in the supplement.

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much their health limits their ability to perform six instrumental activities (e.g., climbing several flights of stairs, walking more than a mile, vigorous activities, moderate activities; α = 0.94), on a 4-point scale (1 = a lot; 4 = not at all). Items were group-mean centred; higher scores reflected greater difficulties in performing activities. Activities of Daily Living was tested in supplementary analyses by asking participants how much their health limits their ability to perform two basic activities (bathing/dressing yourself and walking one block).

Covariates

Analysis included relevant demographic variables: age, gender (male/female), and highest educational qualification (1 = no school or some grade school; 12 = doctoral or other professional degree). For the present analysis, highest educational qualification was grand-mean centred and treated as a continuous variable. This measure is strongly related ($r = 0.97$) to number of years in education [39]. Other covariates related to household composition (marital status, living arrangement [alone/with others], number of living children) were initially included because of their potential associations with social support but were nonsignificant and dropped from analyses for parsimony.

Data Analysis

The within-person coupling of daily affect and routine physical symptoms (referred to as daily physical symptoms in analytic models for simplicity) was examined using multilevel models to accommodate data nested within-persons and across days. Daily affect was tested as a dependent variable in all models, with PA and NA analysed separately. In level 1, daily affect was modelled as a function of daily symptoms and days with emotional support received. Daily symptoms were decomposed into a between-person (grand-mean centred) and within-person (person-mean centred), such that the within-person components reflect occasion-specific deviations from an individual's typical level, while the between-person component captures stable differences across individuals. This allowed us to control for between-person associations while examining within-person fluctuations from day-to-day. Days with emotional support received is a binary variable and was therefore not centred. Nonetheless, we still included the disaggregated between-person component of received emotional support in our analysis, following Hoffman and Stawski [40].

Baseline measures from MIDUS 3 (perceived family support, perceived friend support, functional limitations, age) were grand-mean centred and entered as level 2 predictors, along with between-person symptoms and covariates (gender, education). Notation (^{W},^{B}) has been added to the analytic equation to indicate centring at the within- and between-person levels, respectively. Note that the correlational nature of this modelling technique does not permit interpretation about the causality of associations. Level 1 was specified as

$$\begin{aligned}\text{Affect}_{ti} = {} & \beta_{0i} + \beta_{1i}\ (\text{Daily Physical Symptoms}^{W}_{ti}) + \\ & \gamma_{20}\ (\text{Days with Emotional Support Received}^{W}_{ti}) + \\ & \gamma_{30}\ (\text{Daily Physical Symptoms}^{W} \times \\ & \text{Days with Emotional Support Received}^{W}_{ti}) + e_{ti}\end{aligned}$$

where Affect_{ti} of person i at time t is a function of a person-specific intercept (β_{0i}), person-specific coefficients indicating the extent to which daily affect is associated with daily symptoms (β_{1i}), days with emotional support received (β_{2i}), the interaction of daily symptoms and days with emotional support received (β_{3i}), and residual error (e_{ti}). Between-person differences in intercept and emotional reactivity to daily symptoms were modelled as

$$\begin{aligned}\beta_{0i} = {} & \gamma_{00} + \gamma_{01}\ (\text{Age}^{B}_{i}) + \gamma_{02}\ (\text{Women}^{B}_{i}) + \gamma_{03}\ (\text{Education}^{B}_{i}) \\ & + \gamma_{04}\ (\text{Functional Limitations}^{B}_{i}) \\ & + \gamma_{05}\ (\text{Perceived Support from Family}^{B}_{i}) \\ & + \gamma_{06}\ (\text{Perceived Support from Friends}^{B}_{i}) \\ & + \gamma_{07}\ (\text{Physical Symptoms}^{B}_{i}) \\ & + \gamma_{08}\ (\text{Emotional Support Received}^{B}_{i}) + u_{0i}\end{aligned}$$

and

$$\begin{aligned}\beta_{1i} = {} & \gamma_{10} + \gamma_{11}\ (\text{Age}^{B}_{i}) + \gamma_{12}\ (\text{Functional Limitations}^{B}_{i}) \\ & + \gamma_{13}\ (\text{Perceived Support from Family}^{B}_{i}) \\ & + \gamma_{14}\ (\text{Perceived Support from Friends}^{B}_{i}) + u_{1i}\end{aligned}$$

where γ_{00}, γ_{10}, γ_{20}, and γ_{30} indicate prototypical levels of daily affect, emotional reactivity to symptoms, emotional reactivity to emotional support received, and the interaction of daily symptoms and days with emotional support received (respectively). Parameters γ_{01-08} indicate the extent to which between-person differences in affect are related to baseline moderators (perceived family support, perceived friend support, functional limitations, and age) and covariates. Parameter γ_{11-14} indicates the extent to which differences in emotional

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reactivity to daily symptoms were related to level 2 moderators (cross-level interactions). Person *i*'s deviation from the intercept is denoted by $u_{0i.}$ Person *i*'s deviation from the slope (emotional reactivity) is denoted by $u_{1i.}$ Analyses were conducted using R statistical software (version 4.5.1) using the lme4 package. All moderators were tested simultaneously.

We also intended to examine severity of symptoms in the main analysis, but due to its interdependence with number of symptoms ($r = 0.87$), it was not appropriate to test them simultaneously. We nonetheless examined emotional reactivity to symptom severity in supplementary material (online suppl. Table 1; for all online suppl. material, see https://doi.org/10.1159/000553171). In the main analysis, we focused on instrumental activities of daily living because these are theorized to be key pathways from which physical symptoms are linked to daily emotional well-being (activity theory [17]; activity restriction model [18]). However, we tested basic activities of daily living as a moderator in supplementary material (online suppl. Table 2 for symptom count; online suppl. Table 3 for symptom severity). We also examined a series of age moderation effects to inspect whether the role of social support and functional limitation changed with age, but results were nonsignificant.

Results

Descriptive statistics are reported in Table 1. Unconditional intercept-only models showed between-person variance (intraclass correlation) to be 76% for PA, 49% for NA, and 67% for daily symptoms, indicating substantial day-to-day variability in NA, moderate day-to-day variability in symptoms, and limited day-to-day variability in PA. Participants generally reported high levels of daily PA (M = 2.69, SD = 0.75, range = 0–4) and low levels of daily NA (M = 0.16, SD = 0.26, range = 0–4). As can be seen, PA and NA showed significant small-to-moderate associations with daily symptoms ($r = -0.23$, $r = 0.33$, respectively). Out of all days, 70% of observations ($n = 6{,}709$) were reported to have at least one symptom. Participants reported an average of two routine physical symptoms on each day (SD = 2.07). Across 8 days, participants reported that they received emotional support on an average of 1 day (SD = 1.60). They also reported high levels of perceived support from family (M = 3.50, SD = 0.57, range = 1–4) and from friends (M = 3.36, SD = 0.62, range = 1–4), along with moderate level of functional limitations (M = 1.85, SD = 0.87, range = 1–4). Correlations can be found in Table 1.

Emotional Reactivity to Daily Physical Symptoms in Adulthood and Old Age

Multilevel results are reported in Table 2. As can be seen in Figure 1, for model 1 (main effects only), routine physical symptoms were associated with emotional reactivity in PA (i.e., lower daily PA relative to one's average; $\beta = -0.03$, $p < 0.001$) and in NA (i.e., higher daily NA relative to one's average; $\beta = 0.03$, $p < 0.001$). Findings remained significant in model 2 after adjusting for covariates (sex, education) and moderators (days with emotional support received, baseline perceptions of support from friends and from family, functional limitations, age).

Emotional Reactivity to Daily Physical Symptoms: Moderation by Facets of Social Support

Perceptions of social support at baseline were associated with daily emotional well-being. Those who reported perceiving more support from family and friends (independently) reported higher daily PA ($\beta = 0.23$ for family support, $\beta = 0.22$ for friend support, $p < 0.001$) and lower daily NA ($\beta = -0.05$, $p < 0.001$ for family support; $\beta = -0.03$, $p < 0.01$ for friend support) relative to individuals with less support from family and friends. In contrast, on days with emotional support received, participants reported higher levels of daily NA relative to their own average ($\beta = 0.06$, $p < 0.001$) compared to days without emotional support but was unrelated to daily PA.

A number of moderation effects were detected, but these only arose for emotional reactivity in NA. As can be seen in Figure 2, higher baseline levels of perceived support from family were associated with attenuated emotional reactivity in NA, with less pronounced increase in NA relative to their own average on days with more symptoms ($\beta = -0.01$, $p < 0.05$). Perceptions of support from friends at baseline were unrelated to emotional reactivity. In contrast, on days when participants reported receiving emotional support, they showed exacerbated emotional reactivity in NA, with more pronounced increase in NA relative to their own average on days with more symptoms ($\beta = 0.02$, $p < 0.01$).

Emotional Reactivity to Daily Physical Symptoms: Moderation by Functional Limitations and Age

Although functional limitations were not associated with daily affect, evidence arose for moderation: functional limitations were associated with elevated emotional reactivity in NA, with more pronounced increase in NA relative to one's average on days with more

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Table 1. Descriptive statistics and intercorrelations among study variables

Variable	M	SD	1	2	3	4	5	6	7	8	9	10
1 Age[B] (43–90)	62.69	10.15	1									
2 Sex[B] (56% Female)	1.56	0.5	0.01	1								
3 Education[B] (0–12)	7.87	2.39	−0.11***	−0.12***	1							
4 Daily symptoms[W] (0–15)	1.92	2.07	0.10***	0.16***	−0.12***	1						
5 Days with emotional support received[W] (0–8)	1.04	1.60	−0.03*	−0.07***	−0.10***	−0.12***	1					
6 Perceived family support[B] (1–4)	3.50	0.57	0.10***	0.10***	−0.01	−0.06***	0.01	1				
7 Perceived friends support[B] (1–4)	3.36	0.62	0.03*	0.20***	0.05***	−0.04***	0.04***	0.37***	1			
8 Functional limitations[B] (1–4)	1.85	0.87	0.32***	0.18***	−0.25***	0.36***	0.04***	−0.07***	−0.07***	1		
9 Daily PA[W] (0–4)	2.69	0.75	0.13***	−0.02	−0.09***	−0.23***	−0.04***	0.27***	0.26***	−0.11***	1	
10 Daily NA[W] (0–4)	0.16	0.26	−0.08***	0.03**	0.03*	0.33***	0.18***	−0.16***	−0.13***	0.11***	−0.46***	1

Sex: male as reference. Days with emotional support received was measured by asking participants each day whether they had received emotional support (yes/no) for eight consecutive days; M for days with emotional support represents number of days on average that participants reported receiving emotional support. Perceived support from family and friends were measured at baseline. The correlation matrix is based on long-format data, consisting of between-person and within-person correlations. $^{*}p < 0.05$. $^{**}p < 0.01$. $^{***}p < 0.001$. [B]Between-person variable. [W]Within-person variable.

symptoms (β = 0.01, $p < 0.05$, see Fig. 3). No moderation effect arose for emotional reactivity in PA. Age was associated with higher daily PA (β = 0.01, $p < 0.001$) and lower daily NA (β = −0.003, $p < 0.001$), but no evidence arose for moderation.

Supplementary Analyses

Consistent with the main analysis on symptom count, supplementary analysis revealed that symptom severity was significantly associated with lower daily PA (β = −0.20, $p < 0.001$) and higher daily NA (β = 0.19, $p < 0.001$, online suppl. Table 1) relative to one's average. Evidence for moderation of received emotional support remained (β = 0.12, $p < 0.001$), while perceived family support and functional limitations lost significance. Nonetheless, moderation by age gained significance: increasing age attenuated emotional reactivity, but only in PA (β = 0.01, $p < 0.05$). When basic activities of daily living were examined as a moderator instead of instrumental activities, its effect was nonsignificant for emotional reactivity to number of symptoms (see online suppl. Table 2) and for severity of symptoms (see online suppl. Table 3).

Follow-Up Analysis

To establish whether routine physical symptoms had a "spillover" effect on next-day affect, we conducted a time-lagged analysis of associations between yesterday's symptoms and today's affect, controlling for yesterday's affect (online suppl. Table 4, model 1). Results were nonsignificant, indicating that symptom-related emotional responses are confined to the same day. Second, to further explore the role of received social support, we conducted a time-lagged analysis of associations between yesterday's received emotional support and today's affect, controlling for prior-day symptoms and received emotional support (online suppl. Table 4, model 2). Results were nonsignificant, indicating that the potentially harmful role of received support is short-lived and context-dependent.

Discussion

The present study aimed to extend knowledge of daily health and well-being dynamics by examining different facets of social support, functional limitations, and age as moderators of emotional reactivity to routine daily physical symptoms among middle-aged and older adults. Consistent with a growing body of literature [5–8], we found that days with more routine physical symptoms were associated with lower daily PA and higher daily NA relative to one's average. We also found (reported in the

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Table 2. Multilevel model testing for daily within-person associations between number of symptoms and affect (model 1) and moderation by social support, functional limitations, and age (model 2)

	Daily positive affect			Daily negative affect		
	estimate	95% CI		estimate	95% CI	
		lower	upper		lower	upper
Model 1						
Intercept γ_{00}	2.90***	2.84	2.96	0.08***	0.06	0.09
Daily symptoms^{W} γ_{10}	−0.03***	−0.04	−0.02	0.03***	0.03	0.04
Mean symptoms^{B} γ_{07}	−0.10***	−0.13	−0.08	0.05***	0.04	0.05
Random effect						
Variance intercept σu	0.40	0.36	0.43	0.03	0.02	0.03
Variance daily symptoms σu	0.01	0.01	0.01	0.002	0.002	0.003
Residual variance σe	0.12	0.12	0.13	0.03	0.03	0.03
R^2						
Marginal R^2	0.06			0.11		
Conditional R^2	0.78			0.56		
Model 2						
Intercept γ_{00}	2.96***	2.81	3.11	0.13***	0.09	0.17
Age^{B} γ_{01}	0.01***	0.01	0.01	−0.003***	−0.004	−0.002
Sex^{B} γ_{02}	−0.06	−0.13	0.02	−0.01	−0.03	0.01
Education^{B} γ_{03}	−0.04***	−0.05	−0.02	0.005*	<0.001	0.01
Functional limitations^{B} γ_{04}	−0.04	−0.09	0.004	0.01	−0.01	0.02
Daily symptoms^{W} γ_{10}	−0.03***	−0.04	−0.02	0.03***	0.02	0.03
Days with emotional support received^{W} γ_{20}	−0.02	−0.05	0.01	0.06***	0.05	0.08
Perceived family support^{B} γ_{05}	0.23***	0.16	0.30	−0.05***	−0.07	−0.03
Perceived friends support^{B} γ_{06}	0.22***	0.16	0.29	−0.03**	−0.05	−0.01
Mean symptoms^{B} γ_{07}	−0.10***	−0.12	−0.07	0.04***	0.04	0.05
Mean emotional support received^{B} γ_{08}	−0.03	−0.21	0.14	0.13***	0.08	0.18
Daily symptoms × age γ_{11}	0.001	<−0.001	0.002	<−0.001	−0.001	<0.001
Daily symptoms × functional limitations γ_{12}	<0.001	−0.01	0.01	0.01*	<0.001	0.01
Daily symptoms × days with emotional support received γ_{30}	−0.01	−0.03	0.01	0.02**	0.003	0.02
Daily symptoms × perceived family support γ_{13}	−0.01	−0.02	0.01	−0.01*	−0.02	−0.001
Daily symptoms × perceived friends support γ_{14}	−0.005	−0.02	0.01	−0.01	−0.01	0.004
Random effect						
Variance intercept σu	0.33	0.30	0.36	0.02	0.02	0.03
Variance daily symptoms σu	0.01	0.01	0.01	0.002	0.002	0.003
Residual variance σe	0.12	0.12	0.13	0.03	0.03	0.03
R^2						
Marginal R^2	0.18			0.17		
Conditional R^2	0.78			0.56		

Sex: male as reference. Days with emotional support received was measured by asking participants each day whether they had received emotional support (yes/no) for eight consecutive days. Perceived support from family and friends were measured at baseline. *$p < 0.05$. **$p < 0.01$. ***$p < 0.001$. ^{W}Within-person (person-mean centred). ^{B}Between-person (grand-mean centred).

supplementary analysis) that more severe symptoms were (independently) associated with lower daily PA and higher daily NA relative to one's average. Importantly, by simultaneously testing the moderating role of different facets of social support, we were able to detect meaningful differences in how perceived support from friends or family and received support relate to emotional reactivity to daily symptoms. Those who perceived more support from family at baseline, but not from friends, had lower levels of emotional reactivity (i.e., lower NA than one's average on days with more physical symptoms). In contrast, on days when participants reported

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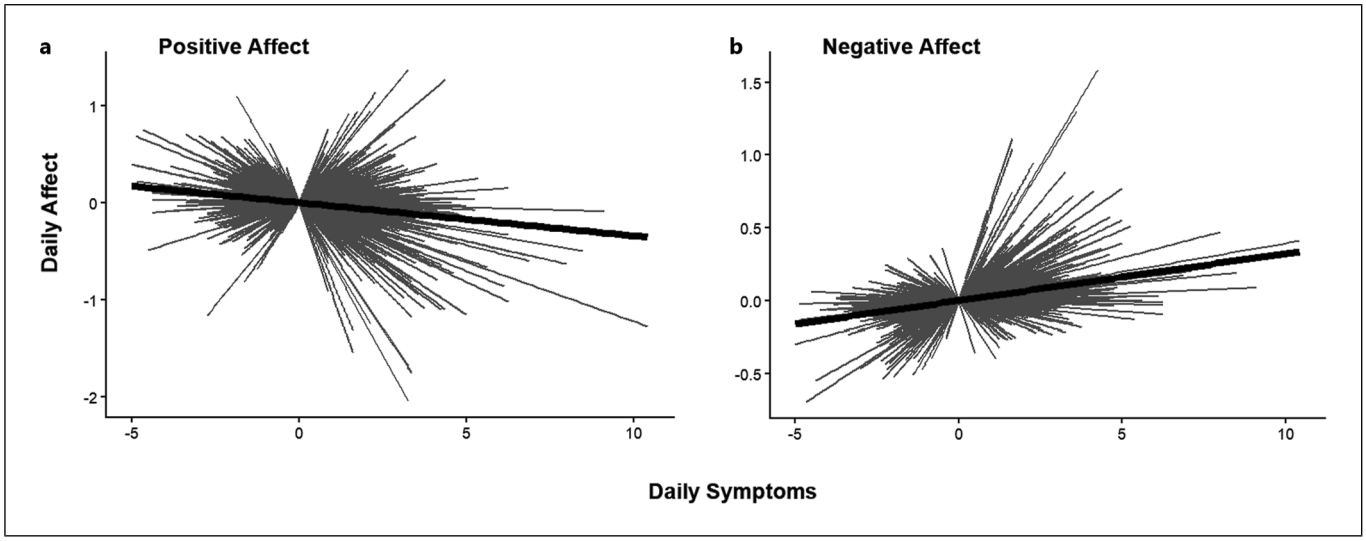


Fig. 1. a, **b** Daily within-person associations between physical symptoms and affect.

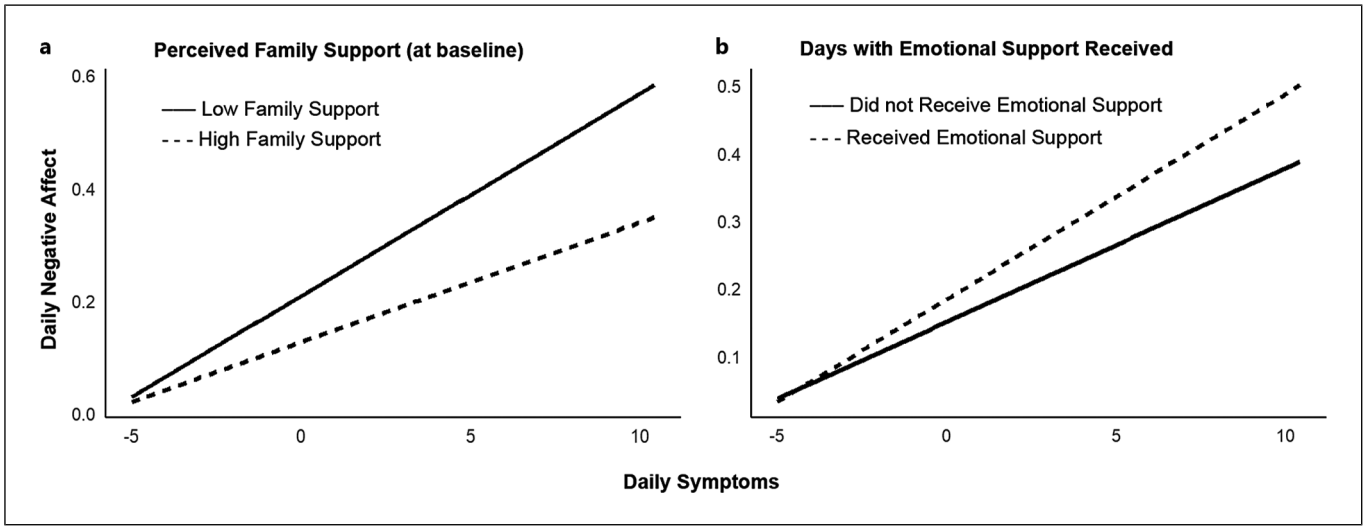


Fig. 2. Daily within-person associations between physical symptoms and negative affect: moderation by social support (perceived family support [at baseline] (**a**) and days with emotional support received (**b**)).

receiving emotional support, they had higher levels emotional reactivity (i.e., higher NA than one's average on days with more physical symptoms). Moreover, we found no evidence of a "spillover" effect, indicating that the role of received support is short-lived and context-dependent. We also found that functional limitations exacerbated emotional reactivity in NA, while age was unrelated. These findings substantiate and extend existing research on daily health and well-being dynamics by providing initial evidence for the differential role of different facets of social support. In doing so, they highlight the complex role of social support and functional health for maintaining emotional well-being in the face of everyday health challenges as we age.

Emotional Reactivity to Daily Physical Symptoms in Adulthood and Old Age

Evidence of emotional reactivity to routine physical symptoms substantiates growing evidence [5–8] and extends these reports by showing that routine symptoms

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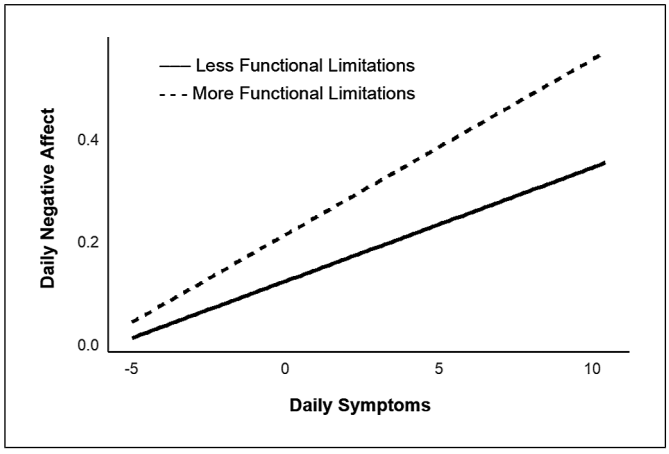


Fig. 3. Daily within-person associations between physical symptoms and negative affect: moderation by functional limitations.

differing in severity also pose a threat to same-day emotional well-being. We found no evidence of a "spillover effect" from yesterday's symptoms to today's affect, indicating a quick recover such that symptom-related emotional responses are confined to the same day. These findings are important in light of accumulating evidence that emotional reactivity to same-day health challenges undermine long-term physical health [6, 9, 10], emphasizing the importance of using intensive longitudinal data and the need for further research examining the long-term consequences of repeated and sustained reactivity to daily health challenges. However, the directionality of effects must be interpreted with caution as the correlational nature of multilevel analyses does not permit causal inference.

Emotional Reactivity to Daily Physical Symptoms: Moderation by Facets of Social Support

Evidence that perceived social support was associated with attenuated emotional reactivity while received emotional support was associated with exacerbated emotional reactivity is consistent with theoretical perspectives that these aspects of social support operate within qualitatively different systems [21] and with growing empirical evidence of their beneficial vs. harmful consequences for well-being [11–14, 26, 27, 31]. While perceptions of support help individuals cope with health stressors, highlighting its buffering effect, received support is typically activated as stressors arise. Although it is possible that these effects stem from reverse causality (i.e., people who receive support already have heightened distress) or shared stressors (i.e., the recipient and provider both affected by the same health symptoms), prior work testing these possibilities in simulated data suggests that they instead arise by signalling deficits, overprotection, or exceeding actual needs [32, 33]. Future work using lagged or bidirectional models could help clarify the temporal ordering of these processes by examining whether routine physical symptoms experienced in everyday life predict subsequent support receipt, and whether support receipt predicts subsequent symptoms or affect. These processes are also consistent with theoretical perspectives emphasizing that the effectiveness of support received in daily life depends on whether help is timely and/or appropriately matched to the individuals need [29]. In the context of daily symptoms, this dynamic may exacerbate emotional responses: when individuals experience symptoms and receive help that feels unnecessary or intrusive, they may interpret this as confirmation of reduced competence or autonomy. Consequently, symptoms may become more than physical discomfort by representing a threat to independence and self-worth. An important next step for future research would be to direct test these possibilities by, for example, examining mismatch in support received *vs.* needed. We found no evidence of a "spillover" effect of received support on next-day NA, indicating that the role of received support is short-lived and context-dependent. This is consistent with stress and coping theory [41], which emphasizes that the emotional consequences of stress and coping processes are situation-specific and shaped by appraisal. Empirical evidence from daily diary studies supports this view, showing that negative effects of received support rarely extend beyond the context in which they occur [31]. It would be interesting to examine whether other forms of support, such as instrumental and informational, engender similar effects. For example, it is possible that instrumental support might exacerbate emotional reactivity more than emotional (or information) support by more directly confirming need and status or attenuate emotional reactivity by providing practical, tangible support that helps alleviate symptom-related stress.

In addition to shedding light on the role of different *types* of support, our findings provide new evidence for different *sources* of social support. Evidence that perceptions of support from family, but not from friends, attenuated emotional reactivity implies that the family unit acts as a more central source of support in the face of everyday health challenges. This is consistent with the convoy model of social relations emphasizing the more central position family occupies in one's supportive network [23] and with empirical evidence of the important and persistent role family support has for coping with health challenges [25]. This suggests that although friends can (and do) provide support [28], they may be less involved in providing day-to-day health-related

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support. An interesting avenue for future research would be to explore whether perceptions of different types of support from friends or family (emotional, instrumental, informational) are differentially associated with emotional reactivity to routine health challenges. For example, there is substantial evidence from social and health psychology that friends and family differ in the types of social support they provide. Friends are often primary providers of emotional support (because they are voluntary and based on mutual trust and intimacy), while family provide more instrumental support [42]. It might therefore be that the benefits of support from friends is more apparent for some kinds of support (i.e., emotional), while other kinds of support (i.e., instrumental) are more strongly welcomed (and thus better received) from family.

Emotional Reactivity to Daily Physical Symptoms: Moderation by Functional Limitations and Age

Evidence that functional limitations were associated with elevated emotional reactivity substantiates and extends initial evidence from Katana et al. [5] and supports notions of sensitization, wherein greater functional limitations cause even modest routine symptoms to be perceived as threatening. This aligns with the idea that individuals with more functional limitations interpret daily symptoms as indicators of further decline/loss of independence. Theoretical perspectives imply that reduced functionality might represent a key pathway from which symptoms impact daily well-being [17, 18]; to more directly test this, future studies may wish to consider functional limitations as a mediator of daily health—affect associations.

Interestingly, no moderation effect was found for age, inconsistent with early findings indicating attenuation of emotional reactivity with age [6, 7]. Given that the current study controlled for functional limitations and social support, these results might imply that these mechanisms underlie previous evidence of age moderation, rather than age pe se. Another explanation is that older adults may increasingly rely on adaptive self-regulatory strategies [35, 36]. While adaptive self-regulatory strategies support emotional stability in the face of health-related challenges, they may also reduce moment-to-moment affective variability, limiting the detectability of age differences in reactivity. Thus, our null findings may indicate effective regulation rather than an absence of age-related processes. Finally, it is possible that the proposed age moderation effects occur principally at older ages (e.g., >90) and that the present MIDUS sample, with a median age of 63, is less suitable to address this point.

Emotional Reactivity to Daily Physical Symptoms: Supplementary Findings

Additional analyses based on symptom severity yielded a different pattern of results, such that the moderation effects of perceived family support and functional limitations observed for symptom count were no longer statistically significant. This might be because severity often reflects how disruptive symptoms are, reducing the amount of explanatory power perceived family support and functional limitations have. It could also reflect floor effects: NA rarely approaches the higher end of the scale (see descriptive statistics) and shows little day-to-day variability. On the other hand, evidence that age was associated with attenuated emotional reactivity to symptoms severity (that was not detected for symptom count) possibly suggest that older adults' enhanced emotion regulation strategies for maintaining PA are more likely activated when symptoms feel severe, rather than merely numerous.

Notably, when basic activities of daily living were examined as a moderator instead of instrumental activities, its effect was nonsignificant for emotional reactivity to symptom count and severity. This is likely because instrumental activities are more sensitive to early or moderate functional decline and often correlate with autonomy and coping resources, whereas *basic* activities are often compromised by more serious health threats that emerge in later life. Given that the sample predominantly consists of healthy, middle-aged adults, limitations in basic activities of daily living are still uncommon (potentially showing little variability), which may explain the absence of the moderation effect.

Emotional Reactivity to Daily Physical Symptoms: Asymmetrical Findings between PA and NA

It is notable that moderation effects were only detected for emotional reactivity in NA and not PA. One possibility is that the moderators primarily operated as a buffer against stressful conditions rather than as a resource that maintains positive emotions. This is consistent with evidence that PA and NA partially reflect independent systems: NA is thought to be more reactive to stressors as it is linked to threat and distress [43], whereas PA is regulated by motivation and reward-related mechanisms [44]. As routine symptoms primarily trigger distress, moderation effects may be more detectable for NA because of the stronger underlying association between daily symptoms and NA. A compatible explanation is

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that the lack of day-to-day variability in PA (consistent with its more stable trait-like nature, see [45, 46]) made moderation difficult to detect, relative to the more frequent ups and downs detected in NA (reflecting its more reactive state-like nature).

Limitations and Future Direction

It is important to note that multilevel analysis does not test causality or directionality but rather whether good/bad days (in terms of above/below average PA and NA) are associated with good/bad days (in terms of above/below average symptoms). Directionality of effects must be interpreted with caution.

The measures used in this study were limited in several ways. Self-reported routine physical symptoms may be problematic in light of older adults' tendency to underreport health challenges; future studies should examine more objective indicators (e.g., cortisol) to elucidate the extent to which perceptions of health drive reactivity. It would also be instructive to incorporate more objective measures of functional ability (i.e., grip strength), especially given the low prevalence of limitations in daily activities in midlife. Our measure of emotional support in daily life did not distinguish sources of or reasons for support. A more nuanced approach is needed to substantiate and extend findings, focusing on the amount, type (e.g., emotional, instrumental, informational), and source (e.g., family, friends, non-kin/formal caregivers) of support received. Furthermore, we used an amalgamated measure of PA and NA where theoretically and empirically distinct emotions were averaged into a single score. This is problematic because individual emotions are likely to be more or less closely associated with the theoretical pathways from which the moderators operate [47]. For example, "feeling close to others" and "like you belong" are more closely associated with social support, and may therefore be more sensitive to moderation than less relevant emotions (e.g., feeling active, proud, attentive).

Finally, it is important to acknowledge that the generalizability of the MIDUS sample is limited. Respondents were more likely to be white, female, and married, report better physical health and be more educated than the general population [48]. There was also a lack of ethnic and racial diversity, with the majority representing European or American backgrounds. Findings should be corroborated in more representative and diverse samples.

Conclusion

This study supports the idea that various social, individual, and demographic factors are associated with emotional reactivity to routine daily physical symptoms in middle-aged and older adults. Findings substantiate and extend existing research on adult health and well-being dynamics by (1) providing new insight into the differential and nuanced role of different types and sources of social support for emotional reactivity, and by (2) adding to the limited and conflicting literature on the role of functional limitations and age. Taken together, findings underscore the complex nature of social support and provide impetus for future research to consider different facets when examining emotional reactivity to everyday physical symptoms across adulthood and old age.

Statement of Ethics

This study was performed in accordance with the Declaration of Helsinki. This human study was approved by the Institutional Review Board of the Pennsylvania State University – approval: 5/4/2015. All adult participants provided written informed consent to participate in this study.

Conflict of Interest Statement

The authors have no conflicts of interest to declare.

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Author Contributions

S.P. and A.V.H. conceptualized the study. A.V.H conducted data analysis, drafted the manuscript, and revised the manuscript. S.P. and E.K.B. supervised the data analysis, drafted and revised the manuscript. J.D. supervised the data analysis and reviewed the manuscript.

Data Availability Statement

Data and documentation for all MIDUS projects are open access and available to download (https://www.icpsr.umich.edu/web/ICPSR/series/203; https://midus.colectica.org). This study was not preregistered.

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