Assessment of Stress and its Relationship with Health Behavior in Daily Life: A Systematic Review

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Abstract

Stress influences health behaviors critical for preventing non-communicable diseases. Although research on the stress-health behavior relationship in daily life has grown, a synthesis of measures and findings is lacking. This systematic review examines stress measures used in intensive longitudinal studies in daily life, their reliability and associations with health behaviors. We included studies measuring self-reported (cognitive appraisal-based) or physiological stress in daily life alongside health behaviors including eating, physical activity, smoking, and alcohol consumption. We excluded studies on physical stress, mood, laboratory-induced stress, non-English publications, and animal studies. Study quality was assessed using the Effective Public Health Practice Project Tool. Following PRISMA guidelines, we searched 2,333 records from PsycInfo, PubMed, and Web of Science, leading to 100 included studies with 18,122 participants. Narrative synthesis of results showed that self-reported stress measures dominated (94.5%), while physiological measures were underrepresented (5.5%). Stress was linked to unhealthier behaviors (30.2%), healthier behaviors (14.1%), or was not associated with health behavior (55.7%), depending on conceptual, methodology, and sample characteristics. Notably, physiological stress predominantly correlated with healthier behaviors, while self-reported stress predominantly related to unhealthier behaviors. Low study quality limit comparability, highlighting the need for standardized reporting to improve future research on stress and health behavior.

Keywords: Stress, Health Behavior, Measure, Physiological, Ecological Momentary Assessment

Introduction

Health behaviors play a critical role in determining our health. Engaging in a range of health behaviors can protect against non-communicable diseases such as cardiovascular disease (e.g., Khaw et al., 2008). Health behaviors can be divided into healthy behaviors, such as physical activity and a balanced diet, which support overall health, and unhealthy behaviors, such as smoking and alcohol consumption, which can be harmful (Lippke et al., 2012). Further, existing meta-analyses have identified key behaviors as major contributors to premature mortality and adverse health outcomes, including eating behavior, physical activity, smoking, and alcohol consumption (Keeney, 2008; Murray et al., 2020). Despite these well-known benefits, many people struggle to engage in these health behaviors. According to reports from the World Health Organization, 10-30% of individuals smoke (World Health Organization, 2021) and 17% of people over 15 years old engage in heavy or binge drinking (World Health Organization, 2024). Moreover, only 20-30% of individuals in the United States of America and Europe meet national physical activity guidelines (Rhodes et al., 2017) and about 40% of individuals in both high- and low-to-middle-income countries do not follow national dietary guidelines (Leme et al., 2021). Stress is a major barrier to health behavior as it can negatively impact the self-regulatory resources necessary for maintaining these behaviors (e.g., Laborde et al., 2018; Thayer et al., 2009, 2012).

Stress and Health Behavior

Stress, a ubiquitous aspect of modern life, emerges when perceived demands exceed an individual's available resources (Lazarus&Folkman, 1984; Ursin&Eriksen, 2004). There are distinct aspects of stress (Segerstrom&O'Connor, 2012; Ursin&Eriksen, 2004) that can be investigated, such as stressors (i.e., stressful situations), the perceived stress experience, or the physiological stress response. The physiological stress response, our body's way of mobilizing resources to cope with stress, happens both through activation of the hypothalamic-pituitary-adrenal axis and the autonomic nervous system (e.g., O'Connor et al., 2021; Weber et al., 2022). Under certain circumstances stress can enhance mental and physical performance and support essential biological functions, such as the immune response (Dhabhar, 2014, 2018; Laborde et al., 2018). However, stress is also frequently associated with negative health outcomes, including obesity, cardiovascular disease, and cancer (Karyotaki et al., 2020; Keller et al., 2012; O'Connor et al., 2021; Taouk et al., 2020). These adverse effects occur due to stress-induced dysregulation of biological processes, but also the influence of stress on health behaviors (O'Connor et al., 2021). Many cross-sectional studies have identified stress as an important factor relating to health risk behaviors such as a poor diet, physical inactivity, smoking and alcohol use in a variety of different populations (e.g., Algren et al., 2018; Beutel et al., 2018; Ng&Jeffery, 2003; Pelletier et al., 2016).

It is believed that stress influences health behavior by negatively affecting the self-regulatory resources necessary for adaptive and goal-directed behavior (Laborde et al., 2018; Thayer et al., 2009, 2012). Self-regulation plays a crucial role across different health behaviors, with executive functions such as updating (e.g., adjusting dietary choices based on new health information), inhibiting (e.g., resisting the urge to smoke when stressed), and shifting (e.g., adapting to a new workout routine after an injury) being essential for translating intentions and automatic responses into actual behaviors (Dohle et al., 2018). Stress can disrupt this process due to the significant overlap between brain regions responsible for the physiological stress response and executive functions, particularly in the prefrontal cortex (Thayer et al., 2009, 2012). Moreover, conscious and unconscious cognitive processes associated with stress, such as worry and rumination, can impair an individual's ability to self-regulate effectively (Brosschot et al., 2018; Clancy et al., 2016). This weakens goal-directed behavior and behavioral adaptability (Laborde et al., 2018), both of which are essential for engaging in health behaviors (Kwasnicka et al., 2016; Rhodes&Lithopoulos, 2023). Additionally, individuals may turn to behaviors like unhealthy eating or smoking in an effort to cope with stress (e.g., Adam&Epel, 2007; Franja et al., 2021; Perski et al., 2022; Standen et al., 2022).

Until recently, the stress-health behavior relationship has mainly been studied focusing on individual differences, using cross-sectional or panel designs (e.g., Ng&Jeffery, 2003; Steptoe et al., 1996), and in highly controlled settings such as laboratories (e.g., Epel et al., 2001; Zellner et al., 2007). However, these approaches overlook the dynamic nature of stress and health behaviors as they unfold in daily life.

Stress fluctuates rapidly in response to everyday situational demands (e.g., Bamert&Inauen, 2022; Zawadzki et al., 2019), and these moment-to-moment variations are crucial for understanding how stress influences behaviors which can occur multiple times a day.

Studying Stress and Health Behavior in Daily Life

Intensive longitudinal methods (e.g., ecological momentary assessment, daily diaries, ambulatory assessment) allow for the investigation of momentary experiences and behaviors as they unfold in real time within everyday contexts (Mehl&Conner, 2011; Trull&Ebner-Priemer, 2014). These methods offer advantages such as (1) studying processes in their natural context, enhancing ecological validity, (2) capturing experiences in real time, and (3) understanding how these processes unfold within individuals over time (Bolger&Laurenceau, 2013; Mehl&Conner, 2011). However, they also present challenges, including compliance issues, reactivity, participant burden, technical difficulties, and extensive data preparation requiring numerous methodological decisions (Shiffman et al., 2008).

In recent years, intensive longitudinal studies have increasingly been used to examine the stress–health behavior relationship. While many studies report associations between stress and eating behavior, physical activity, smoking, and alcohol consumption (e.g., Almeida et al., 2020; Hill et al., 2018; Mereish et al., 2022; Minami et al., 2011), findings are inconsistent. Some studies find no significant relationship (e.g., Reichenberger et al., 2021; Savoy et al., 2021; Wemm et al., 2022), while others suggest stress is linked to both unhealthier (e.g., smoking lapse: Cambron et al., 2019; binge drinking: Grzywacz&Almeida, 2008) and healthier behaviors (e.g., lower alcohol consumption; Helzer et al., 2006; O'Connor et al., 2009).

Methodological variation contributes to these mixed findings. Study designs range from randomized controlled trials (e.g., Businelle et al., 2016; Mereish et al., 2018) to mixed methods research (e.g., Kwasnicka et al., 2021) and observational designs such as daily diary studies (e.g., Finkelstein-Fox et al., 2020; O'Connor et al., 2008). Stress measurement frequency differs across studies, from one prompt per day (e.g., Hill et al., 2023; Park et al., 2025) to eight prompts per day (e.g., Jones et al., 2017; Schilling et al., 2022). The level of analysis also varies, with some studies employing multiple assessments per day (e.g., Almeida et al., 2020) and others using monthly assessments (e.g., Cadigan et al., 2021).

Conceptual and methodological challenges further complicate research on the stress–health behavior relationship. Stress can be assessed in multiple ways—such as exposure to stressors, perceived stress, or physiological stress (Ursin&Eriksen, 2004), each of which may yield different associations with health behaviors. Additionally, studies differ in their handling of within- and between-person effects and their choice of time scales (e.g., hourly, daily), which can influence findings. Technical and practical challenges, including data aggregation decisions and participant compliance, further contribute to inconsistencies across studies. Differences in study populations (e.g., healthy individuals vs. those with specific health conditions) add another layer of complexity.

For stress measures to be suitable for investigating or intervening in the stress–health behavior relationship in daily life, they must be both valid and feasible for real-time use. A key challenge is balancing accuracy with participant burden, as frequent assessments and lengthy self-report measures can reduce compliance and data quality (e.g., Bos et al., 2019; Eisele et al., 2022). Passive physiological measures such as heart rate variability (HRV) or electrodermal activity provide lower-burden alternatives while still capturing meaningful stress fluctuations but the need to carry and charge devices, and the visibility of wearable sensors could compromise compliance. Careful selection of covariates is also essential, as including too many may increase participant burden, while omitting key variables may limit interpretability. Contextual factors (e.g., time of day, social interactions) and individual differences (e.g., trait stress reactivity, baseline health behaviors) should be carefully considered to ensure a comprehensive understanding of the stress–health behavior relationship. Finally, analytical decisions—such as handling missing data and distinguishing within- from between-person effects—can significantly impact findings and should be transparently reported to improve study comparability.

Aim of This Systematic Review

Despite growing use of intensive longitudinal methods to study the stress-health behavior relationship, there is considerable variability in findings that could be due to differences in stress assessment, time scales, analytic approaches, and study populations. While there is research synthesizing the measurement of health behavior in daily life contexts (e.g., in regards to measurement reactivity: König et al., 2022), a comprehensive overview of how stress is measured when studying the stress-health behavior relationship in daily life is missing as is an overview of the factors influencing these associations, and the implication for real-time interventions. This systematic review aims to provide an overview of how the relationship between stress and health behavior is investigated in daily life, and to present recommendations for the field. Specifically, we are interested in the key health behaviors that have been linked to premature deaths globally such as (1) eating behavior, (2) physical activity, (3) smoking, and (4) alcohol consumption (Keeney, 2008; Murray et al., 2020). As preregistered on PROSPERO (CRD42023397663), we aimed to investigate (1) which measures of stress have been used to investigate the relationship between stress and health behavior in daily life, (2) the reliability of these measures, (3) the magnitude and (4) the variability in the associations between stress measures and health behaviors, (5) and which covariates were controlled for. The results from these research questions will further be discussed in terms of how suitable the reviewed measures are for guiding ecological momentary interventions that focus on the relationship between stress and health behaviors.

Methods

This systematic review included intensive longitudinal studies investigating the relationship between stress and key health behaviors important for health outcomes (Keeney, 2008; Murray et al., 2020), including (1) eating behavior, (2) physical activity, (3) smoking and (4) alcohol consumption. We followed the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) checklist (Page et al., 2021).

Inclusion Criteria

Two key measurement domains were essential for inclusion: first, either a self-reported stress measure incorporating cognitive appraisal of stress (Hill et al., 2022) or a physiological stress measure had to be included (e.g. cortisol, HRV). Second, one or more of the following four health behaviors had to be assessed: eating behavior, physical activity, smoking, or alcohol consumption. We only included intensive longitudinal studies, wherefore studies needed to include repeated measurements of both stress and health behaviors in daily life (at least two measurement points each). Stress assessments needed to be short-term measures (i.e., no measures of chronic stress, defined as going back longer than 30 days) and needed to be assessed prior or concurrent with health behavior assessments. Furthermore, all measurements were required to be conducted in naturalistic settings using ecological momentary assessment, ambulatory assessment, daily diary methods, or similar real-world data collection approaches. Lastly, only quantitative studies were included.

Exclusion Criteria

Reports were excluded if they were preprints. Reports were also excluded if they only assessed physical stress (e.g., stress from physical exertion), measured general mood states or negative affect rather than perceived stress, or only induced stress in a laboratory setting. Non-English language studies, animal studies, and those that did not analyze or report the stress-health behavior relationship were also excluded.

Search Method to Identify Suitable Studies

A comprehensive literature search was conducted using three databases: PsycInfo (Ovid), PubMed, and Web of Science. The initial search was performed on May 8, 2023, with no restrictions on publication dates. The search terms were developed through a systematic process of identifying key words and phrases, which involved both scanning relevant literature and consulting experts in the field (DOC and JI). The full search terms can be found in the supplementary material (S1). The initial search yielded 809 records from PsycInfo, 464 from PubMed, and 1,267 from Web of Science. Duplicate records were eliminated using Zotero software (Corporation for Digital Scholarship, 2024), followed by manual screening. A total of 2,015 unique records remained for review.

On September 13, 2024, the search was updated using the same search terms on the same databases. 285 unique and new records were found and screened for inclusion. Lastly, to identify foundational studies that may have been missed in the initial database searches, a backward citation search was performed for the eight records that were both highly relevant to answer at least one of our research questions and contained a stress measure that was reported by the study authors to be reliable.

Data Collection and Analysis

Selection of Studies

Three reviewers (YS, AH, LB) initially screened the records for inclusion in the review. At first, 400 records (~20% of all records) were randomly chosen to be triple screened to establish interrater reliability (Landis&Koch's Kappa: 0.73). All records were rated as either included, excluded, or unclear. Wherever there was a discrepancy, or ratings were unclear, it was resolved by screening the full text or discussing with MB, or where necessary with DOC and JI. Where not enough information was gained from the report, study authors were contacted. For all records, title, abstract, and the methods section were screened. Methods screening was performed for all records because much of the information necessary for assessing eligibility was found therein (e.g., if data were collected in daily life, timing of data collection, the exact wording of items measuring stress). The entire research team assessed whether the self-reported stress measures included cognitive appraisal of stress (similar to other systematic reviews on stress e.g., Hill et al., 2022).

The screening for the updated search and the backward citation screening were conducted by one single reviewer (YS) in the same manner as for the initial screening. Unclear records were discussed with MB or where needed with JI. New stress measures were discussed between YS and MB.

Records were excluded based on the following criteria, applied in hierarchical order: full text was unavailable; details remained unclear and information could not be obtained from study authors; records were retracted or preprints; records were not written in English; participants in the study were not human; studies were not quantitative; stress and health behavior were not measured in the study; stress and health behavior were not measured in daily life; stress self-report did not include a cognitive appraisal; measures of stress and health behavior were not repeatedly assessed; stress was only operationalized as physical stress; stress measure was actually mood (e.g., negative affect); health behavior was not measured at the same time or after stress; stress and health behavior measurements were assessing timeframes longer than 30 days (chronic stress); stress – health behavior relationship was not analyzed or reported.

Data Extraction and Management

An Excel form was created to extract data from the studies by MB and FB, incorporating feedback from DOC and JI. FB extracted key study characteristics, including author names, year of publication, article title, study design information (e.g., study duration), sample information (e.g. age, education), information about stress measures (e.g., rationale, stress aspect measured), health behavior (e.g., type of behavior, measurement), participant burden (e.g., prompt frequency, actions to minimize burden), study quality, and limitations named by authors (e.g., bias specific to stress). MB extracted information on the statistical analysis and results (e.g., data preparation steps, models calculated, size and significance of effects). Uncertainties were discussed together by FB, MB and where necessary with JI. While this data form included a coding scheme for information about the extent to which the reviewed measures are suitable for informing ecological momentary interventions targeting the relationship between stress and health behaviors, it was not unique enough and largely overlapped with other research questions, preventing additional meaningful extractions.

Quality Appraisal

Due to the large variability in study designs, outcome measures, and the absence of an appropriate risk of bias tool for intensive longitudinal studies, we opted to conduct a study quality appraisal instead of a formal risk of bias assessment, following the approach of previous systematic reviews (e.g., Hill et al., 2022). To assess study quality, we used the Effective Public Health Practice Project (EPHPP) quality assessment tool (Effective Public Health Practice Project: Jackson et al., 2005) on the study level, where we excluded the category on study design because the named designs were not fitting for intensive longitudinal studies. The overall study quality was predominantly rated as weak, with 85.9% of studies falling into this category and none classified as strong. Selection bias was a common concern, with 85.9% of studies rated as weak. The reliability and validity of stress and health behavior measures were also frequently rated as weak (68.5% for both). While withdrawals and dropouts were more evenly distributed, nearly half of the studies (47.8%) received a weak rating in this domain. A more detailed breakdown of study quality ratings according to the EPHPP quality assessment can be found in the supplementary material (see S2, Table SI for a summary and Table SII for ratings per record). Additionally, we extracted information based on multiple intensive longitudinal study reporting guidelines (e.g., Adapted STROBE Checklist for Reporting Ecological Momentary Assessment Studies, CREMAS; Liao et al., 2016) such as additional information on training of participants, ecological momentary assessment procedure, or the time allowed to answer prompts (see S2, Table SIII-SV in the supplementary material). While many records did not report on these, available information is described in the results section.

Data Synthesis

In this systematic review, the record level refers to individual database entries (i.e., published manuscripts), the study level represents distinct research projects (i.e., empirical studies), study samples are the groups of participants within each study from whom data were collected, and analyses are the statistical models used to investigate the stress-health behavior relationships within the records. For each record, relevant coefficients from analyses (e.g., standardized beta coefficients, odds ratios, rate ratios, f-statistics, or unstandardized model estimates) relating to the stress-health behavior relationship were extracted by MB and all uncertainties were discussed with

JI. Where necessary, unstandardized estimates were transformed into odds or rate ratios. A rate ratio expresses how the rate of an event changes with a one-unit increase in a predictor, where values above one indicate a percentage increase and values below one a percentage decrease in the event rate (Atkins et al., 2013). If the effect size of coefficients, such as standardized beta coefficients, fell outside a plausible range (e.g., betas exceeding 1 or falling below -1), we only used it to determine the direction but not magnitude of the association between stress and health behavior. Records only reporting Pearson correlations did not appropriately consider repeated measurement points nested within participants and were often done with raw scores, violating statistical assumptions. Therefore, these were not synthesized in this review.

For addressing our research questions on the magnitude, variability, and predictive validity of the stress–health behavior association, we included multiple statistical models within each study, when available, to account for important differences in statistical analyses, such as whether within- and between-person effects were disentangled and the time scale used. This approach ensured a more comprehensive understanding of how methodological choices influence results, rather than limiting the synthesis to a single model per study sample.

Data Pre-Processing

To investigate the direction of relationship between stress and health behaviors in the included records, we recoded the result for analyses when needed, so that a positive relationship means greater stress relating to unhealthier behavior. This ensures that for synthesizing the results, a greater coefficient relates to unhealthier behavior. Results for healthy behaviors, including fruit and vegetable intake, healthy snacking, healthy eating, consuming main meals, physical activity (amount, duration, frequency), smoking abstinence were thus recoded. In turn, results on unhealthy behaviors were left as originally scored, i.e. those regarding dietary lapses, (unhealthy) snacking, consuming unhealthy foods, disordered eating, binge eating, eating tempting food, overeating, loss of control eating, restricted eating, emotional eating, meal skipping, physical inactivity (e.g., sedentary behavior), number of cigarettes, smoking instances, smoking lapses, alcohol consumption (frequency, amount) and heavy/binge drinking.

Identifying Duplicate Samples

Duplicate samples within the included records were identified by FB and YS by documenting instances with the same parent study. Further, if sample demogaphics and size were identical and there was an overlap in authorship, it was recorded as a duplicate sample. If two records came from the same parent study but reported different sample information (e.g., age), we used the information from the larger sample to describe the study sample.

Narrative Synthesis

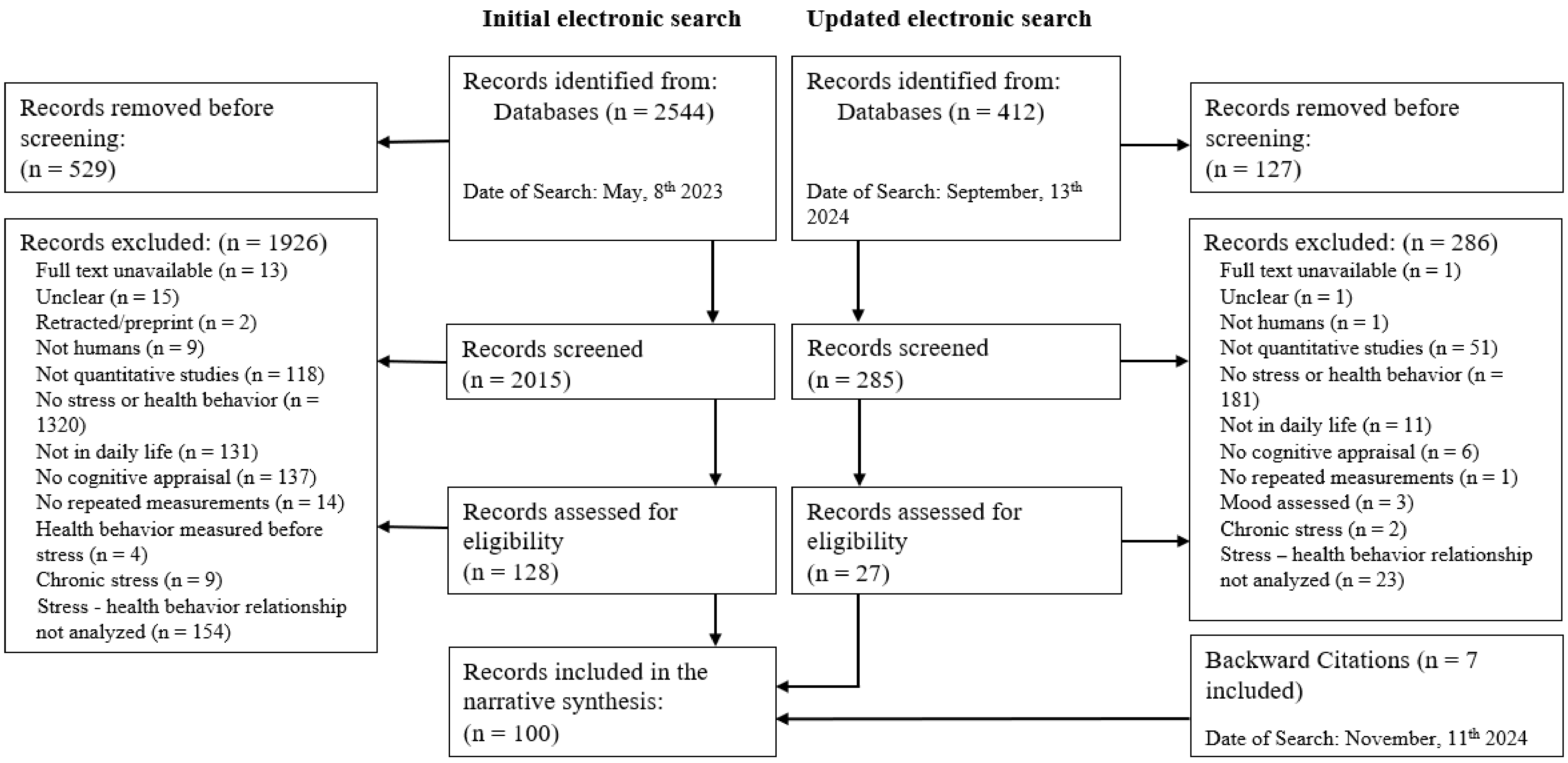
A meta-analysis was not conducted, because of significant variability in study designs, stress measures and health behavior outcomes as well as the lack of information reported in records. Instead, we descriptively summarized the characteristics and quality of the included records, ecological momentary assessment designs and study samples to answer the six research questions. First, to explore the measures of stress used, we summarized the number and types of self-reported and physiological stress measures on study level. This included the use of active (e.g., self-report via questionnaires; Fowler et al., 2023; Schilling et al., 2022) versus passive (e.g., HRV measured with wearables or patches; Mahoney et al., 2023; Ranzenhofer et al., 2022) stress measures (Wenze&Miller, 2010). The stress measures used were then summarized according to the stress aspects assessed (i.e., stressors, perceived stress, physiological stress; Ursin&Eriksen, 2004). Physiological measures were additionally connected to the distinction between measures of hypothalamic-pituitary-adrenal axis and autonomic nervous system activity (e.g., O'Connor et al., 2021; Weber et al., 2022). Second, the reliability of these stress measures was reported at study level. Third, the magnitude in the associations between stress and health behaviors was described on the level of analysis both for each specific health behavior and overall. Fourth, the variability in these associations on analysis level was summarized according to sample (health status, body mass index), conceptual (the stress aspect investigated), and methodological characteristics (the type of self-report questionnaire used, the characteristics of the statistical analysis). Additionally, moderators that were tested in the included studies were divided into interindividual and time-varying factors and thematically grouped (bottom up). Fifth, we summarized and thematically grouped (bottom up) which and how many covariates were controlled for in the statistical analyses. To avoid duplication, information on the suitability of stress measures for informing ecological momentary interventions targeting the relationship between stress and health behaviors was not synthesized separately. Instead, it was integrated into the discussion, drawing on findings from other research questions.

Results

A total of 100 records including a total of *N* = 18,122 participants across 92 studies were included in this review (see supplementary material S8 for the full list of included records). See Figure 1 for the flow diagram of study selection. Data supporting the findings of this systematic review are available in the supplementary material (see S3, Table SVI). There were many records that nearly met all inclusion criteria but required exclusion due to critical limitations. For example, often studies only reported bivariate correlations between stress and health behaviors or did not analyze the relationship at all (e.g., Aronson et al., 2008; Clevers et al., 2020; de Vries et al., 2022). Additionally, some studies were excluded because they examined combinations of health behaviors (e.g., alcohol and drug use) and did not report the stress–health behavior relationships separately (e.g., Linden-Carmichael et al., 2022).

Figure 1

Flow diagram of included studies



Note. Unclear = details about report/study remained unclear and information could not be obtained from study authors, records removed before screening are duplicate records.

Of the included studies, most were observational (*n* = 79, 85.9%) and about half of all studies were conducted in the United States of America (*n* = 49, 53.3%). There was high variability in study duration (between 1-730 days). The median sample size per study was 116 participants. Study participants had a median age of 35.5 years, and a median of 57% participants were women. More information on the studies included and the study samples (e.g., country of data collection, study duration, health status of the study samples) are summarized in the supplementary material (S2, Table SV).

Concerning the statistical analyses, the majority of analyses comprised multilevel analysis (*n* = 286, 71.3%) to investigate the stress-health behavior relationship, due to the nested structure of the data (repeated measures nested within participants; see supplementary material S4, table SVII for a list of analyses used). Across all analyses, 249 (62.1%) were done concurrently (no lag) and 152 (37.9%) were lagged analyses, where stress was used to predict future health behavior. For the level of analysis, about half of the analyses used the day (*n* = 218, 54.4%), followed by multiple times a day used in 118 of analyses (29.4%). There was considerable variation in modelling choices, such as inclusion of random slopes or intercepts, and distinguishing within- and between person variances by centering (See S3, Table SVI in the supplementary material).

Fiftynine (64.1%) studies had an empirical rationale for using an intensive longitudinal study design to investigate their research question. 18 (19.6%) studies gave some other rationale (e.g., authors explanation) and one study (1.1%) had a mix of empirical and theory-based rationale. 14 (15.2%) studies did not report their rationale. Concerning the rationale for the specific timing and frequency of assessments in daily life that studies used, 21 (22.8%) had an empirical rationale and 16 (17.4%) gave some other rationale (i.e., authors explanation). 55 studies (59.8%) gave no rationale, and no study had a theory-based rationale.

Of the included studies, 32 (34.8%) investigated eating behavior, 21 (22.8%) alcohol consumption, 14 (15.2%) smoking, 15 (16.3%) physical activity, and 10 studies (12.9%) investigated multiple of these health behaviors. Of the studies investigating eating behavior, five (12.5%) investigated energy/food intake (e.g., participants had to report on how much they had eaten; Reichenberger et al., 2021), four (10.0%)

investigated unhealthy or healthy eating (e.g., participants estimated the healthiness of their last meals, Schultchen et al., 2019; participants reported the number of times they ate sweet or salty snacks over the past day, Finkelstein-Fox et al., 2020), seven (17.5%) investigated snacking (e.g., participants reported the amount and type of each snack they consumed from the time of waking up to before going to bed; Sezer&Öner, 2023), 13 (32.5%) investigated clinically relevant eating behavior (binge eating, loss-of-control eating, disordered eating; e.g., participants were asked to indicate whether or not they had experienced a binge episode at each assessment; Fischer et al., 2017), two (5.0%) other (comfort eating, lapses; e.g., participants had to report if a dietary lapse occurred since the last survey; Goldstein et al., 2018), and nine (22.5%) investigated multiple aspects of eating behavior (e.g., Hsu&and Raposa, 2021; Smith et al., 2021).

Of the studies looking at physical activity, nine (39.1%) looked at physical activity (amount/bouts) (e.g., participants' physical activity was passively measured using a chest-worn device; Almeida et al., 2020), four (17.4%) at moderate to vigorous physical activity (amount/bouts) (e.g., participants reported duration (in minutes) of engagement in different physical activities; Dunton et al., 2009), two (8.7%) at sedentary time (e.g., sedentary behavior was objectively measured with a wrist-worn device; Diaz et al., 2018), and seven (30.4%) at multiple aspects of physical activity (e.g., Jones et al., 2017).

In the smoking studies, five (31.3%) looked at smoking (e.g., participants indicated if they smoked the previous day; Braitman et al., 2021), four (25.0%) at number of cigarettes consumed (e.g., participants reported the number of cigarettes smoked each day; O'Connor et al., 2009), two (12.5%) at smoking events (e.g., participants had to report smoking events immediately prior to smoking; Beckham et al., 2008), two (12.5%) at smoking abstinence or status (e.g., smoking abstinence was measured both with self-report and carbon monoxide testing; Spears et al., 2019), and three (18.8%) looked at smoking lapses (e.g., participants reported all their smoking lapses; Shiffman et al., 2020).

Lastly, for alcohol consumption 12 (46.2%) studies investigated the amount of alcohol consumed (e.g., participants reported their alcohol consumption from the previous day, including the number of beers, liquor-based drinks, and glasses of wine; Helzer et al., 2006), nine (34.6%) alcohol consumption (yes/no, e.g., participants reported if they consumed alcohol during the past 24 hours; Park et al., 2023), one (3.8%) heavy drinking (participants were asked to report the previous months heavy episodic drinking frequency; Cadigan et al., 2021), and three (11.5%) investigated multiple aspects of alcohol consumption (e.g., Luk et al., 2018).

Use of Stress Measures and their Reliability

This section presents the results for the first two research questions: (1) which measures of stress have been used to investigate the relationship between stress and health behavior in daily life, and (2) the reliability of these measures. A large majority of studies used self-report measures of stress (n = 87, 94.6%), with only few studies using physiological measures (n = 2, 2.2%), or a combination of both (n = 3, 3.3%). 14 studies (15.2%) measured stressors, 51 (55.4%) the stress experience, two (2.2%) the physiological stress response, and 25 studies (27.2%) measured multiple aspects of stress. For self-report measures, only 23.3% (*n* = 21) of studies reported on the reliability of the measure used, whereas 76.7% (*n* = 69) of studies did not report on reliability. For physiological stress measures, 20.0% (*n* = 1) of studies reported their measure to be reliable, the other studies (80.0%, *n* = 4) did not report on reliability. All studies that reported on reliability of stress measures reported good reliability (see S2, Table SI in the supplementary material).

The studies included in this review employed various strategies and frequencies to prompt stress assessments (see S5, Table SIX in the supplementary material). The most common prompting strategy was interval-based sampling, used in 44 studies (47.8%), where participants were asked to report their stress at fixed time intervals. (Semi-)random signal-based prompting was used in 19 studies (20.7%), ensuring that stress reports were collected unpredictably throughout the day. Event-based prompting, in which participants were asked to report stress following specific events, was used in four studies (4.3%), while device-based prompting, triggered by physiological or contextual data from a wearable device, was used in two studies (2.2%). Additionally, 21 studies (22.8%) combined multiple prompting strategies, and three studies (3.2%) did not report their prompting approach.

Regarding sampling frequency, most studies collected stress data multiple times per day (*n* = 50, 54.3%), allowing for fine-grained analyses of stress fluctuations.

Another 35 studies (38.0%) used a daily assessment schedule, while three studies (3.3%) assessed stress weekly. A small number of studies (*n* = 2, 2.2%) used continuous measures, where stress was assessed passively or near-continuously through physiological monitoring (see the supplementary material S5, Table SVIII for information on prompting strategy and sampling frequency).

Median percentage of missing data was 7.1% per intensive longitudinal study (Q1 = 3.8%, Q3 = 16.9%). 64 studies did not report percentage of missing data. As reasons for missing data, three studies (3.3%) reported device detection failure, 11 (12.0%) human errors, and three (3.3%) reported (other) technical problems. Concerning reasons for non-compliance of participants, two studies (2.2%) reported forgetting to wear or charge sensors and two studies (2.2%) reported too high burden of diaries. Further reasons that were mentioned by one study each (1.1%) were forgetting the smartphone at home, not receiving diary prompts during "do not disturb mode", medical issues, or loss of diary forms.

In the following sections, we provide a more detailed overview of the self-report and physiological measures, and which stress aspect they analyzed (see Table 1). There was considerable variation in self-report measures of stress, including the adaptations that were made (e.g., adapting to daily life context), response options, scale type and range, and the number of items used. This and information about the sources of questionnaires can be found in the supplementary material (see S6, Table SX).

Stressful Event Questionnaires

Twenty-eight studies (31.1%) used questionnaires about stressful events or daily hassles such as asking participants to select from a list of stressful or unpleasant experiences (checklists) or to write down the stressful events they experienced (open format), and to then rate the stressfulness of these experiences. Examples of such stressful events checklists were the assessment of daily experience (Stone&Neale, 1982; e.g., Armeli et al., 2000), or the daily stress inventory (DSI, Brantley et al., 1987; e.g., Fowler et al., 2023). These checklists involved longer lists of potentially stressful events such as the daily stress inventory with 58 items for which participants indicated the perceived stressfulness for the events that occurred during a specified timeframe (most of the time day level). On the other hand, open format questionnaires about stressful events, oftentimes called daily hassles, involved participants to first list a certain number (between 3-5) of stressful or unpleasant events they experienced during the day in a short text description and to then rate the stressfulness of each event.

Of the analyses run within the studies using questionnaires about stressful events, the association between the stressor aspect and health behavior was often analyzed. Either the number of reported stressors was analyzed using the sum of checked boxes for checklists (n = 25, 20.7%) or the sum of hassles described in open format (n = 18, 14.9%), or the types of stressors were analyzed (n = 24, 19.8%). In studies that investigated the types of stressors, categorization of events was done by coders (e.g., into ego-threatening, interpersonal, work/academic, physical or other stressors; Hill et al., 2023). Lastly, some analyses used these questionnaires to investigate a combination of stressor and stress experience aspects (*n* = 54, 44.6%), by using the stressfulness rating of the most stressful event (e.g., Armeli et al., 2000) or by averaging the stressfulness ratings of all reported stressful events (e.g., Fowler et al., 2023).

Perceived Stress Scale

Further, 13 studies (14.4%) used the perceived stress scale (PSS, Cohen et al., 1983 e.g., Dunton et al., 2017) and adaptations thereof, which consists of a subscale for (1) perceived helplessness (e.g., How often did you feel difficulties were piling up so high that you could not overcome them today?) and (2) perceived self-efficacy in dealing with stress (e.g., How often did you feel confident in your ability to manage your stress today?) (Harris et al., 2023).

Of the analyses run within the studies using the PSS and its adaptations, some investigated the stress experience aspect (*n* = 9, 18.4%) but oftentimes they investigated a combination of the stress experience and self-efficacy (*n* = 24, 49.0%) or even only the items on self-efficacy (*n* = 16, 32.7%).

Single Items and Other

Single items were the most frequently used to assess stress on the study level (*n* = 43, 47.7%). Most of these single items used by studies were self-generated (*n* = 27, 64.3%; e.g., “At the moment, I feel stressed out”, Doerr et al., 2017). In other studies the single items were adapted from other questionnaires, such as using the “stressed” item from the positive and negative affect scale (PANAS, Watson et al., 1988; e.g., Beckham et al., 2008; Coffman et al., 2021) or individual items from the PSS (Cohen et al., 1983; e.g., Li et al., 2020; Sheng et al., 2023) such as “Right now, how nervous and stressed do you feel?” or “Right now, you feel out of control of important things in your life”. Single items were used to analyze the relationship between different stress aspects and health behaviors (see Table 1).

Of the analyses run within these studies using single items, the stress experience aspect was most often analyzed (*n* = 135, 78.5%) with items such as “How stressed have you been since the previous prompt?”. Some analyses also investigated stressors (*n* = 19, 11.0%) with dichotomous items on the occurrence of stressful events (e.g., “Did stressful events occur in the past 2 hours?”; Minami et al., 2018). One study also used a combined single item to assess stressors and stress experience, asking participants to indicate whether they believed a stressor had triggered a behavior (e.g., smoking). Lastly, some single items assessed a combination of the stress experience and coping, such as self-efficacy in managing stress (“I can manage with all the things I have to do right now”) which made up 9.3% (*n* = 16) of analyses.

Lastly, three studies (3.3%) used other items to assess specific types of stress such as appearance-related stress (e.g., “Did you feel stress when you saw reflection of self"; Mason et al., 2018). In the analyses run within these three studies, most often self-efficacy in coping with stress was investigated (*n* = 10, 41.7%), followed by the stress experience aspect (*n* = 6, 25.0%), a combination of stressor and stress experience aspects (*n* = 6, 25.0%), or a combination of the stress experience aspect and coping with stress (*n* = 2, 8.3%). Finally, some studies also assessed multiple questionnaires (*n* = 3, 3.3%%; but then ran separate analyses).

Table 1

Self-report stress measures according to the studies

Questionnaire type	Operationalization of stress aspect	Example item or description	Number of analyses per operationalized aspect
Stressful events questionnaires	Number of stressful events (checklist)	Which of the following events made you feel stressed today?; the sum of checked boxes from the checklist was calculated	25 (20.7%)
	Number of stressful events (open format)	Participants were asked to record any stressful experience they encountered that day (up to 5 daily hassles); the sum of hassles was calculated	18 (14.9%)
	Type of stressor	Stressors were coded into categories such as interpersonal, work/academic, …	24 (19.8%)
	Experience of stressors	Participants rated the most stressful event from each assessment interval according to how stressful they found it to be.	54 (44.6%)
Perceived stress scale and adaptations	Perceived stress/helplessness	How often did you feel difficulties were piling up so high that you could not overcome them today?	9 (18.4%)
	Perceived self-efficacy	How often did you feel confident in your	16 (32.7%)

		ability to manage your stress today?	
	Combination of perceived helplessness and self-efficacy	Items from both scales were combined.	24 (49.0%)
Single items	Occurrence of stressful event	Did stressful events occur in the past 2 hours? (yes or no)	19 (11.0%)
	Experience of stressors	Participants indicated whether they thought stress had triggered the health behavior.	2 (1.2%)
	Perceived stress	How stressed have you been since the previous prompt?	135 (78.5%)
	Perceived self-efficacy	I can manage with all the things I have to do right now.	16 (9.3%)
Other	Experience of stressors	Have you seen a media image about food, shape, or weight? If yes: How stressful was it to see this image?	6 (25.0%)
	Perceived stress/helplessness	Did you feel stress when you saw reflection of self?	6 (25.0%)
	Perceived self-efficacy	Thing are working out as I have planned right now	10 (41.7%)
	Combination of perceived helplessness and self-efficacy	Items from both scales were combined.	2 (8.3%)

Note. The frequency per questionnaire column describes the frequency with which each questionnaire was used to investigate (i.e., analyze) the association between a specific stress aspect and health behavior.

Physiological Measures

Of the five studies (5.4%) including physiological measures, two studies each included HRV (28.6%), heart rate (HR) (28.6%), or the cortisol awakening response

(28.6%). One study included mean daily cortisol levels (14.3%). To measure HRV and HR, studies used fitbit (Cook et al., 2022) garmin (Mahoney et al., 2023) or medical grade devices (Ranzenhofer et al., 2022). Salivary cortisol was measured using salivette tubes (Moss et al., 2021; Naya et al., 2021). Of the physiological measures, HR (e.g., Ranzenhofer et al., 2022) and HRV (e.g., Cook et al., 2022) are considered measures of autonomic nervous system activity, whereas the cortisol awakening response (e.g., Naya et al., 2021) and mean daily cortisol levels (Moss et al., 2021) are measures for hypothalamic-pituitary-adrenal axis activity (Weber et al., 2022).

Direction of Stress Health Behavior Associations

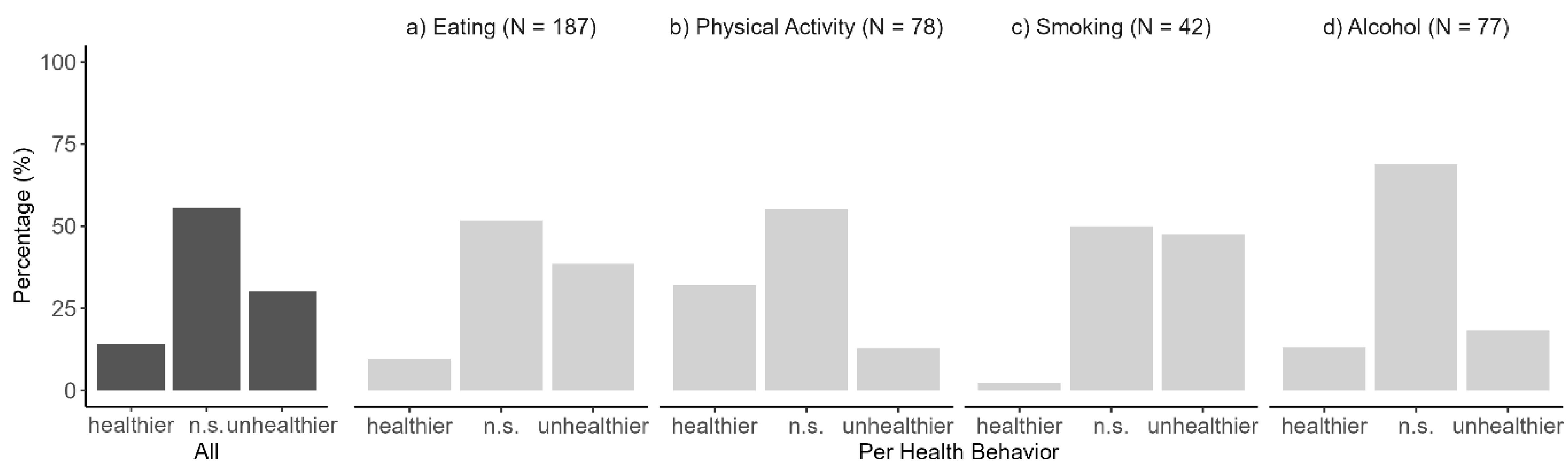
This section presents the results for research question (3), focusing on the direction and magnitude of the stress–health behavior associations. In total, we extracted information on 387 analyses examining the stress–health behavior relationship. For three analyses, information on either significance or effect size was unavailable (e.g., due to the use of machine learning models that did not report standard estimates). Therefore, the following results are based on the 384 analyses for which complete information was available.

Across the included analyses, 30.2% (n = 116) found stress to relate to unhealthier behavior, 14.1% (n = 54) to healthier behavior, and 55.7% (n = 214) found no relationship between stress and health behavior. The rate ratios ranged from 0.71 to 2.77 (Md = 1.01, IQR = 0.91–1.08), odds ratios ranged from 0.13 to 4.53 (Md = 1.14, *IQR* = 1.01–1.41), and standardized beta coefficients ranged from –0.94 to 0.79 (*Md* = 0.03, *IQR* = –0.04 to 0.13).

As can be seen in Figure 2, the stress-health behavior association varied between the different health behaviors. This was confirmed by a chi-square test, which revealed significant differences in the results on the stress-health behavior relationship (positive, negative or not significant) by health behaviors (X^2 [6, *N* = 384] = 47.80, *p* <.001). Whereas analyses on stress and eating behavior or smoking showed predominantly no relations or relations to unhealthy behavior (i.e., more unhealthy eating or smoking with greater stress), the opposite was found for physical activity (i.e. more physical activity with greater stress). For alcohol consumption the predominant finding was a non-significant relationship.

Figure 2

Direction and significance of associations of the stress-health behavior relationship by



type of health behavior

Note. Healthier means that stress related to healthier behavior, unhealthier is stress relating to unhealthier behavior, n.s. = non-significant stress-health behavior association; total number of analyses in all is 384.

Variability of Stress Health Behavior Associations

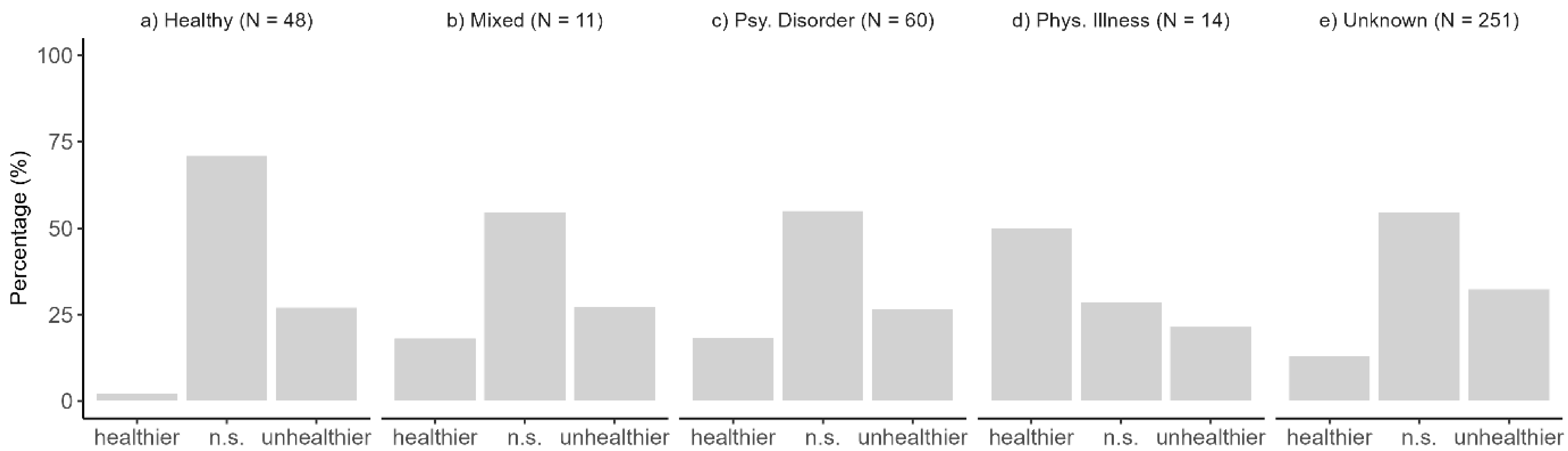
This section presents the results for research question four, about the variability of the associations. The variability in the stress - health behavior associations will be presented according to sample characteristics, conceptual characteristics, methodological characteristics, and moderators that authors used in their analyses.

The variability in the direction of stress – health behavior associations in the analyses by sample characteristics can be seen in Figure 3 (health status of sample in Panel A and body mass index (BMI) in Panel B). A chi-square test of independence revealed significant differences in the distribution of results regarding the stress-health behavior relationship by health status (X^2 [10, N = 384] = 27.33, p = <.001). In samples specified by authors as healthy, stress related to more unhealthy behavior while in samples with physical illness stress related to more healthy behavior. In mixed samples or samples with psychological disorders results were more balanced. A chi-square test of independence revealed a non-significant association between body mass index and the distribution of significant associations (X^2 [8, N = 384] = 3.42, p = .907).

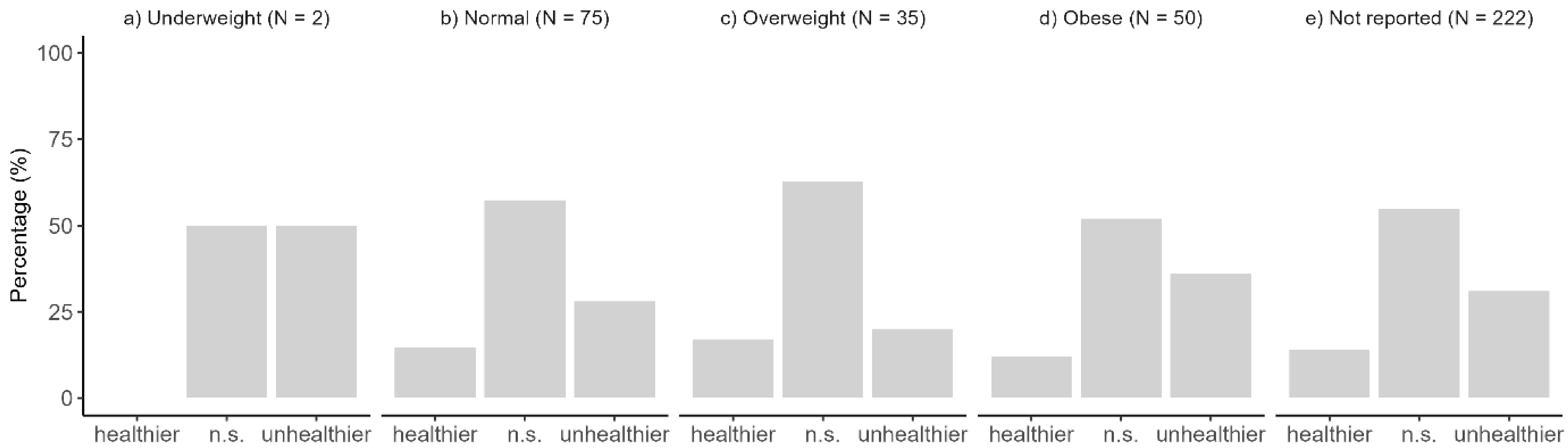
Figure 3

Variability in direction and significance of associations between stress and health behavior by sample characteristics

Panel A: Health status



Panel B: Body mass index



Note. healthier means stress relating to healthier behavior, unhealthier means stress relating to unhealthier behavior, n.s. = non-significant; psy. disorder = psychological disorder, phys. illness = physical illness; underweight = body mass index <18.5, normal = body mass index ≥ 18.5 ≤ and < 25, overweight = body mass index ≥ 25 ≤ and < 30, obese = body mass index ≥ 30.

Differences in the direction of stress – health behavior associations in the analyses by conceptual and methodological characteristics can be seen in Figure 4 (Panel A: stress aspect investigated; Panel B: stress measure used; Panel C: concurrent versus lagged analysis by level of analysis; Panel D: centering of predictor). Chi-square test of independence revealed a significant association between stress aspect investigated and distribution of significant relationships (X^2 [6, N = 384] = 27.32, p <.001). Analyses examining the stressors and health behavior showed a balance between non-significant associations and those relating to unhealthier behavior. Greater stress experienced related more to unhealthier behavior while greater physiological stress was more frequently associated with healthier behavior. However, overall, stress experience and physiological stress predominantly showed no association with health behavior. When a combination between the stressor and stressor experience aspect was investigated, results looked similar to investigating the stressor aspect.

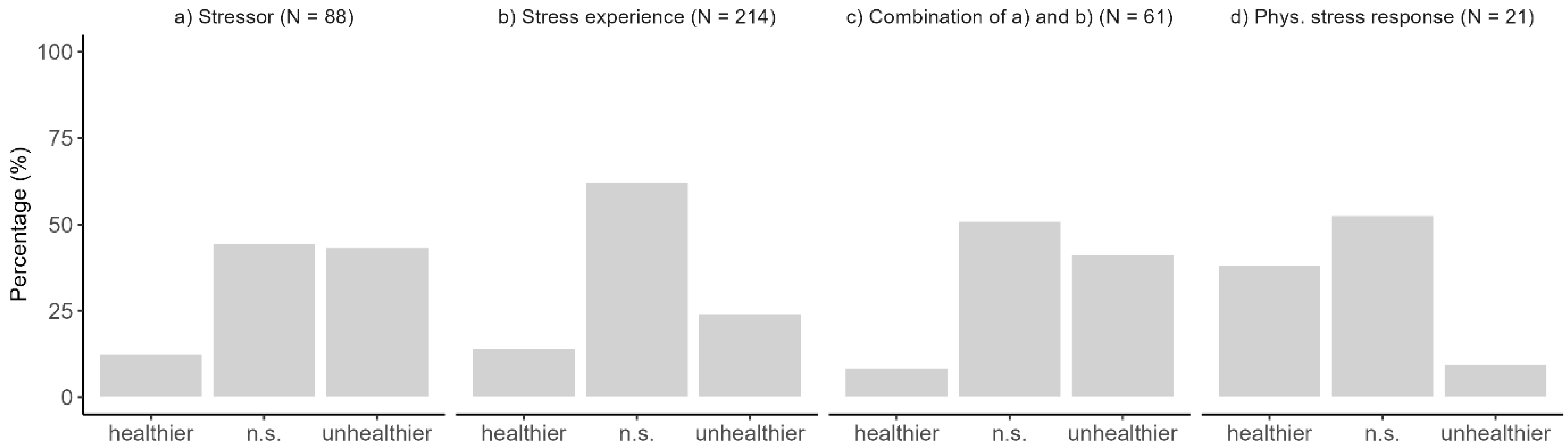
For the specific stress measures used, chi-square test of independence revealed a significant association between stress measures used and health behavior (X^2 [8, N = 384] = 30.68, p = <.001). While for physiological stress measures, greater stress related to healthier behavior, self-report measures showed that greater stress related to unhealthier behavior. Except for stressful events questionnaires with an open answer format, where more events were most often linked to unhealthier behavior, stress measures predominantly showed no significant relationship with health behavior.

Further, chi-square test of independence revealed a significant association between lagged versus concurrent analyses, (X^2 [2, N = 384] = 6.38, p = .041). Both, concurrent and lagged analyses of stress and health behavior predominantly showed no relationship, but significant associations showing that greater stress related to unhealthier behavior were more frequently observed in concurrent analyses. Further, chi-square tests of independence revealed no differences in stress-health behavior relationships depending on centering of stress predictors (X^2 [8, N = 384] = 13.09, p = .109).

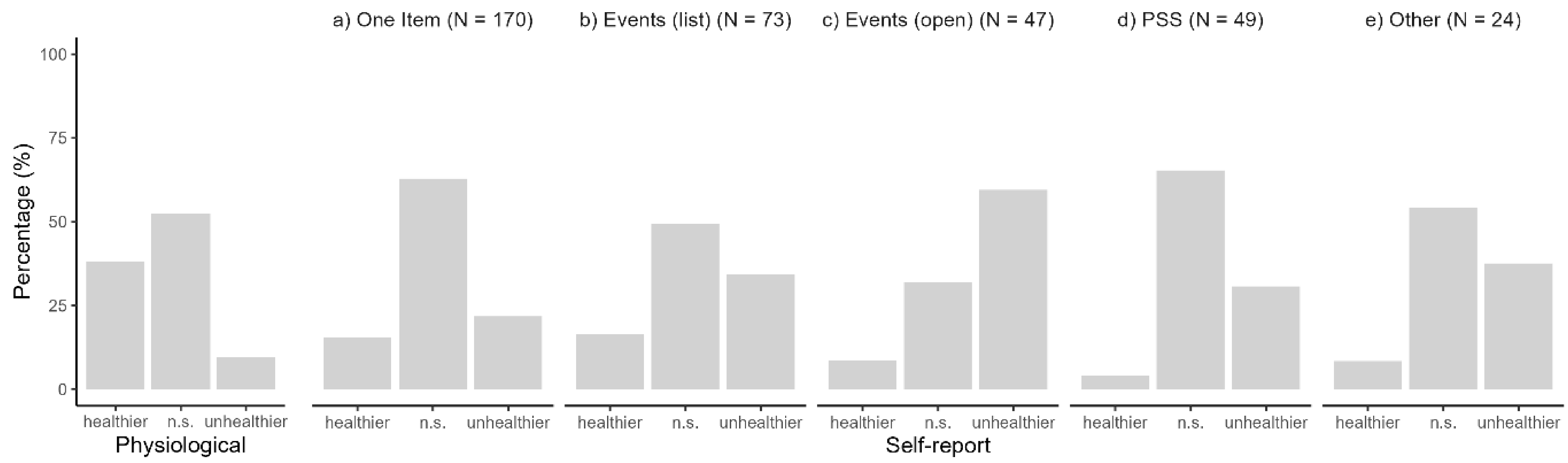
Figure 4

Variability in direction and significance of associations between stress and health behavior by conceptual and methodological characteristics

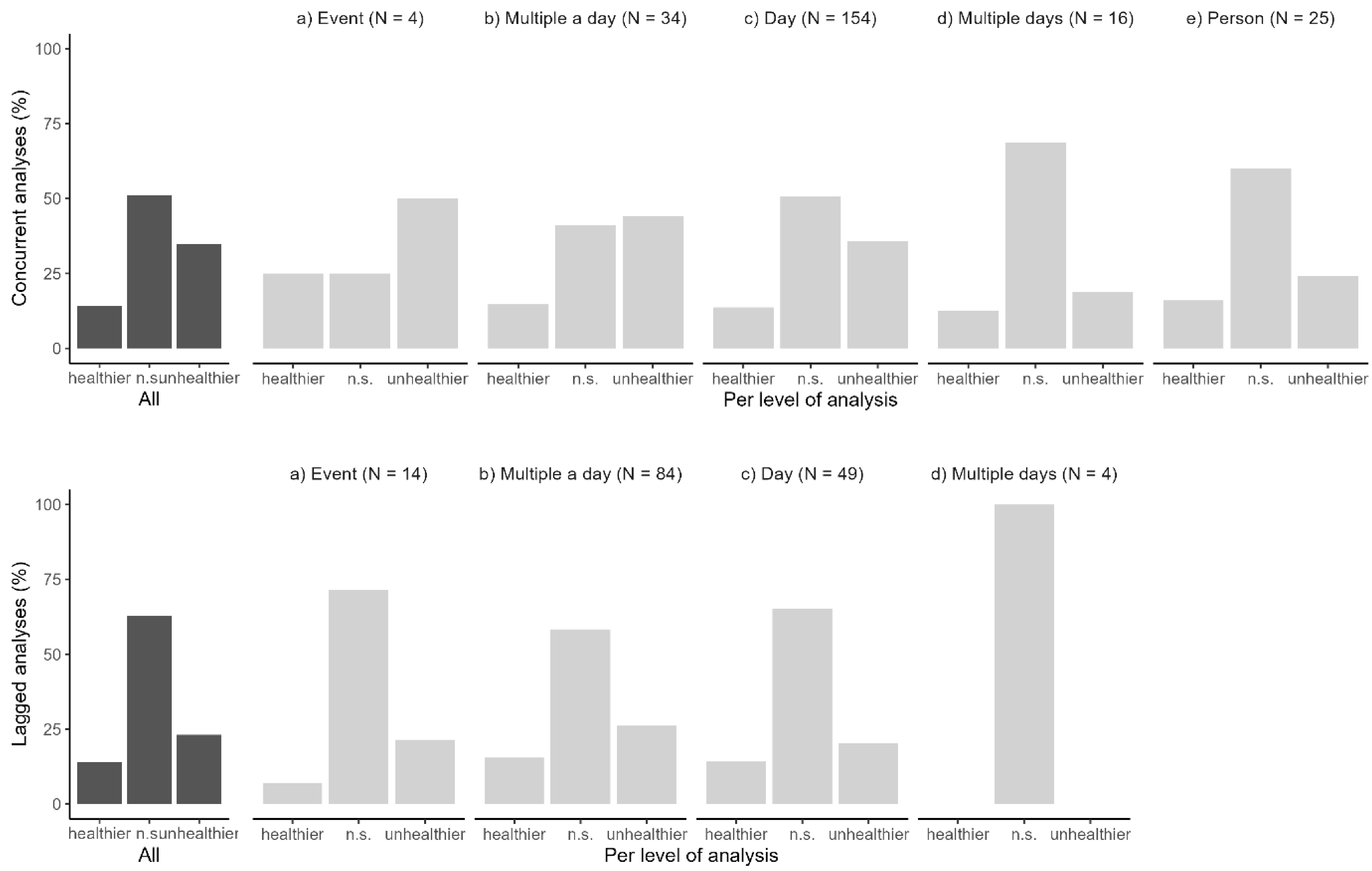
Panel A: Stress aspect investigated



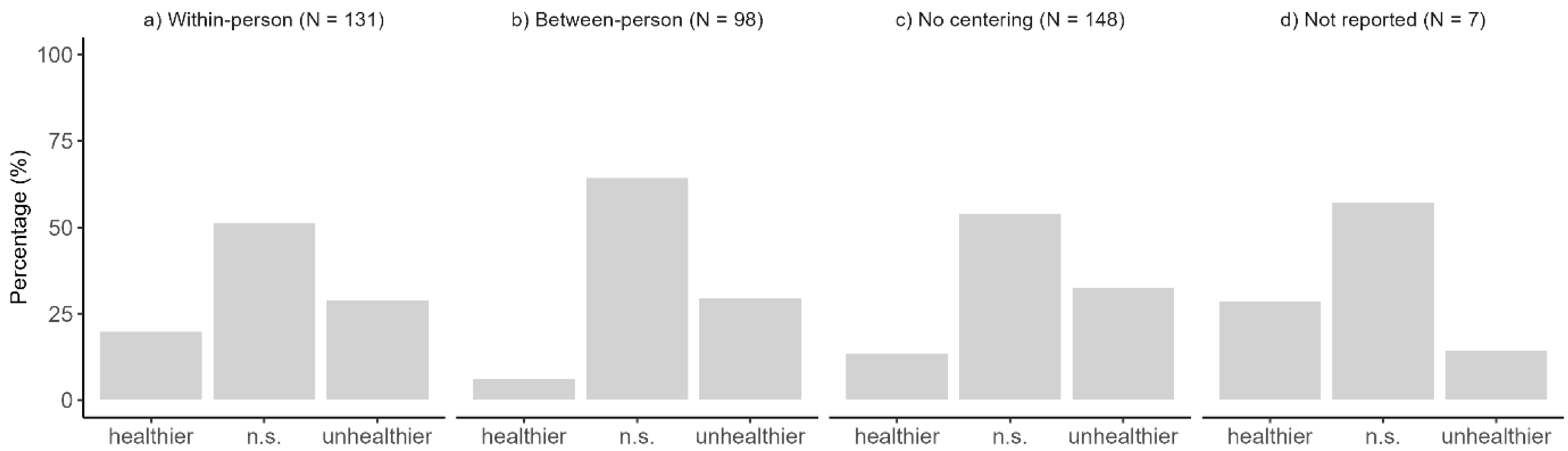
Panel B: Stress measure used



Panel C: Level of analysis



Panel D: Centering of stress predictor



Note. Phys = physiological, healthier means stress relating to more healthier, unhealthier means stress relating to unhealthier behavior, n.s. = non-significant; example measures of stress aspect such as stressor (e.g., "Did stressful events occur in the past 2 hours?"), stress experience (e.g., "How stressed do you feel right now"), and physiological stress response (e.g., salivary cortisol measure, HRV measure); level of analysis refers to the temporal resolution of the stress – health behavior relationship that was analyzed (e.g., multiple a day meaning the association between stress and health behavior got analyzed multiple times a day).

Moderators of the Stress – Health Behavior Relationship

Individual records tested and reported a range of different moderators in the stress – health behavior relationship (see S7, Table SXI in the supplementary material). Most moderators were stable, interindividual factors relating to personality (e.g., trait mindfulness, conscientiousness, sensation seeking), stress (e.g., average severity of hassles, fMRI responses to stress), health behavior (e.g., restrained eating, habit strength, alcohol dependence, family history of behavior), sociodemographic (e.g., sex/gender, education, family cohesion, income), or clinical variables (e.g., high versus low depression symptoms). Some records also investigated time-varying moderators including study or time-related factors (e.g., time between stress and health behavior assessment), social factors (e.g., social support) or psychological factors (e.g., coping styles).

Notably, personality traits (e.g., trait mindfulness, conscientiousness), biological stress responses (e.g., cortisol; specific activations observed by functional magnetic resonance imaging, fMRI), and sociodemographic factors (e.g., sex, education) were among the most consistently significant moderators of the stress-health behavior relationship. Time-varying moderators (e.g., coping style, timing of assessment) also emerged as significant in some studies.

Covariates Controlled for in Analyses of Stress and Health Behavior Associations

This section covers the results for research question (5), about which covariates were controlled for. In 72.9% (*n* = 280) of the analyses investigating the stress - health behavior association, at least one covariate was controlled for. 27.3% (*n* = 105) of models controlled for stable covariates assessed at baseline (e.g., age), 12.8% (*n* = 49) controlled for time-varying factors assessed during intensive longitudinal assessment (e.g., craving), 28.4% (*n* = 109) controlled for a mix of both, and 2.1% (*n* = 8) controlled for variables they calculated themselves (e.g., time between assessments). In 24.2% (*n* = 93) of models authors did not give a reason for why they included said covariates, in 30.2% (*n* = 116) authors gave an empirical rationale, in 2.6% (*n* = 10) authors gave a theoretical rationale, and in 12.0% (*n* = 46) authors gave some other arguments. Find a list of the covariates that were controlled for in each model in S7, Table SXI in the supplementary material.

Stable covariates that were added to the models included (1) study-related covariates (intervention or control group, targeted calory intake), (2) personality (trait anxiety, stress eating trait, conscientiousness, average level of negative affect), (3) demographic variables (sex/gender, ethnicity, income, education level, car ownership), (4) clinical variables (presence of mood or anxiety disorder, chronic health conditions, body mass index, menstrual cycle group), (5) behavioral variables (habit strength, health behavior at baseline), and neuropsychological variables (fMRI response in laboratory).

Time-varying covariates that were added to models included (1) time variables (day of the week, work shift in the morning/evening/night, time of day), (2) psychological states (positive and negative affect, boredom, anger/irritation, feeling deprived, loneliness, frustration, feeling left-out), (3) behavioral variables (physical activity, sleep), (4) contextual variables (presence of accompanying person, place, work-shift intensity, social support, availability of delicious food, hungry, time pressure), (5) coping variables (coping strategies, self-compassion), (6) autoregressive effects (stress or health behavior measure at last timepoint), and (7) study-related variables (number of completed surveys per day).

Discussion

This systematic review examined how the relationship between stress and key health behaviors (eating behavior, physical activity, smoking, and alcohol consumption) is investigated in daily life. It synthesizes the stress measures used, their reliability, the magnitude and variability of associations, and the covariates considered. Most studies used self-report measures of stress, primarily assessing the stress experience. Self-report measures of stress were mostly single items, often self-generated, while multi-item questionnaires were less common. Physiological stress measures were used in very few studies, often including multiple indicators (e.g., HRV, HR). Reliability of stress measures was rarely reported, nor was missing data. Overall, the associations between stress and health behaviors were small and inconsistent, with the majority of analyses showing no significant relationship. The wide range of effect sizes, particularly in the standardized beta coefficients, highlighted substantial variability across studies. The stress-health behavior relationship varied by health status, with stress linked to unhealthy behaviors in healthy samples but healthier behaviors in samples with physical illness, while BMI showed no significant association. The stress-health behavior relationship further varied by stress aspect, with the stress experience relating to unhealthier and physiological stress to healthier behavior, and stressful event questionnaires with open format more often relating to unhealthier behavior compared to other self-report measures. Further, significant effects were more common in concurrent compared to lagged analyses, while centering approaches (e.g. distinguishing within- or between-person differences) did not differ. Moderators of the stress-health behavior relationship that were found to be significant by the included records suggest that both stable personal characteristics (e.g., personality, stress reactivity) and time-varying factors (e.g., coping style, timing of assessment) can help explain the variability of stress-health behavior relationships. Most analyses controlled for covariates, including stable, time-varying, or mixed factors, though reasons for inclusion were often not stated or lacked theoretical rationale.

Stress Aspects and Measures Investigated

While physiological measures focused exclusively on the physiological stress response, the stress aspect measured with self-reports varied. Self-report measures were used to assess stressors, the stress experience and combinations thereof, also sometimes including related concepts such as stress-related coping.

Both the stressor (e.g., through quantifying stressful events) and stress experience aspects (e.g., through individuals reflecting on the subjective level of stressfulness) can be assessed well through self-report questionnaires (O' Connor&Ferguson, 2016; Ursin&Eriksen, 2004). When assessing the stressor aspect, this was often done based on frequency (number of stressors) or their categorization into types (e.g., interpersonal vs. academic stressors). In the included studies this was done via stressful events questionnaires (checklists or open format) or single items. While checklists of stressful events such as the daily stress inventory allow a seemingly more objective quantification and interindividual comparison of stressors that occurred, subjective appraisal and thus personal relevance of these stressors might be missing. Some studies included a stressfulness rating of the events, but this blending of stressor and stress experience makes it hard to distinguish whether observed effects are due to the occurrence of stressors themselves or the subjective appraisal of their stressfulness. On the other hand, open-format assessment of occurred stressors provides ecological validity by letting participants list personally relevant stressors they experienced. However, this introduces recall biases and the variability in what participants consider “stressful” may reduce reliability for research questions on the interindividual level. Lastly, single-items (e.g., “Did a stressful event occur?”) provide a brief but unnuanced assessment of experienced stressors. Unlike stressful event questionnaires, they do not allow categorization into stressor types. However, they offer a more concise alternative to extensive checklists (e.g., with 56 items), minimizing participant burden. During the screening process, records assessing the stressor aspect were more frequently excluded compared to those assessing the stress experience due to the inclusion criterion requiring cognitive appraisal. Many of these excluded studies used checklists of potentially stressful events without assessing participants' subjective evaluation or limited responses to whether the events occurred, not whether they were experienced as stressful.

For the stress experience aspect, mostly the PSS (Cohen et al., 1983) and single-item measures (e.g., “How stressed do you feel right now?”; Chen-Sankey et al., 2019) were used. In the PSS, especially the subscale on perceived helplessness with items such as “In the last month, how often have you been upset because of something that happened unexpectedly?” or “In the last month, how often have you felt nervous and “stressed”?” closely relate to assessing the subjective level of stressfulness of the stress experience aspect (Harris et al., 2023; Ursin&Eriksen, 2004). On the other hand, the subscale on perceived self-efficacy with items such as “In the last month, how often have you felt confident in your ability to handle your personal problems?” and “In the last month, how often have you felt that you were on top of things?” even when recoded as is intended in the PSS might assess something qualitatively different from the level of stressfulness (e.g., ability to cope with stress). While both stress experience and perceived self-efficacy in coping with stress might be relevant for health behavior, content validity could be reduced when conflating stress experience with coping ability, making it unclear if it is the stress experience relating to health behavior or someone’s perceived self-efficacy, which might be closely related to perceived self-efficacy in engaging in healthy behavior. Further, the PSS by measuring subjective feelings of unpredictability and overload might reflect more broader, generalized, chronic and stable interindividual characteristic of stress perception (Harris et al., 2023) compared to concrete, behaviorally-relevant fluctuations in the stress experience. Even when adapted to a daily life context and shorter time periods, the PSS was originally developed and validated for assessment of global, more chronic stress (Cohen et al., 1983). In comparison, single-item measures (e.g., “How stressed do you feel right now?") could be more useful for assessing these acute variations in stress experiences in daily life.

Lastly, the physiological stress response was only investigated by very few studies included in this review. From previous research we know that the physiological stress response in daily life can be measured through autonomic nervous system activity with indicators such as blood pressure, HR, HRV, ambulatory blood pressure, electrodermal activity, and salivary alpha-amylase (Weber et al., 2022). Of these measures, in the studies included in this review only HR (e.g., Ranzenhofer et al., 2022) and HRV (e.g., Cook et al., 2022) have been investigated in relation to health behavior. To measure hypothalamic-pituitary-adrenal axis activity, the common measures in everyday life contexts include current salivary cortisol levels, the cortisol awakening response, diurnal cortisol slope, single daytime cortisol levels, and the area under the curve of salivary cortisol across the day (Weber et al., 2022). Of these measures, only the cortisol awakening response (e.g., Naya et al., 2021) was investigated in relation to health behavior by studies included in this review. One study additionally investigated mean cortisol levels over the day in relation to health behavior (Moss et al., 2021). Thus, in this review we were only able to investigate the relationship between a few of the possible physiological stress measures to health behavior in daily life. Although these indicators are well-established in psychophysiological research and are commonly used to index physiological stress responses in everyday life, their validity and reliability can vary significantly depending on the device and context of use. For example, measures of HR and HRV at the wrist through sensors such as fitbit or garmin using photoplethysmographic signals can be easily disturbed through movement artefacts in daily life settings (e.g., because of physical activity, changes in posture; Quigley et al., 2019). Similarly, while salivary cortisol is a well-established measure, valid interpretation requires precise sampling timing and adherence to protocols, which are less standardized in daily life compared to laboratory settings (Stoffel et al., 2021). Lastly, the inclusion of measures of the physiological stress response also requires handling saliva samples (e.g., carrying tubes, storage in fridge; Stoffel et al., 2021) or charging of sensors to measure HR and HRV which can be burdensome to participants.

Relationship of Stress and Health Behavior in Daily Life

Understanding the complexity of the relationship between stress and health behavior could be affected by the way stress was measured (i.e., stress aspect and specific questionnaire used). This association is further complicated due to different health behaviors often being studied using distinct methods (e.g., more frequent single-item and event-based assessment of stress in studies investigating smoking behavior). Thus, making it difficult to separate the effects of stress measurement from the choice of health behaviors examined.

The findings of this review confirm the complexity of the stress-health behavior relationship, and that it depends on many factors. In terms of the stress aspect, the results suggest that greater physiological stress is more consistently associated with healthier behaviors (e.g. less smoking, more physical activity), whereas greater self-reported stress, especially stressors reported in an open format, tends to relate more strongly with unhealthier behaviors (e.g. more smoking, less physical activity). One reason for the diverging findings between self-reported and physiological stress measures in relation to health behavior may be the broader, less specific nature of physiological stress measures. Unlike self-reported stress, which captures an individual's subjective experience of stress, physiological stress measures reflect activity in the autonomic nervous system and the hypothalamic-pituitary-adrenal axis, which are systems that are activated during stress but also respond to other physiological and emotional states (e.g., Laborde et al., 2017).

Another reason for the variable associations between stress and health behavior could relate to the temporal resolution investigated. Physiological stress responses, particularly when acute, are closely linked to adaptive survival mechanisms such as fight-or-flight, first described by Cannon (e.g., 1914, 1929). In response to an immediate stressor, the body releases corticotropin-releasing hormone and noradrenaline, which facilitate energy mobilization for rapid action and movement (e.g., physical activity) and suppress appetite (Sominsky&Spencer, 2014; Torres&Nowson, 2007). Thus, heightened physiological arousal could promote increased physical activity and lower food intake as part of an evolutionary response to escape or confront a threat, potentially reflecting an adaptive coping mechanism. For example, Cook et al. (2022) and Moss et al. (2021), included in this review, found that more physiological stress related to increased physical activity and healthier eating. In contrast, perceived stress, particularly the experience of frequent stressors, tends to be associated with unhealthier behaviors (e.g., increased consumption of energy-dense foods; Adam&Epel, 2007) which we also found in our review (e.g., increased snacking, Conner et al., 1999; less physical activity and more sedentary behavior, Zenk et al., 2014; higher cigarette consumption, O'Connor et al., 2009).

Further, also for the specific self-report measures used there was variability in the association to health behaviors with stressful events questionnaires in an open format showing the most frequent associations to unhealthy behavior. One potential explanation for why these were most often associated with unhealthier behavior is that they capture frequent, specific, and cumulative stressors occurring in everyday life. It might be this cumulative pattern of repeated stressors and the experience thereof that are associated with unhealthy behavior. Repeated reactivity to and recovery from stressors, a phenomenon often described as pileup (e.g., Almeida et al., 2020; Smyth et al., 2018), compared to the stress experience has been shown more relevant for subsequent health behavior in previous studies (e.g., for physical activity; Almeida et al., 2020). Unlike acute stress, which triggers energy mobilization, frequent stressors might contribute to the learned association between stress and unhealthy behaviors, particularly through repeated engagement in reward-driven behavior as a coping mechanism (e.g., unhealthy eating, Adam & Epel, 2007; smoking, Minami et al., 2018). Over time, individuals may learn that engaging in unhealthy behaviors temporarily relieves stress by activating the brain's dopaminergic reward system, with repeated use potentially sensitizing the reward system to stress-related cues (e.g., Adam&Epel, 2007). This suggests that while acute physiological stress may momentarily support healthier behaviors through biological activation, the cumulative experience of stressors might drive unhealthier behavior.

Temporal Resolution of Stress

Concurrent and lagged analyses of stress and health behavior predominantly showed no relationship, but significant associations were more frequently observed in concurrent analyses. Furthermore, in the lagged analyses, more significant associations were observed in shorter time lags (e.g., multiple times per day as level of analysis; Park et al., 2004) compared to longer ones (e.g., daily level of analysis; Mereish et al., 2018). This pattern suggests that the effects of stress on health behavior may be short-lived and fleeting, with immediate influences that dissipate over time. This aligns with the idea that stress-driven behaviors, such as emotional eating or alcohol consumption may serve as immediate coping mechanisms rather than leading to sustained behavioral changes (e.g., Adam&Epel, 2007). Additionally, the stronger associations in concurrent analyses could partially be due to the bidirectional relationship between stress and health behavior. Stress can influence behavior, but behaviors can also impact stress, creating a feedback loop (e.g., Nguyen-Michel et al., 2006; Schultchen et al., 2019). For instance, to cope with stress, a person might reach for a cigarette or engage in unhealthy snacking for potential relief from the effects of the stressful experience (e.g., Adam&Epel, 2007; Kassel et al., 2003). This can temporarily create a feeling of relaxation and stress relief, but through physiological (e.g., dropping of nicotine levels in the body, Cambron et al., 2019) and psychological pathways (e.g., feelings of guilt or regret for behavior inconsistent with goals; Sorys&Byrka, 2021), stress levels may rise again. Retrospective bias may also play a role as individuals recall stress and behaviors in ways that fit their expectations rather than actual experiences, potentially attributing behavior to stress after the fact (e.g., “I only drank so much alcohol because I had a stressful day”).

How to Use Stress Measures to Inform Ecological Momentary Interventions

When choosing how to measure stress in order to inform interventions in daily life, it is crucial to consider how well it captures dynamic, context-sensitive information that can guide personalized interventions (Nahum-Shani et al., 2018). This includes identifying critical moments where fluctuations in the measure are most likely to relate to health behavior, ensuring timely and relevant intervention delivery (Nahum-Shani et al., 2018). In line with this, based on the results in this review, more frequent and immediate assessment of stress (i.e., event-based, multiple times a day) seemed to be more often related to changes in subsequent health behaviors compared to less frequent assessments (e.g., once daily). In order to better define moments in time when interventions could be given in daily life, it is necessary for studies to better investigate and report on how meaningful changes in stress (measures) look like and how often they happen (e.g., investigate sudden gains and losses; Chevance et al., 2021).

Another important factor when choosing stress measures to inform interventions in everyday life is the occurrence of missing data (Nahum-Shani et al., 2018). In our review, the median percentage of missing data was 12.0%, with substantial variation across studies. Missing data arose from technical issues such as device detection failures, sensor malfunctions, and data corruption, as well as participant-related factors like forgetting to wear or charge sensors, high reporting burden, or environmental disruptions (e.g., smartphone in do-not-disturb mode). These findings highlight several challenges when incorporating stress as a tailoring variable in adaptive interventions. First, the reliability of stress measurement depends on the completeness of physiological and self-report data, which may be compromised by technical failures and non-compliance. To address this, interventions should incorporate strategies to minimize data loss, such as real-time monitoring of sensor function, automated reminders for device charging and diary completion, and redundancy in stress assessment (e.g., combining physiological and self-reported stress indicators). Future interventions could work on optimizing sampling frequency based on individual burden thresholds or use imputation techniques to handle missing data in real-time adaptations. Finally, given that missing data is often not random and may be systematically related to participant burden or stress levels, future research should examine whether certain individuals (e.g., those with higher baseline stress) are more prone to missing data. Understanding these patterns could help refine intervention strategies to account for biases in intervention decisions and ensure that adaptive interventions remain effective and equitable. Furthermore, stress might also relate to more missing data especially in active measures such as health behavior and self-report stress measures, further complicating the usage of stress measures to inform interventions.

Improving the Science of Stress and Health Behavior in Daily Life

To advance our understanding of how stress impacts health behaviors in daily life, future research must address several critical methodological and theoretical gaps identified in this review.

Specify Stress Aspect and Align Measurement

A key challenge in studying the relationship between stress and health behavior in daily life is selecting appropriate stress measures that balance validity and feasibility. Unfortunately, this has not been done routinely in the reviewed literature. Given the multidimensional nature of stress (e.g., Ursin&Eriksen, 2004), it is crucial to explicitly define the stress aspect investigated, clearly distinguish adjacent stress-related concepts that are assessed (e.g., perceived ability to cope with stress), and closely align the measurement method with the stress aspect and its temporal resolution (e.g., acute fight-or-flight reaction). While investigating acute stress responses may require high-frequency, momentary assessments, chronic stress effects on behavior may be better captured through aggregated daily or weekly measures. Further, measures should be validated for the timescale used (e.g., validating an adapted version of the PSS for daily use). Given the existing research gaps regarding the mechanisms and timescales through which stress influences health behavior in daily life, a systematic approach is needed to explore the different time scales at which stress relates to health behavior (cf. multiverse studies; Langener et al., 2024). By integrating multiple assessment methods and examining different timeframes, future research can better capture the dynamic interplay between stress and health behavior in everyday life.

Currently, many studies lack information on the reliability of their measures, limiting confidence in the robustness of their findings. Future studies should systematically report both the reliability and validity of their measures, particularly in everyday life contexts. Furthermore, researchers should clearly define the stress aspect they aim to investigate, and critically evaluate whether their measures accurately capture this aspect, or if they inadvertently measure related constructs, such as self-efficacy. The variability in study designs and reporting practices currently hinders meta-analytic syntheses. Future studies should include detailed descriptions of measurement reliability, the rationale for sampling timing and frequency, and the theoretical basis for selected timescales and lags. This will enhance transparency and comparability across studies, ultimately improving the field’s capacity to derive robust conclusions about stress-health behavior relationships.

Rationale for Sampling Timing and Frequency

Our results showed that the timing and frequency of intensive longitudinal sampling are often inadequately justified in existing studies. This lack of rationale poses challenges for interpreting results and integrating findings across studies. Future research should be grounded in theoretical models that specify how stress and health behaviors fluctuate over time and on what timescales these processes unfold. These considerations will support more meaningful decisions regarding the intensive longitudinal study design, ensuring that sampling aligns with these dynamic processes. Researchers should develop and test models that explain how stress relates to health behaviors over different time scales, considering concepts like stress recovery, cumulative stress exposure (e.g., pileup), and behavioral decision points (e.g., choosing between a healthy or unhealthy meal at lunchtime). Due to the current lack of theory on these issues, phenomenological studies are needed that provide basic insight about the fluctuation of the different stress aspects in daily life (cf. Borsboom et al., 2021).

Limitation of this Review

Only studies published in English were included in this review, which may have resulted in the exclusion of relevant research conducted in other languages. This language restriction could introduce bias by overrepresenting studies from English-speaking contexts and underrepresenting findings from other cultural and linguistic backgrounds. Additionally, although many records reporting non-significant results were included, the effect may still be overestimated due to the exclusion of grey literature, such as unpublished dissertations, reports, and conference proceedings.

The heterogeneity in study designs, measures, and methodologies across the included studies limited the feasibility of conducting a quantitative meta-analysis. Variability in factors such as sampling strategies and operational definitions of stress and health behaviors introduced complexity that precluded statistical synthesis of results. As a result, the conclusions drawn from this review are qualitative in nature and may lack the precision offered by meta-analytic approaches.

To maintain a clear focus on stress, this review excluded measures of related but distinct constructs, such as anxiety and negative affect. While this approach ensures conceptual clarity, it also means that some physiological indicators of stress, such as biomarkers, were not directly examined. Future research could explore how different conceptualizations of stress, including physiological responses, contribute to the stress-health behavior relationship.

Conclusion

This review highlights the many different measures used to investigate the relationship between stress and health behaviors in daily life. This diversity is shaped by methodological variability and a predominant reliance on self-report measures, which may influence the consistency and comparability of findings. Simply asking whether stress relates to health behavior is insufficient; it is essential to consider which stress aspect is being assessed, and how, and when the relationship occurs. To advance the field, future research should be clear which stress measures they used for which aspect of stress, systematically investigate the reliability and validity of tools, and better justify assessment timing and frequency. Addressing these gaps, alongside reducing participant burden and improving standardized reporting, will enable more robust conclusions and the development of effective ecological momentary interventions. While observational studies have provided valuable insights in daily life, experimental studies in everyday contexts are necessary to establish causal pathways between stress and health behavior (e.g., through online adaptations of the Trier Social Stress Test to induce stress; Kirschbaum et al., 1993; such as Gunnar et al., 2021; or stress-reduction paradigms e.g., slow-paced breathing; Laborde et al., 2022). These steps are essential for capturing the nuanced interplay between stress and health behaviors, ultimately informing targeted interventions to promote health in everyday contexts.

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